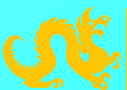
2017 STAR SCHOLARS SUMMER SHOWCASE

Thursday, August 31, 2017

Edmund D. Bossone Research Center

9:00am - 5:00pm



DREXEL UNIVERSITY
Office of
Undergraduate Research
Pennoni Honors College

DREXEL UNIVERSITY
Office of
Undergraduate Research
Pennoni Honors College

SUZANNE ROCHELEAU, PHD
Associate Dean, Pennoni Honors College
Director, Office of Undergraduate Research

JAYA MOHAN, MA
Associate Director
Office of Undergraduate Research

EMILY KASHKA, MA
Program Coordinator
Office of Undergraduate Research

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

Table of Contents

Table of Contents

Table of Contents

Schedule of Events

9:00am - 10:30am
Poster Session A
Bossone Research Center
First Floor Lobby

11:00am - 12:30pm
Poster Session B
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 2017 STAR Scholars Summer Showcase.

The STAR Scholars Program, administered by the Office of Undergraduate Research and housed within the Pennoni Honors College, has contributed to and benefitted from the impact that Drexel's focus on undergraduate research has had, not only on our students and their faculty mentors, but also on our broader Drexel community, the City of Philadelphia, and our wider world.

Since the Program's inception 15 years ago, more than 1,500 Drexel students have participated in the STAR, iSTAR and Rising STAR Scholars programs, including students this year who have worked with faculty at the Indian Institute of Technology - Madras and the University of Sussex (England) and for a former STAR Scholar now completing his PhD at Johns Hopkins University School of Medicine. In each of these settings, the research, scholarly, and creative partnerships of our STARs and their faculty mentors continue to produce exceptional results.

Last fall, two former STAR Scholars represented Drexel at the first World Congress of Undergraduate Research in Doha, Qatar, and more than 40 former STAR Scholars presented their work at national and international discipline-specific and undergraduate research conferences this year. 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 2016-17 class of STAR, iSTAR, and Rising STAR Scholars will shine as brightly.

Over the summer, 173 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 such cutting-edge projects as using biomimicry to address everyday problems, harnessing the power of movement in wearable technology, and identifying new uses for autonomous wireless technology; our students who have worked in off-campus sites have been placed as locally as at the Academy of Natural Sciences, Children's Hospital of Philadephia, and ZSX Medical, a biomedical device start-up, and as far-reaching as at the Indian Institute of Technology Madras and University of Sussex (England).

Each summer, we see our STAR Scholars 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.

2016 Outstanding Mentor of the Year
PROFESSOR DIANA NICHOLAS

The 2016 Outstanding STAR Mentor of the Year Award was presented to Professor Diana Nicholas (Architecture & Interiors, Westphal College of Media Arts & Design) at the 2016 STAR Summer Showcase. Prof. Nicholas received a plaque engraved with her name, as well as a $1,000 grant to support her further work with undergraduate researchers, which she has used to support her undergraduate students' continued participation with the URBN STEAMlab.

> ***"[When Prof. Nicholas] told me that she would like for my project to be my own - I would be designing and 3D printing my own iterations of prototypes to bring algal hydroponic food growth to the home interior, based in the research and mission of the URBN STEAMlab - I realized I would not be assisting with research, but standing on the shoulders of giants to design using my own voice. I could not wait for my STAR Summer to begin."***
>
> ***- Kiera Townsend***

Professor Nicholas is an assistant professor of Architecture & Interiors at Drexel University's Westphal College of Media Arts and Design. Her research focuses on speculative design and tools for the design of healthy urban spaces in underserved communities. She founded the informed design research laboratory URBN STEAMlab with Dr. Shivanthi Anandan, a trans-disciplinary laboratory exploring urban sustainability through science and informed design.

It is for Professor Nicholas' commitment to educating and mentoring students, both in the STAR program and in the research and design setting, that we honor her as our 2016 Outstanding Mentor of the Year.

Abigail Gard

College of Engineering
Civil Engineering

Addressing Food Inaccessibility with an Interdisciplinary Approach to Hydroponics

As urbanization increases throughout the United States, lower income, urban areas experience greater inaccessibility to healthy foods and space for food production. Indoor, sustainable farming, which often utilizes hydroponics, a method for growing plants without soil that relies heavily on water, is one possible solution to this problem of space and access.

As hydroponics development continues within URBN STEAMlab, the investigative focus switches from hydroponic functionality to determining the best methods for areas with the greatest need. This inquiry focuses on the user experience and the scientific necessities for maintaining two biological systems in one environment, cyanobacteria and food producing plants. Our process cycles between scientific research and design based iteration.

Throughout the course of this research, the user experience of those in low income and federally funded housing was considered and explored. Prototyped units were produced for testing in the biology lab using Vitruvius' idea of firmitas, utilitas, venustas, which are strength and usefulness for the user and biological systems along with beauty for design.These prototypes consist of stationary wall systems as well as similar portable units. A framework is currently being established for community participatory processes, which allow the lab to modify designs based on user research.

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

Dr. Shivanthi Anandan, *Co-Mentor*

Hung Dinh Nguyen

College of Engineering
Environmental Engineering

A New Perspective on Hydroponics

Hydroponics is the process of growing plants without the need for soil. Such a system utilizes a nutrient solution as the food source for the plants and an inert medium as support for the roots. This system eliminates many common problems that face conventional farming like pests, diseases, and soil degradation. Unfortunately, a majority of hydroponic systems available on the market are designed for large scale operations where space is not an issue. Urban dwellers often find space and light to be commodities difficult to afford. The summer project has been spent trying to convert traditional hydroponics systems into wall based systems that can be dividers of space or part of the façade of a building. The current prototype can accommodate one plant whose growth is stable and efficient. I will continue my design process and accompanying research to develop a prototype to the product I know it can become. In the future, families plagued by food deserts and low income can afford a healthy and delicious meal grown right from their own homes.

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

Dr. Shivanthi Anandan, *Co-Mentor*

Julia Schultz

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

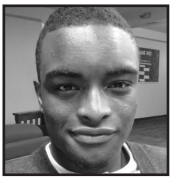
Making Physical Therapy Fun: Creating Art For Active Games

The process of physical therapy for individuals with cognitive and sensory issues, while extremely necessary, can be boring. Video games are frequently used for recreation and entertainment, however they can also be an effective therapy tool. This project focuses on the development of active games for use in physical therapy and discovering the challenges that arise while creating these games as opposed to traditional games. EnAble Games is a company working to make therapy fun, friendly, and accessible while also allowing care providers to tweak the game on-the-fly to suit their patients' therapeutic needs. I worked to create graphics and assets for EnAble Games that would function well in games meant for therapy. This entailed a combination of working with 2D art in Photoshop and Illustrator, along with modeling and texturing 3D assets using Autodesk Maya and Unity. Creating art for therapy games requires paying careful attention to color and clearness that traditional games do not. The process of the project required creating the needed art, testing the art in-game, receiving feedback from therapists and other team members, and then tweaking the art based on this feedback until it was satisfactory for the game.

Faculty Mentor: **Dr. Paul Diefenbach**
Digital Media

Christopher Francis

College of Engineering
Computer Engineering



Digital Chronicles

21st century humanists embrace digital technologies to collaborate and interact with new audiences producing media rich environments that go far beyond the limits of traditional text. This summer term I worked in the emerging field of Digital Cultural Heritage, which integrates archaeology, cultural history, and computer programming to create 3D immersive interactive learning environments favored by younger generations.

Archaeology is an area well suited for digital cultural heritage projects. Every day archaeologists uncover artifacts from earlier time periods revealing stories about people not mentioned in written histories. Because archaeological reports have until recently been limited to written reports, the information recovered from archaeological sites has not been accessible to general audiences. The densities of historical texts also tend to keep non-professional audiences out.

My poster describes 2 projects using digital technologies to interact with non-traditional audiences. One project is the James Oronoko Dexter House Project which works with archaeological finds to communicate life styles of Free African Americans living in Philadelphia in the late 18th century. The other project seeks to virtually recreate Peale's Museum of Art and Science going beyond printed history books. The project shows the importance of the humanities in early post-Revolutionary America.

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

Ethan Graham

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

Dual Digital Cultural Heritage

Digital technology transforms the way we live, work and learn. Digital humanists have gone beyond traditional text collaboration, interacting and communicating with expanding audiences. This summer term I worked in the area of Digital Cultural Heritage, a developing field that makes historical and cultural learning and understanding more approachable My collaborative research and creative activities build upon works of previous STAR Scholars, Drexel students, faculty, area archaeologists and other cultural heritage professionals.

My research contributes to two projects. The first is a virtual reality recreation of the late 18th-century house of James Oronoco Dexter, a manumitted slave active in the first free African American community in Philadelphia. The end goal is to create a role-playing game which takes place in Dexter's house during a meeting to form the African Episcopal Church of St. Thomas in 1793. The second project contributes to a virtual recreation of Charles Willson Peale's Museum of Art and Science, housed in Independence Hall 1801-1827. Visitors will be able to view it in augmented reality. The project will raise awareness about the importance placed on art and science following the American Revolution.

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

Sara Castellano

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

Effective Stage Management: A New Approach

What makes a good manager? Successful producers and managers will run a long list behaviors and traits that make an effective manager. Though it is important to understand the qualifications professionals see necessary, looking to them in isolation misses a vital perspective of what makes a good manager: that of the artists, who complete the full picture. As a versatile producer and teacher, Brannon Wiles has hypothesized that part of what makes a dynamic manager is cultivation of a good rapport with their creative and production teams, respect for and understanding of individual crafts and skills, and a sense of trust and collaboration between the creative and management sides. By writing a book that interviews A-list playwrights, composers, lyricists, directors, and designers on this topic based on their experiences with successful managers, he hopes to prove his proposition through research while appealing to theater enthusiasts. This has the power to change what it means to be a good general manager and, in turn, could transform the dynamic and foster a more efficient community within these sectors. The evolution of this change starts with the rise of the new generations of arts management students.

Faculty Mentor: **Prof. Brannon Wiles**
Entertainment and Arts Management

Gabrielle Bak

Antoinette Westphal College of
Media Arts & Design
Fashion Design

Wearable Fabric Triboelectric Generator

The Shima Seiki Haute Tech Lab is a contributor to the growing industry of functional fabrics and wearable technology. Through diverse collaborations, they focus on the integrating of technology into textiles and knit structures. This project was influenced by research on a paper triboelectric generator (TEG), published by Xiao-Sheng Zhang, Meng Su, Jargen Brugger, and Beomjoon Kim in Nano Energy, which harnesses friction between surfaces into storable energy. My STAR partners and I designed and tested a functioning TEG utilizing knit fabrics. This device is unique from existing TEGs because it is made from a multi-material textile produced in one piece using industrial knitting machines. My role was to design the TEG to be integrated into a wearable on areas of the body that create friction. The more friction produced, the more energy there will be to collect. The TEG was knitted in a self-folding structure that easily conforms to the body when placed on the elbow or knee. The designs focus on mapping the device to certain regions of the body that could create enough voltage to produce and store energy. This project illustrates how people can create power by simple movements that are done every day like walking.

Faculty Mentor: **Prof. Genevieve Dion**
Fashion Design

Brahmleen Chaggar

College of Engineering
Chemical Engineering

Triboelectric Generator as an Energy Harvesting Device

Current examples of wearable technology are still comprised of traditional, hard electronic components. However, the Shima Seiki Haute Tech Lab works to integrate electronic capabilities seamlessly into fabrics using industrial knitting machines, creating smart textiles with conductive yarns that transform the garment itself into a device. One challenge in wearable technology is power. Research was conducted on a triboelectric generator (TEG), an energy harvesting device, which has the potential to power smart textiles by converting mechanical into electrical energy. Although they have previously been fabricated out of paper and polymers, this research was focused on knitted fabric TEGs. Different fabrics, such as Teflon™, cotton, and nylon, were tested in the device. The generator's effectiveness was determined by comparing the voltages measured when it was compressed at constant rates. Tests indicated that cotton and Teflon™ produced a higher voltage when compressed than nylon and Teflon™. Further research into other materials and configurations is necessary to increase the output voltage for use in powering smart textiles. Improved TEGs will addess a challenge associated with smart textiles, allowing the field to advance.

Faculty Mentor: **Prof. Genevieve Dion**
Fashion Design

Elizabeth Moroz

College of Engineering
Materials Science & Engineering

Self Folding Fabric Triboelectric Generator

Imagine wirelessly charging your phone through your clothing as you move through your daily activities. Recent research into triboelectric generators (TEGs) shows the potential to harvest energy from smart fabrics. Smart fabrics are textiles that have been engineered to perform specific functions like harvesting energy and self-folding architecture. The triboelectric effect occurs when electrons are transferred between materials. For example, during wintertime you may experience a shocking feeling when you remove your arm from your coat sleeve. The shock occurs as electrons are transferred between your positively-charged skin and your negatively-charged winter coat. The goal of this project was to create a working self-folding, knitted TEG. Using industrial knitting machines, initial prototypes were fabricated using multiple layers of carbon, cotton, nylon, and Teflon™ yarns. The final prototype consists of a single patch with self-folding properties that can be integrated into high friction areas of a textile garment. Further research includes studying origami patterns where the structures repeatedly enlarge and compress under force. Such patterns could then be translated into self-folding TEG fabric prototypes.

Faculty Mentor: **Prof. Genevieve Dion**
Fashion Design

Chelsea Knittel, *Graduate Student*

Aaron Michael Bartuska

Antoinette Westphal College of
Media Arts & Design
Film & Video

The Experience Gained from Low-Budget Filmmaking

Attempting to make a feature-length low-budget film is not an easy task to accomplish. As the sole creator of this film project, I had to take on many more roles than would be expected of me on an actual film set. I acted as director, writer, editor, color correctionist, and cameraman, among others. I had the help of many friends, each of whom enjoys the art form and was passionate about making a good film while maintaining a fun filming environment.

This project was important to me because I believe the only things you need to make a successful film is a good story and passionate people supporting you. I wanted to get the root of what I love about cinema and transfer a personal story of my own over to the screen.

So far, thanks to the use of consumer-level cameras and improvisation, I have found the film has a very realistic, documentary-like feel to it, which was the goal I was looking to obtain. I have learned a lot from the experience, as I hope my peers have, and have the new-found confidence to successfully and efficiently do what I love: make films.

Faculty Mentor: **Prof. Thomas Quinn**
Film & Video

Anna Cushing

Antoinette Westphal College of
Media Arts & Design
Graphic Design

Exhibiting the Polish Posters

Drexel's URBN Center houses the Frank Fox and Kenneth F. Lewalski Polish poster collections which holds about 2,600 Polish posters from the Twentieth Century. Their subject matters are often conveyed through compositions with deep allegory and symbolism. Analyzing them in the context of their time helps to understand their individual messages.

This year's STAR researchers delved into the poster collections and curated a show of twenty-five posters for the University of Delaware which will be on display throughout September. Researchers purposefully chose posters of different styles to appeal to a diverse audience. Each wall is dedicated to a different subject: circus, politics, music, theater, and film. About half of the posters have extended labels to link the posters to the events of their times.

The STAR students created a rotating gallery of Polish posters for the URBN center and photographed the Lewalski collection in high resolution for Drexel's online library. This allows student designers to view, reference, and be inspired by the posters. The purpose of this STAR project was to continue the work of past students, to expose more people to the wealth of this collection, and to prepare the databases for future researchers.

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

Courtney Mattson

Antoinette Westphal College of
Media Arts & Design
Graphic Design

Polish Posters

The impact of Polish posters is still relevant today. They were once the center of the arts, politics, and entertainment in communist Poland. These posters have an array of subject matter from post-World War II political propaganda, to circus posters, and most importantly, American movie posters with styles that have bled into our overall art culture. These posters, from the 1940s to the 1990s were created by an array of artists from Poland and abroad. Through the STAR program, my team and I have done research and documentation of quite a few Polish posters. Most of our summer was spent culminating a gallery exhibition with our partner school and through our research we discovered a few things about the two collections at Westphal. We found that there were three waves of Polish posters, post-World War II, the '50s and '60s, and the '60s to the '80s. In the first wave we see quick sketches, strong coloring, surrealism, and the use of symbolism. In the second wave we see a continuation of what the first generation started but with the artists using more restraint and leaning towards abstractionism. The final wave used more aggressive designs; their works often involved camouflage and commonly understood ironies.

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

Sarah Rucci

Antoinette Westphal College of
Media Arts & Design
Graphic Design

Polish Posters of the 20th Century

The Polish posters of the 20th century convey political standpoints and cultural influences of that era. The posters are extremely versatile with themes from politics to the circus. Though originated from the same country and century, they do not all have the same artistic styles. The designers of these works each have their own unique artistic perspective, enriching this genre of art. Drexel University holds over 2,600 posters from the Frank Fox and Kenneth F. Lewalski collections. The documentation and preservation of these collections are extremely important because of their historical value and their ability to influence artists of today.

The STAR scholars have worked closely with Drexel University's poster collections. They have taken out original works and photographed them so that they may become part of iDEA, Drexel's online library database. The scholars have also selected 25 posters to become a part of an installment at the University of Delaware. Scholars chose posters by the most influential artists in an attempt to display an array of motifs. This installment will serve as inspiration to students as well as bring the history and culture of Polish posters to light.

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

Daniel Evans Gavrin

Antoinette Westphal College of
Media Arts & Design
Product Design

Evaporative Cooling for Urban Seating

Each summer many of people walk through cities suffering from the daily heat of the sun. Many urban seating areas currently in place are mostly ineffective at keeping people cool. This research details a potential solution to the problem of heat that people experience. Using biomimicry to develop a space for people to stay cool in summer involved researching how animals adapted to the heat of their environment. A list of needs (comfortable, social, clean, etc.) was created, several ideas were developed through sketches and an idea was selected and developed further. The project consists of creating the experience of nature with the sensory stimulus of running water and plants to create an environment. This environment utilizes the Biophilia effect, a tendency for people to feel reduced stress and improved concentration due to nature views. The seating provided will be cooled by water through every seating element, much like blood through hare ears. Like many other animals, this will allow people to cool off with evaporative cooling. Moving forward, this work could be brought to design firms, contractors, or the city to begin developing, testing, and final iteration development.

Faculty Mentor: **Prof. Michael Glaser**
Product Design

Christopher Haley

Antoinette Westphal College of
Media Arts & Design
Product Design

Adaptating Hedgehog Spines to Improve Item Packaging

Hedgehog spines are small, semi elastic quills that flex with impact. Their structure has been studied and applied to helmets to reduce contact force between American football players. This research explores how hedgehog quills can be applied to shipping containers for fragile items. Five layouts of foam pieces and hot glue drips were fabricated, based off observations from quills and other overlapping systems that produce linear strength. Variations between systems were orientation, size, and direction of pieces as well as material. A primary test revealed that large spines was most successful at absorbing local impact force. A group of commonly shipped items was then created with a range of dimensions for each item. Three models were created, one with spines alternating directions, one with all spines pointed in same direction, and a control with loose foam pieces. All three were dropped with eggs inside to test shock absorption. The two models with positioned spines outperformed the control with the single direction spines protecting eggs from 11-foot drops. Future steps entail applying this system into other high impact zones. Body armor and sports equipment or car bumpers are all possibilities as they serve as similar padding for humans during impact events.

Faculty Mentor: **Prof. Michael Glaser**
Product Design

Sean Christopher Huberth

Antoinette Westphal College of
Media Arts & Design
Product Design

A Narwhal System For Contemporary Content Sharing

Bio-Inspired Design is using Biology to inspire and apply biological adaptations to design. In this project, narwhals were selected to inspire the design of a contemporary ad hoc content sharing system. Then narwhal attributes were used to create a metaphor to design a system of content sharing; a system of content sharing in media, being images, audio, video and documents. The project relied on a common design process of emotion and critique. Choices of direction were chosen by an arrangement of possibilities, in which ultimately narwhals and content sharing were selected. Through the design process the idea was developed, expanded and contracted. Design critique was used to lead the project in a direction that encouraged development. This idea will continue to be developed through the design process.

Faculty Mentor: **Prof. Michael Glaser**
Product Design

Nethra Shankar

Antoinette Westphal College of
Media Arts & Design
Product Design

Off-grid Refrigeration Inspired By Snails

Biomimicry is the approach of imitating nature's time-tested strategies in design to derive sustainable solutions to solve human challenges. The goal of this research was to utilize biomimicry to imitate the adaptations of land snails in order to design a product. Initial observations of the animal and plant kingdom led to the discovery of the interesting adaptations of land snails to tackle heat. The aesthetics and structural adaptations of different snail shells were examined with the assistance of land snail experts at the Academy of Natural Sciences. A deep understanding of the snail's cooling adaptations led to the idea of applying these mechanisms to refrigeration. The study then was focused on developing a refrigerator for low-income groups that don't have access to electricity, which constitutes 16% of the global population. Several designs of off-grid refrigerators were sketched and modeled by mimicking the snail's material and structural mechanism for blocking out heat. After several rounds of experiments and validation, a single design was chosen and solar powered technologies and insulation methods were researched to fit the design. The next step would be to build a scale model, incorporate the technology and test the prototype.

Faculty Mentor: **Prof. Michael Glaser**
Product Design

Jason David Wong

Antoinette Westphal College of
Media Arts & Design
Product Design

Creating Refugee Shelters Using Bee Honeycomb Matrix

Biomimicry is an emerging field of design that imitates nature-developed systems and materials to improve facets of human life. This research aims to use this inspiration from nature to improve the shelters of refugees living in crowded temporary camps that are vulnerable to the elements, and lack privacy and security. Field observation of plant and animal species, and secondary research sources, brought knowledge of several species' environmental adaptations. Preliminary sketches were created, inspired by protective adaptations, animal-made shelters, and plant forms. Soon after, a volunteer from a Greek refugee shelter was interviewed to gain insight on the conditions found in specific refugee camps. Efforts were then focused on developing solutions aimed toward these high key issues, namely, extreme temperatures, flooding, and security and cultural conflicts between tenants. The hexagonal matrix of a bee's honeycomb was chosen in order to maximize space in the shelter and allow modification to fit individual needs. Constructing modular shelters with this hexagonal matrix can reduce the amount of material used in proportion to volume, while also improving structural integrity throughout the shelter due to the matrix's ability to distribute tension. Future research plans include architectural and material planning for the shelter.

Faculty Mentor: **Prof. Michael Glaser**
Product Design

Benjamin Folk III

Bennett S. LeBow College of Business
Finance

Cloud Computing Adoption for Accounting Needs

Cloud computing is an up and coming technology that is gradually creeping in to several facets of our everyday lives. Many business processes, including accounting processes, would benefit from a cloud based computing system. This begs the question of what factors influence firmsâ€™ decisions to adopt cloud based accounting systems. To answer this question, literature was reviewed and examined to construct a survey to gather data about the factors that are important to companies when deciding whether to adopt a cloud based accounting system. We used various data sources to identify trends and metrics in the adoption decision. We found that company size, security and productivity concerns, and industry membership were key drivers in the decision to adopt cloud based accounting systems. Specifically, larger companies, those with fewer concerns over security, and companies in the government and education industries were more likely to adopt cloud based accounting systems.

Faculty Mentor: **Dr. Curtis Hall**
Accounting

Amanda Marino, *Doctoral Student*

William J. McKeown

Bennett S. LeBow College of Business
Management Information Systems

A Survey for Modern Information Systems Architecture

Each day, American people and corporations alone spend $50 billion on goods and services; the majority of which is processed and recorded by businesses using Information Systems (IS). Besides covering transactions, IS must support the sales, finance, marketing, and supply chain, and cyber security functions of businesses.

The criticality of this field has led it to grow in a disorganized fashion with new vendors, technologies, and paradigms developing at breakneck speed. As such, businesses are often struggling to keep up with the latest IS solutions. In that spirit, the purpose of my research is to conduct a comprehensive analysis of business/data analytics-centric IS solutions.

The research involved learning about and evaluating several cloud based IS solutions for a variety of business functions with practical explorations of Amazon Web Services based solutions. Two interviews with industry leaders at Salesforce and an IT consulting firm were conducted as part of the research.

As IS solutions continue to develop, we anticipate that data-analytics centric methods will be applied to an increasing number of business problems and that the research presented in this paper may serve as a guide for future business decision making.

Faculty Mentor: **Dr. Pramod Abichandani**
Decision Sciences, Management Information Systems

Andrew Gerges

Bennett S. LeBow College of Business
Finance, Economics

Property Tax Limitations and School Quality

Even though public schools receive funds from all three levels of government (federal, state, and local), in most states they depend mainly on the local government's property tax revenue as their primary source of funding. In turn, the level of revenue raised depends on the details of the property tax system and the property values. In order to compare school spending levels with the amount of funds received, we use per pupil support levels since they have proven to be an effective measure of school quality in several studies. Therefore, we examine changes in house prices and their effects on property tax revenue, general government revenue, and school quality. It is important to note that we take into account that most states impose different types of property tax limitations in order to prevent excessive property tax growth. Thus, we also try to observe the effects that these limits might have on the relationship between house values and schools' spending behavior. It is important to understand the unintended consequences which these limits might have on the housing and educational markets-such as reductions in school quality-in order to identify the best types of property tax systems that protect homeowners from excessive tax obligations and improve public school quality simultaneously.

Faculty Mentor: **Dr. Sebastien Bradley**
Economics

Ioan Octavian Rusu

Bennett S. LeBow College of Business
Finance, International Business

Wage Rigidity in the US Economy

Dating back to Keynes' (1936) General Theory, economists have argued that wage rigidity is an important reason for why even relatively small negative shocks can lead to severe downturns and spikes in unemployment. Indeed, in a frictionless labor market, wages would quickly adjust to where labor supply meets labor demand and the economy would recover quickly from the shock and unemployment would be absent.

One of the main explanations for why firms keep wages above the market-clearing level are efficiency wages: firms are concerned with the work effort that each of their employees provides and believe that by keeping wages high, they can elicit a sufficiently high level of effort to justify the additional labor cost.

Thus, this project revolves around the conditions under which efficiency wages indeed lead to equilibrium wage rigidity and whether we observe this type of wage setting behavior in the US data. Furthermore, we propose a new reference wage model which aligns with the actual data and takes into consideration both the average wage of the economy and the workers' previous wages, thus avoiding extreme rigidity and better explaining the distribution of wage change rates.

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

Alaina Barca

Bennett S. LeBow College of Business
General Business

Get divorced for the kids: Does the FAFSA incentivize divorce for parents of college-bound children?

Over the last three decades the cost to attend college skyrocketed, as did the number of students enrolled. Government-funded programs like grants, loans, and tax incentives make college possible for many low-income families. However, the main tool for assessing need, the Free Application for Federal Student Aid (FAFSA), creates incentives for college students to appear poorer. In particular, since income is a main determinant of need, the application process may incentivize parents of prospective college students to get divorced in order to receive more financial aid. A literature review of sociology research and correlations between variables from the National Education Longitudinal Study of 1988 provided common predictors of divorce such as income and race. Controlling for the significant variables, we conducted logit regressions with divorce as the dependent variable to show how college attendance and financial need may be contributing to higher divorce rates. Preliminary econometric investigation is suggestive, but also yields some puzzling results. More regression work is required before any strong conclusions can be drawn, but some evidence suggests a link between college-bound children and divorce.

Faculty Mentor: **Dr. Christopher Laincz**
Economics

Mehmet Birtan Derin

Bennett S. LeBow College of Business
Finance, Mathematics

Financing Research and Development: Evidence from Covenant Violations

Bank loans include financial covenants that serve as performance targets which firms need to satisfy to avoid defaulting and losing decision rights. Ideally, lenders should trust firms to run their businesses and would not need to restrict their loan contracts; however, conflicts of interest exist between management and creditors, and some firms fail to comply with their contracts. We focus on the impact that research and development (R&D) spending has on covenant violations. R&D intensive firms are riskier, harder to value, and have low asset tangibility, which makes their loans particularly risky for lenders. We hypothesize that firms with higher R&D face stricter performance targets and violate their financial covenants more frequently.

Examining more than 130,000 quarterly reports (1996-2015) to estimate the relationship between covenant violations and R&D spending, and using regression to control for factors that affect violation frequency, we find that higher R&D intensity leads to fewer violations. Further examination suggests R&D intensive firms rely more on equity than debt financing and use internal funds for innovative projects. These results shed light on funding technological developments, its relation to loan violations, and raise questions on the cost of tighter covenants in exchange for losing potential borrowers.

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

Dr. Gregory Nini, *Co-Mentor*

Allan Gichohi

Bennett S. LeBow College of Business
Finance, Mathematics

Deeper Pockets: Financing Innovation in Healthcare

Terms in loan contracts aim to reduce conflicts of interest between firm management and lenders. In the healthcare sector, innovation of new products comes with huge costs and risks, with product failure resulting in loan contract violation. We hypothesize that healthcare firms have higher probability of violating loan contracts. However, over 1996-2015, healthcare firms experience the second lowest frequency of violations, despite having the highest R&D spending.

Within the healthcare sector, we focus on 33,749 public firms to examine the puzzling relationship between R&D spending and covenant violations. After controlling for factors such as size, firm value, and performance, we observe a lower probability of violations for firms with larger R&D. Further analysis details a strong relationship between high cash levels and high R&D; cash is an important source of finance that helps to reduce the volatility of R&D expenditures. Large cash balances also reduce the chance of a covenant violation, as cash is a readily available asset that can be used to service debt payments. We conclude that firms with high R&D spending in the healthcare industry maintain large cash balances which then reduce probability of loan contract violations.

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

Dr. Gregory Nini, *Co-Mentor*

BENNETT S. LEBOW COLLEGE OF BUSINESS

Tatiana Fried

Bennett S. LeBow College of Business
Finance, Accounting

Quantitative and Qualitative Analysis of the Global Classroom on Drexel Students

Literature notes that those embracing emerging technology tend to be more globally minded, inclusive of diversity, and develop a broad perspective of different cultures. Drexel University's Global Classroom experience for business uniquely allows students to work in group settings with international students, exposing them to different cultures. We looked at the qualitative and quantitative data from Drexel's LeBow participants in the Global Classroom. We separated this data into the KSA format (knowledge, skills, and attitudes) in order to analyze what the students learned from their experiences in the Global Classroom. Overall, students reported that they became more knowledgeable and learned more skills about business topics. We discovered the Global Classroom fostered an enthusiastic and open-minded attitude that compelled students to learn more leading to a positive correlation between a student taking part in the Global Classroom and a higher final grade in the course. In conclusion, we found that the Global Classroom created a better student measured by KSA. This novel and unique method of learning forced students to think outside their culture and prepared them for a world without boundaries.

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

Professor Jodi Cataline, *Co-Mentor*
Professor Emilee Simmons, *Co-Mentor*

Kathryn Dailey

Bennett S. LeBow College of Business
Marketing, Operations Management

Incubators in India, are they meeting the needs of startups?

The academic literature has not paid significant attention to incubators in emerging economies. This makes developing successful incubator in those economies difficult. Not knowing the best practices to provide, what advisors to bring on board, or how much funding to provide can lead to unproductive incubators which in turn leads to startups not being served well and could be more likely to fail. A successful startup is generally considered one that is "cash positive," or generating more money than spending.

The purpose of this research was to determine how satisfied start-ups in India are with their incubators and their practices, funding, and administrative support. This research was conducted through literature review, archival sources, and survey. The differences between incubators were hypothesized and tested. The satisfaction of start-ups overall is positive, however, there is a negative feeling regarding funding and financial support from incubators.

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

Xiumei Li, *Doctoral Student*

Ada Li

Bennett S. LeBow College of Business
Accounting, Mathematics

Consumers' Perceptions of Food Made from Surplus Ingredients

In the world that we live in, there exists a population who suffer from world hunger even though approximately 40 percent of the food that is produced is discarded. Value added surplus foods (VASP) could be the potential cure for world hunger. However, manufacturers are uncertain about this new category of food due to fear that consumer may perceive these foods as trash or would require these foods to be sold at discount to limit financial viability.

A total of 24 consenting participants between 18-40, who have corrected-to normal vision and hearing, and are able to provide informed voluntary consent were recruited to participate in a single session lasting approximately thirty minutes where physiological data was collected with the fNIR 1100. Participants experienced an orientation with a total of fifty yes/no choice task, where one of the three conditions in a single factor between subjects design (Neutral vs. Rational vs. Emotional) were randomly assigned to participants.

The aim of the study is to understand a) whether the purchase decision choices of participants change after the intervention, b) if yes, which intervention changes the choice and c) brain activation patterns in participants pre and post intervention

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

Siddharth Bhatt, *Doctoral Student*

Aiswarya Sama

Bennett S. LeBow College of Business
Marketing

Don't Throw Away Your Food, Upcycle it: A Neuromarketing Study

This research examines how consumers perceive upcycled food, a new category of food products. It describes food that is manufactured using ingredients that are usually discarded during regular food processing. A significant amount of food that is currently produced ends up wasted or discarded. One way to help battle world hunger and food insecurity is to use this surplus food to create other food products. However, manufacturers have expressed reluctance to get into the upcycled food business. There is a popular perception that consumers may not accept food that they perceive as trash or would require such a discounted price that it limits financial viability. However, there is little information available that examines how marketing techniques might affect these consumer perceptions. This study explored how emotional or rational marketing techniques and product labeling impacts the consumers' willingness to purchase value-added surplus foods. In addition to survey measures, we used fNIR, a neuro-imaging technology, to visualize the thought process as consumers evaluated purchasing decisions related to this category. We examined whether marketing intervention changes these consumer purchase decisions.

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

Siddharth Bhatt, *Doctoral Student*

James Raphael Armentani

Bennett S. LeBow College of Business
Finance, Marketing

Finding Answers of Finding Dory: The Curious Marketing Behind Finding Dory

Has your curiosity ever been piqued by an upcoming movie trailer? Do you wish to learn more about the movie after watching the trailer? Consumer curiosity, usually elicited by a movie trailer or teaser advertisement, is essential in gaining attention, creating interest, and generating buying behaviors. Along with curiosity, companies also attempt to trigger consumers' emotions with teaser advertisement or trailers in order to connect with the viewer on a deeper level. This research examines how consumer curiosity and emotions induced by a movie trailer influence subsequent consumer behaviors. We focused on three trailers of Pixar's *Finding Dory* movie, and conducted a survey to determine the correlation between consumer emotions and their likelihood to view the movie. The survey was sent out to participants to gain a perspective of the main target market. Finally, we analyzed the data and determined whether consumer curiosity and emotions played a prevalent role in the overall success *Finding Dory* had in theaters. This research is important to marketers around the country to become knowledgeable about the new phenomenon of consumer curiosity. This could help them assess whether a campaign for a movie is a success or failure.

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

Soleil Smith

Bennett S. LeBow College of Business
Business & Engineering

Shea Moisture's "Hair Hate" Campaign and its Effects on the Company

Shea Moisture was established in the United States in 1912. The company primarily focuses on skin and hair products using ingredients from Africa. Shea Moisture started a campaign called "Hair Hate" designed to make women feel empowered by their hair, and not ashamed of it. As a part of the campaign, they released a commercial and received negative feedback from their consumers because they were displeased with the commercial. My research was based upon determining why consumers were upset with Shea Moisture. My first steps involved establishing a downstream variable to focus on, and how the commercial affected said variable. I chose to focus on sales, and started to gather consumers' behavioral responses. The following steps involved designing a survey that uncovered if consumers believed the commercial was controversial, and if they would continue using Shea Moisture products. The first step to determining this was selecting an advertisement that was not controversial, and using it as a control. Once I analyzed the results, I was able to draw conclusions about people's reactions and how it affected the company.

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

Patrick John Stewart

Bennett S. LeBow College of Business
Marketing

Changing the Tides

In every year's epic Super Bowl, the game itself isn't the only competitive field. The Super Bowl has become the top advertising spot for companies seeking public attention for their goods and services. In 2017, one company -Tide -stood above the rest. In their Super Bowl LI commercial, football analyst Terry Bradshaw is caught with a massive stain on his shirt in what appears to be a live broadcast. Leaving millions of viewers confused and curious, Tide later aired another advertisement which portrayed Bradshaw's hectic journey to remove the unsightly stain using Tide's new laundry pods, thereby satisfying the crowd. In this research we analyzed the impact of consumer curiosity through this innovative Super Bowl commercial. Using primary data from a survey, we examined viewers' attitudes towards the advertisement, the product, and the brand. With the massive commotion, Tide proved to pique interest and break ground in the advertisement industry. But even with such a great commercial, would Tide make the viewers more likely to purchase the featured Tide Pods? Our research seeks to provide answers to satisfy your curiosity to this question.

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

Tamyka George

Bennett S. LeBow College of Business
Accounting

Differences in shopping decisions when customers use voice-assistant versus traditional online shopping

Technology and online shopping has advanced as of recent as retailers and marketers seek to globally expand their businesses. One of these inventions is Voice-assistant shopping. This involves customers using microphones on applications (apps) and websites instead of using the traditional online shopping (mouse-clicking). However, the use of this technology is said to influence the decisions buyers make in terms of the types of purchases they make and increase the amount or quantity that is bought. This study was used as a means of finding answers to this question but also how technology affects buyers shopping decisions. For this research, we conducted two experiments, one of which involved participants going onto our created website to order pizza. Some used mouse clicking while others were asked to use voice-assistants. For the second experiment, we tested how technology can influence our shopping with the simple use of a paper shopping list or a technological one. We tested this by having some participants go to the grocery with a hardcopy lists while others used their phones. After this trip, they sent us their bills which was used to find differences in the products that they listed and what was purchased.

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

Zhen Yang, *Graduate Student*

Aidan Dwyer

Close School of Entrepreneurship
Entrepreneurship and Innovation

Using Community Asset Mapping to Inform Successful Transformation of Blighted Land in West Parkside

Philadelphia contains approximately 40,000 vacant lots dispersed throughout its neighborhoods. Vacant land is not only a serious economic problem for many cities, but also a health and safety risk for residents. Previous research has shown, vacant land leads to an increase of crime, anxiety, and trash build-up in a neighborhood. Many residents take pride in their neighborhood, but don't have the resources to maintain or transform vacant land. Land Health Institute (LHI) is a non-profit organization that focuses on reactivating vacant land to serve the needs of inner-city communities. LHI is presently focused on improving two blighted parcels in West Parkside. It is essential to understand the unique characteristics and needs of neighborhood when activating land. To aid LHI in its endeavors, community asset mapping (CAM) was conducted. CAM is a tool that helps identify the resources, strengths, and problems of a neighborhood through interviews and conversations with community members. Topics discussed with residents included the history, environment, economic needs, and communication within the neighborhood. West Parkside was revealed to be a neighborhood with a rich history and potential for future economic development. LHI will use the information collected to progress the transformation of vacant land in West Parkside.

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

A.R. Ciccariello

College of Arts & Sciences
Geoscience (Paleontology)

Exploring a new species of Onychodontid fossil fish from the Late Devonian (382–360 million years old)

Onychodontids are an enigmatic group of lobe-finned fish from the Devonian Period(407-358 million years ago) characterized by a parasymphysial tusk whorl at the rostral end of the lower jaw. The group *Onychodus* comprises onychodontid specieswith a dentary ridge, and visible rib microstructure on the parasymphysial tusks. Though first described in 1857 by J.S. Newberry, species diagnosis in *Onychodus* is still imprecise, and many forms are described on relatively little material. Building on earlier research, the focus of this study is on fossil material recovered from the Frasnian-age, Nordstrand Point Formation on Devon Island, Nunavut, Canada, in 2011. Recent publications have further illuminated diversity of onychodontids, yet new material in this study appears to greatly deviate from described forms. We propose that this material comprises a new species within the *Onychodus* grouping. This new species can be distinguished from other members of *Onychodus* by features including a single row of dentary teeth, closely spaced parasymphysial tusks, and relatively diminutive size. This research project assembles a review of known taxa, describes a new species, and expands understanding of morphological diversity among onychodontids.

Faculty Mentor: **Dr. Ted Daeschler**
Biodiversity, Earth, and Environmental Science
Academy of Natural Sciences

Kevin Sievers

College of Arts & Sciences
Geoscience

Describing the lower jaw of the stem tetrapod Tiktaalik roseae through computed tomography data

Describing the morphology of stem tetrapods is essential to understanding the evolutionary transition between finned and limbed animals. In particular, the lower jaw can be useful to reconstruct musculature and potential feeding behavior. This element is well studied in certain taxa of significance to the fin-to-limb transition such as the finned Eusthenopteron foordi and the limbed Acanthostega gunneri, but has received almost no attention in important transitional forms such as Tiktaalik roseae. In this project, we describe the lower jaw of Tiktaalik through computed tomography data and map out the individual bones within it for the first time, using the left jaw of a large individual recovered from Devonian-age rocks of Ellesmere Island, Nunavut in 2004. Both primitive features, such as the nature of the coronoid fossae, and derived characters, such as sutural morphology that supports a terrestrial-style mode of feeding proposed in other recent studies, can be observed in this specimen. Finally, we constructed a three-dimensional digital model of the jaw to compare to those of similar organisms, in order to track anatomical change through the evolutionary history of this lineage.

Faculty Mentor: **Dr. Ted Daeschler**
Biodiversity, Earth, and Environmental Science
Academy of Natural Sciences

Chyna Poor Thunder

College of Nursing & Health Professions
Health Sciences

Infection Prevalence of Malarial Parasites in Nicaraguan Birds and its Relationship to Altitude, Habitat, and Host Life History

Malaria is caused by parasitic protozoans that are found on all continents except Antarctica. Birds are parasitized by three genera of haemosporidians (*Plasmodium*, *Haemoproteus* and *Leucocytozoon*) that cause malaria-like infections. These parasites are spread by different dipteran vectors, such as mosquitos, black flies, biting midges, and hippoboscid flies. This project examines the effects of altitude, habitat, and avian life history on the prevalence of haemosporidian infections using blood sample collections made from two expeditions to Nicaragua in 2016 and 2017. In total 367 blood samples were collected from three different locations. Samples collected in 2016 were from a high-altitude cloud forest. Those collected in 2017 were from two sites including a Caribbean lowland site with pine savanna and gallery forest and a submontane primary broad leaf rainforest site. We extracted DNA from blood preserved on FTA cards and used a nested PCR Cytochrome b assay to screen for haemosporidians. We sequenced DNA for all positives and then used BLAST to compare them with DNA sequences in the MalAvi database. This allowed us to identify the haplotypes. We then used these data to ask whether haemosporidian infection prevalence across these three sites differs in a predictable way.

Faculty Mentor: **Dr. Jason Weckstein**
Biodiversity, Earth, and Environmental Science
Academy of Natural Sciences

Janice Dispoto, *Lab Manager*

Meghan Campbell

College of Arts & Sciences
Biological Sciences

An Investigation into the Relationship between Reproduction, Dominance, and Nutritional Intake in *MISCHOCYTTARUS* Paper Wasps

Mischocyttarus paper wasps are group-living (social) insects. In each colony there is a social hierarchy and division of labor: some females forage for food, and others remain on the nest and display dominance behaviors. The nutritional intake of wasps is suspected to have an effect on reproduction of female colony members, and the relationship between nutrition and reproduction could explain the development of sociality in paper wasps. We hypothesized that dominance, nutrition, and reproduction are connected, and tested this by connecting an individual's behavior with her reproductive development and nutritional intake relative to other wasps in a colony. We used stable isotope ratios of Carbon and Nitrogen from wasps collected in Monteverde, Costa Rica to determine the relationship between nitrogen enriched diets (from animal prey) and reproductive development and dominance in *M. mexicanus*, *M. pallidipectus* and *M. basimacula* colonies, from wasps of varying ages. Data collection began with individual marking and observation. The wasps were then collected and ovaries were measured. Finally, the stable isotope analysis was conducted on each individual. We tested whether more dominant wasps have the ability to take more insect based prey from foragers, enriching their diet with the nitrogen necessary for greater ovary development.

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

Katie Fiocca, *Graduate Student*

Cheyenne McNair

College of Arts & Sciences
Environmental Science

The Pest Relief: Does Erythritol act as an insecticide for ants?

Erythritol, a non-nutritive polyol sweetener found in Truvia, has been shown in previous work to be toxic when ingested by the fruit fly *Drosophila melanogaster* and, more recently, the red imported fire ant, *Solenopsis invicta*. However, the effects of erythritol on other common pest ant species is unknown. The effect of erythritol in varying concentrations, and with or without excess water present, was tested on three ant species, *Tetramorium species E*, *Formica glacialis*, and *Camponotus chromaiodes* that are common household pests in the United States. Behavioral studies were performed to assess the recruitment of ants to erythritol and control foods and dissections coupled with the use of a blue dye ascertained that ants were consuming the erythritol-laden food. 1.5 M erythritol was found to be toxic to at least two of three species, with and without excess water present; ants died faster without excess water present, suggesting that the ant's water balance may play a key role in erythritol's toxicity.

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

Meghan Barrett, *Graduate Student*

Jasmine Timar

College of Arts & Sciences
Environmental Science

The impact of roads on meta-populations of the northern pine snake (*PITUOPHIS M. MELANOLEUCUS*) in the New Jersey Pine Barrens

Habitat replacement, degradation, and fragmentation are the primary drivers of species decline worldwide. For species of conservation interest these threats are exacerbated in New Jersey which has the highest population density of any state in the United States. With high-density human populations comes increasingly fragmented natural landscapes. This study examines the effects of roads as agents of landscape fragmentation on the genetic composition of the New Jersey state threatened Northern Pinesnake, *Pituophis m. melanoleucus*. We collected genetic samples (blood, tissue, or shed skin) from six suspected metapopulations. DNA was extracted from a total of 500 samples using Qiagen DNeasy extractions kits. We tested snake-specific microsatellite primers (N = 9) for efficacy within our populations by performing PCR and gel electrophoresis. We determined that 7 of our 9 cross-amplified primers return positive results. The future of this project involves genotyping DNA samples in order to elucidate the impacts of roads and population fragmentation on *P. melanoleucus* within the Pine Barrens through population genetic analyses.

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

Dr. Walter Bien, *Co-Mentor*

Eric Gebski

College of Arts & Sciences
Biological Sciences

Differences in odor sensitivity – in a mouse model of Fragile X Syndrome

Fragile X Syndrome (FXS) is the most common inherited form of intellectual disability and autism. FXS is due to a loss of a single gene *FMR1*, which encodes for the Fragile X Mental Retardation Protein (FMRP). FXS is characterized by cognitive disabilities, hyperactivity, and hypersensitivity to sensory stimuli, including olfactory stimuli. The *Fmr1* null mouse model for FXS, like human patients, lacks FMRP and exhibits many of the same symptoms as the FXS patients. We are therefore using this mouse model to explore the cellular and molecular basis of behavioral olfactory hypersensitivity. Previous data from our lab suggest that *Fmr1* null mice are more sensitive to odors compared to wild type mice based on their ability to find hidden food items. To further investigate these differences in odor sensitivity between *Fmr1* null and wild type mice, we are measuring the responses of both wild type and FXS mice to a series of increasingly concentrated odors. Since FXS patients find strong odors aversive, we are asking whether *Fmr1* mice exhibit increased sensitivity and/or abnormal behavioral responses to odorants that are normally attractive (peanut butter) or aversive (2-methylbutyric acid, a compound associated with spoiled foods).

Faculty Mentor: **Dr. Michael Akins**
Biology

Danielle DeBartolo, *Graduate Student*

Anshul Ramanathan

College of Arts & Sciences
Biological Sciences

FXG Conservation in Adult Hippocampus Across the Rodentia Family

Local axonal protein synthesis plays critical roles in the formation of neuronal circuits. Understanding the roles of this mechanism requires identifying circuits that contain axonal ribonucleoprotein particles (RNPs) and how these vary across development. Fragile X Granules (FXGs) are axonal RNPs found in a stereotyped subset of mature brain axons. FXGs contain the translational regulator FMRP along with mRNA and ribosomes. Remarkably, the developmental pattern of FXG expression in hippocampus is species-dependent. Past work from the lab has shown that FXGs are found in the hippocampus of most adult mammals. In contrast, in adult lab mice (*Mus musculus domesticus*), FXGs are absent from hippocampal axons despite their presence in hippocampal circuits in juvenile mice. I therefore examined adult brains from several species closely related to lab mice. I found FXGs in adult hippocampus in rodents outside the *Mus* genus but not in any *Mus* animals, including both *Mus musculus* and *Mus Spretus* mice. This suggests that adult hippocampal FXGs represent a broadly conserved mechanism for regulating the axonal proteome that was selectively lost in the *Mus* lineage sometime after mice and rats diverged.

Faculty Mentor: **Dr. Michael Akins**
Biology

Danielle DeBartolo, *Graduate Student*

Sudipti Attri

College of Engineering
Chemical Engineering

Feeding the Future: Hydroponics in the Home

According to the United Nations Environment Program, 66% of the world's population will reside in urban areas by 2050. A study done by The Chicago Council on Global Affairs suggests that food production needs to increase by 50% to 60% by 2050, to sustain the predicted urban population. As one possible strategy to make food more accessible to the growing urban population, we propose an in-home food production system. Our lab, URBN STEAMlab, works on creating aesthetically pleasing, fully-functional, and easy to use in-home plant growth systems using nitrogen-fixing cyanobacteria to provide fertilizer. This project focuses on testing the efficacy of different tabletop prototypes to support successful plant growth. Throughout the course of this project, we designed two hydroponic systems to observe the effects of different liquid and agar nutrient conditions on seed germination and plant growth. The results of this project will provide an effective roadmap to make food more accessible to an urban population.

Faculty Mentor: **Dr. Shivanthi Anandan**
Biology

Prof. D.S. Nicholas, *Co-Mentor*

Raviteja Bethamcharla

College of Arts & Sciences
Biological Sciences

RNAi Screening in *DROSOPHILA* implicates genes in Tau-mediated mechanisms

Alzheimer's Disease (AD) is a progressive neurodegenerative disorder with no cure and limited treatment. In the AD brain a microtubule associated protein, Tau, is abnormally hyperphosphorylated which causes the protein to form neurofibrillary tangles (NFTs). The degradation of tau destabilizes microtubules, leading to defects in axonal transport and neuronal dysfunction. Mutations in Tau have been found to cause frontotemporal dementia in Parkinsonism, however they have yet to be been linked to AD. Expression of human Tau solely in the eyes of *Drosophila melanogaster* allows us to evaluate neurodegeneration caused by the protein. The gene knockdown technique of RNA interference (RNAi) in conjunction with human Tau expression in the *Drosophila* model allows us to evaluate whether the genes of interest are part of the Tau pathway. We investigated 10 genes that we believe are affected in AD, including KCNA1, MAP1A, DLG1, DVL2, and GSK3 using their fly homologs. Participation of genes in the Tau pathway can be identified by a change in ocular neurodegeneration Tau fly with RNAi compared to one without RNAi. Our hope is to use the results of the screen to elucidate which genes should be targeted in further research to ameliorate the harmful effects of NFTs.

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

Mariah Beaver, *Graduate Student*

Niteesha Betini

College of Arts & Sciences
Biological Sciences

Cognitive Effects of Tip60 HAT on Parkinson's Disease Model Flies

Previous research conducted by the Elefant lab has demonstrated the important role of epigenetics in Alzheimer's disease (AD) in *Drosophila* flies. Tip60 HAT is a histone acetyltransferase, which controls gene expression by loosening tight DNA strands, so genes can be transcribed and the appropriate proteins can be produced. Previous results have shown that histone acetylation levels were lower in AD flies than in healthy flies. In addition, the AD flies demonstrated cognitive and locomotor defects; however, when Tip60 levels were increased, the defects were rescued. Not only do these results propose possibilities of future AD cures, but it also opens the door to the potential role of Tip60's function in other neurodegenerative diseases, such as Parkinson's disease (PD). This current project's research determined whether cognitive defects expressed in PD flies can be rescued by an increase in Tip60 during early development before the disease fully progresses. By conducting a learning and memory assay to test scent association over a two-hour period, a decrease in cognitive ability was observed in PD flies in comparison to the control. Continued research will demonstrate whether increasing Tip60 expression can rescue these defects.

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

Mariah Beaver, *Graduate Student*

Gayathri Vijayakumar

College of Arts & Sciences
Biological Sciences

Effects of Tip60 on Learning and Memory in Huntington's Disease

Huntington's disease (HD) is an autosomal dominant neurodegenerative disease that results from a mutation in the huntingtin gene on the fourth chromosome. Typical symptoms of Huntington's disease include both cognitive and movement disorders. Currently, only symptomatic treatment is available for HD putting patients at a disadvantage. The Tip60 histone acetyltransferase (HAT) is an enzyme that epigenetically regulates genes associated with neurons and may have a neuroprotective role in the body. Learning and memory assays were conducted on larvae from 201Y flies crossed with HD and 201Y flies with excess Tip60 crossed with HD to test larval ability to associate sucrose with a particular odor. In HD model larvae, it was observed that the larvae had difficulty learning but were able to later recall the association between the odor and the sucrose. On the other hand, larvae with excess Tip60 were able to immediately learn the association between the sucrose and the odor. Increasing Tip60 levels was able to rescue the learning defect in HD model larvae. This could imply that Tip60 may be a viable option to therapeutically treat the cognitive defects experienced in Huntington's disease even in its early stages.

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

Mariah Beaver, *Graduate Student*

Nishtha Gupta

College of Arts & Sciences
Biological Sciences
Frances Velay Fellow

Optimizing Stereotaxic Injection Coordinates in Juvenile Mice using SR101

Microinjection is a powerful tool that may be used to study brain function. Juvenile mouse brains (<PND14) have not been mapped as extensively as compared to adult mouse brains, which is problematic for developmental studies. In this study, we sought to determine the optimal stereotaxic injection coordinates to target cell-specific, localized expression in the somatosensory cortex in order to set up future studies involving the virus-mediated expression of transgenes. We performed microinjections of the dye, Sulforhodamine 101 (SR101), at varying locations and depths, followed by histology to determine the corresponding brain structures at those coordinates. Microinjection of SR101 consistently produced diffuse labeling throughout the injected hemisphere, with prominent labeling of astrocytes closest to the injection site. Based on our results we conclude the best coordinates for targeting somatosensory cortex in juvenile mice. These results will serve as the basis for future studies in which we will inject a viral vector to drive expression of Green Fluorescent Protein (GFP) in neurons to study synaptic plasticity in the somatosensory cortex.

Faculty Mentor: **Dr. A. Denise R. Garcia**
Biology

Dr. Andrew Blaeser, *Post Doctoral Fellow*

Poster Session A

Shelby Jain

College of Arts & Sciences
Biological Sciences

The Laminar Distribution of Cortical Gli-1 Expressing Cells in Postnatal Development

Astrocytes are a type of glial cell found in the brain and are responsible for performing vital functions within the central nervous system (CNS), including synapse formation and maturation. Despite these functions, very little is known about astrocyte development. During early embryonic CNS development, neural precursor cells (NPCs) undergo neurogenesis, followed by gliogenesis with peak astrocyte development occurring postnatally. There is a much more known about how neurons develop, including patterning into functionally distinct layers within the cortex. It is unclear if astrocytes develop similarly. One subpopulation of astrocytes expresses the transcription factor, Gli1, a readout of active Sonic hedgehog (SHH) signaling, and important pathway during CNS development. Gli1 cells display a laminar distribution in the adult cortex, making Gli1 astrocytes a useful tool to assess whether astrocytes develop in a layers. We use a transgenic mouse line to permanently mark and identify this distinct population and study the positional identity of these cells across postnatal development. Our results show that Gli1 expressing cells are seen across all cortical layers during early, but not late, postnatal development. These results suggest that astrocytes maturate distinctively from neurons, though still form layers later in development.

Faculty Mentor: **Dr. A. Denise R. Garcia**
Biology

Ellen Gingrich, *Lab Technician*

Sprikena Nako

College of Arts & Sciences
Biological Sciences

Investigating lysogeny in bacteriophages: Superphikiman and SirKandyKane

Bacteriophages (phages) are viruses that are able to infect bacteria, they can be either lytic or temperate. Lytic phages infect and lyse cells. Temperate phages infect bacterial hosts and insert their DNA into the genome of the bacteria, becoming lysogenic. The phage is then protected and able to replicate with the bacterial cell. Lysogenic phages have various mechanisms of preventing other phages from infecting the same cell. To further understand lysogenic phages and their immunity repressor mechanisms, stable lysogens for phages SirKandyKane and Superphikiman were cultured. It was found that SirKandyKane was able to prevent infection of 12 phages (of the 34 tested) from different phage clusters, suggesting that the immunity repressors are not cluster specific but depend on another variable. On the other hand, Superphikiman was able to fully prevent the infection of 1 phage (of the 34 tested). This phage (Jeon) was from the W cluster, while Superphikiman is J cluster. These Superphikiman results may suggest cluster specific immunity repressors, when compared to the SirKandyKane immunity repressor. By studying the mechanisms of how lysogens prevent infection, more can be understood about phage infection and diversity.

Faculty Mentor: **Dr. Susan Gurney**
Biology

Trinh Tran

College of Arts & Sciences
Biological Sciences

Bacteriophage PherrisBueller's Day Off

PherrisBueller is a mycobacteriophage virus that was isolated in the Fall of 2016 at Drexel University by a student in the SEA-PHAGES program. In the laboratory, phage PherrisBueller formed a stable lysogen and was also shown to infect different bacterial hosts. The complete genome of PherrisBueller was sequenced in order to investigate the genetics of this phage. Genome sequencing and annotation revealed that PherrisBueller belongs to the A1 cluster of bacteriophages, its genome contains 49209 base pairs with a 64.0% GC content. Manual genome analysis confirmed that PherrisBueller has 90 genes, 47.7% of which were assigned a function. By comparing PherrisBueller to similar A1 bacteriophages, it was found that PherrisBueller had lost genes 41, 44, 90, 91, 92 and 94 which are present in phages Dreamboat and Jasper. One interesting feature in PherrisBueller's genome was a -1 frameshift mutation in gene 24. This tail assembly chaperone gene (gene 24) is a common location for frameshift mutations. The -1 frameshift occurs when the ribosome slips backwards when reading the nucleotide sequence and in this case the "G" is counted twice, creating a fusion protein. PherrisBueller is the first A1 cluster bacteriophage to be isolated and annotated by students at Drexel University.

Faculty Mentor: **Dr. Susan Gurney**
Biology

Bhavya Thuremella

College of Arts & Sciences
Biological Sciences

Exploration of the effects of 1700 FDA approved drugs in a Daughterless knockdown model in *DROSOPHILA MELANOGASTER*

Daughterless (Da) is a protein found in *Drosophila melanogaster*, which is the homolog of the mammalian protein Transcription Factor 4 (TCF4). Da/TCF4 are class I basic helix-loophelix proteins which have various roles during development including acting as a master regulator of embryonic neurogenesis. In addition to this role during development, our lab has recently shown that Da/TCF4 functions in differentiated postmitotic neurons. We have shown that knockdown of Da/Tcf4 results in an increase of neurite branching and synapse formation in postmitotic neurons. The knockdown of Da/Tcf4 results in decreased larval contractions, a readout of proper glutermatergic neurotransmission. These results are important because mutations in *TCF4* have been associated with the neurodevelopmental diseases Pitt-Hopkins syndrome and schizophrenia.

The purpose of this research is to screen a library of 1700 FDA approved drugs in our Da knockdown model. Pitt-Hopkins syndrome is caused by haploinsufficiency of *TCF4* in humans, and as we are also decreasing Da in our screen, this is a quick, efficient, and cheap model to screen drugs to determine which drugs can alleviate larval motor defects. A long-term goal of this project is to move identified drugs into a mouse model to see if their effect is conserved across species.

Faculty Mentor: **Dr. Daniel R. Marenda**
Biology

Edward Waddell, *Graduate Student*

Poster Session A **60**

Vamsee Vemulapalli

College of Arts & Sciences
Biological Sciences

Characterization of Novel Therapeutics Targeting Neurodegeneration in Alzheimer's Disease

Alzheimer's Disease (AD) is an age-related neurodegenerative disease affecting over 5.4 million people, with few palliative-only treatment options. In an attempt to optimize AD research, transgenic models have become increasingly popular and well characterized. Our lab expresses human AD-associated proteins APP and BACE in the *Drosophila melanogaster* central nervous system to generate a powerful AD model for drug screening. In collaboration with the Wistar Institute, a non-profit that creates novel therapeutics, we are testing compounds, initially designed to fight cancer, in our AD model. Progression of AD was measured by counting larval contractions per minute to quantify synapse function. Using this technique, a drug screen tested the efficacy of four compounds at varying concentrations. Although the drugs did not significantly rescue the AD motor defect, two compounds were selected from this screen for further characterization. This will include staining muscles and neurons in the AD fly model to observe changes in neuronal structure following administration of these compounds.

Faculty Mentor: **Dr. Daniel R. Marenda**
Biology

Katherine Innamorati, *Graduate Student*

Kaustav Riju Patra

College of Arts & Sciences
Biological Sciences

An investigation into the effects of HDAC inhibitors on kismet knockdown flies

The *Drosophila melanogaster* gene, kismet, is a chromatin reader that recognizes histone modifications. Our lab has previously shown that pharmacological intervention with HDAC inhibitors can rescue larval motor function in kismet knockdown animals. HDAC enzymes remove acetyl groups from histones, allowing the DNA to wrap around histones more tightly, thereby inhibiting gene expression. Here, we aim to genetically examine the effects of decreased HDACs on motor function in adult kismet knockdown flies. We utilized the GAL4/UAS system to knockdown individual HDACs using RNA interference in a kismet knockdown background. We assayed the effect on adult motor behavior using the climbing paradigm. We suggest that the effects of these HDACs and others continue to be studied in order to determine true correlation between their enzyme function and kismet expression.

Faculty Mentor: **Dr. Daniel R. Marenda**
Biology

Nina Latcheva, *Graduate Student*

Shivani Patel

College of Arts & Sciences
Biological Sciences

Regulation of Cellular Protrusions by Osmotic Pressure

Cell movement is essential for many physiological and pathological processes, including prenatal development, wound healing, and cancer metastasis. Cells migrate using protrusions to extend their leading edge. Lamellipodial protrusions are formed by actin polymerization, which results in thin, fan-shaped lamellipodia. Recently, we discovered fibroblasts moving in three-dimensional tissue use a different type of protrusion. In these cells, actomyosin contractility generates high intracellular pressure and transforms lamellipodia into lobopodia. To test the hypothesis that high-intracellular pressure physically prevents lamellipodia formation, we manipulated intracellular pressure by changing the osmolarity of the extracellular environment. Our initial investigation shows that fibroblasts respond to increased osmotic pressure by significantly reducing lamellipodia. Further, reduced osmotic pressure significantly increases lamellipodia formation. Future experiments will confirm whether osmotic pressure directly governs lamellipodia formation through physical mechanisms or intracellular signaling pathways. Ultimately, this work will help identify new therapeutic targets to control cell movement in the body.

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

Kimheak Sao, *Research Technician*

Dmytro Klitchyk

College of Arts & Sciences
Biological Sciences

Investigating the Pro-Apoptotic Mechanism of Dependence Receptors: EphA4 & EphB3

Eph receptors, such as EphA4 and EphB3, which are a subfamily of the Tyr kinase receptor superfamily, have been shown, in previous studies, to function as dependence receptors; in the absence of their respective ligand these trans-membrane receptors signal for programmed cell death, yet their mechanism for cell death induction has not been explicitly studied. To shed light on their function, we used mouse embryonic fibroblasts (MEFs) from EphA4-/-/EphB3-/- animals. The primary goal was to establish optimal conditions that would allow us to measure Eph-induced cell death in these cells. Afterwards, TrypanBlue exclusion assays were performed to quantify cell death in cells expressing either EphA4 alone, EphB3 alone, or EphA4/EphB3 together; the results were used to establish whether EphA4/EphB3 can cause effective apoptosis individually or if there is synergistic function between EphA4-EphB3 producing even greater cell death. Although inconclusive, our results suggest that EphB3 under our conditions is able to initiate apoptosis on its own in the absence of its respective ligand. Yet, further tests need to be conducted to better understand the function of EphA4 alone, as well as EphA4 and EphB3 in tandem.

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

Wujun Xiao

College of Arts & Sciences
Biological Sciences

Facultative Symbionts of Pea Aphid

Symbiosis is the living together of dissimilar organisms, including host animals and their resident microbes. The pea aphid, *Acyrthosiphon pisum*, is a symbiotic creature and the focus of our research on symbiotic bacterial communities. This phloem-feeding, asexual insect reproduces requires the maternally transferred symbiont Buchnera, and may or may not harbor additional, non-essential bacteria called facultative symbionts. In nature, some facultative symbiont combinations exist more frequently than expected. But the reason behind this remains undicovered. By transferring symbionts between pea aphid clones, via microinjection, we have attempted to create common and rare facultative symbiont combinations with future plans to study their establishment and effects on aphid fitness -- of particular interest are the hypotheses that rare symbiont partners compete and that common symbiont partners cooperate. To complement these efforts we have performed field-based research to estimate rates of symbiont transfer to offspring and how this varies for various partnerships. Our findings on these simple, pliable symbiotic communities may have implications for the more complex symbiotic communities, including those seen for humans.

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

Linyao Peng, *Graduate Student*

Isabella Santosusso

LeBow College of Business
Legal Studies, International Business

Should We Be a 24-Hour City?

The objective of this study is to answer: What is the 24-hour city and how does increasing hours of economic activity affect a city's economic health?

First, I had to define the concept of various schedules of a city's economic activity, which the concept of it not universally accepted. I conducted a literature review of academic databases and urban policy research to gain a crucial understanding of terminology regarding the 9-5, 18, and 24-hour cities. From this, I found that the 18-hour city is prevalent in the U.S, along with the progress of a "nighttime economy" (NTE).

Next, I used secondary sources to construct a preliminary cost benefit analysis of 18/24-hour cities in attempt to identify and quantify associated benefits and costs. I then examined the effectiveness of various public policy interventions that either encouraged or discouraged an 18/24-hour economy of the past and their potential effectiveness looking forward.

My research suggests that there is a net benefit associated with prolonged hours of economic activity and an 18/24-hour economy is a legitimate public policy objective for certain cities. With this new understanding of the 18/24-hour city, I developed policy recommendations for the City of Philadelphia.

Faculty Mentor: **Prof. Stephen P. Mullin**
Center for Public Policy

Ellende Chongolola

College of Engineering
Chemical Engineering

Green Liquid Chromatography

As the analytical chemistry community continues to implement sustainable practices within their laboratories, a focus has been placed on reducing the amount of harmful chemical waste produced during experimentation. In this project, the strengths of organic solvents methanol, ethanol, and acetonitrile as mobile phases for reversed phase liquid chromatography are compared. Applying the experimental conditions practiced in Thermo Fisher's HPLC analysis of nonsteroidal anti-inflammatory (NSAID) compounds helped evaluate each solvent's efficiency when separating compounds at varying percentages of organic solvent. Ethanol proved to be the strongest and most eco-friendly solvent by eluting NSAID compounds quickly with lower percentages of solvent used, which will produce lower amounts of chemical waste. This project also includes the optimization of chromatographic simulators using computational analysis methods in MATLAB, which will aid analytical chemists in developing accurate predictions for isocratic and gradient separations over a variety of mobile phase compositions and conditions. The results produced in this project will serve as a precedent for further research conducted along the journey toward greener analytical chemistry.

Faculty Mentor: **Dr. Joe P. Foley**
Chemistry

Catherine Kita, *Graduate Student*

Jawhara Karam

College of Arts & Sciences
Biological Sciences
Frances Velay Fellow

Construction of a FET with polymer-based coating

According to a CDC report published in 2014, over 29 million Americans are living with diabetes mellitus. Through careful glucose monitoring, diabetics can avoid health complications and can live relatively normal lives. The equipment used for glucose monitoring, however, can be expensive. As such, scientists have been investigating cost-friendly ways to measure glucose concentrations inside and outside of cells. One innovative approach is to utilize field effect transistors. A field effect transistor, also known as a FET, consists of some insulated conductive element as well as several electrodes. A FET works by applying voltage to the gate electrode and then having that voltage manipulate the current flowing from the source electrode to the drain electrode through a semiconductor channel. In this study, a core-wire FET is constructed by depositing a layer of the semiconductor polyaniline onto an insulated copper wire. In this way, the polyaniline acts as the FET channel and allows a current to pass through the polymer. While polyaniline does make the FET device conductive, for future research, an alternative polymer such as poly(3-hexylthiophene-2,5-diyl) may be able to provide better conductivity measurements for the device.

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

Tyler Milo

College of Engineering
Electrical Engineering

Novel Spray-Coating Method for Creating Zinc Oxide Field-Effect Transistor Glucose Biosensors

Field-Effect Transistors (FET) are used in various electronic devices ranging from integrated circuits to sensors. Zinc oxide is a common compound used in the production of metal-oxide-semiconductor field-effect transistors (MOSFET), a subcategory of FETs. Zinc oxide MOSFETs are great candidates for FET biosensors. These FET biosensors are capable of detecting and measuring glucose levels in the bloodstreams of diabetes patients. This is because zinc oxide is a biocompatible molecule, and has the ideal electrical properties for use in transistors. However, the current process for making zinc oxide MOSFET biosensors is complex, time-consuming, and expensive. To simplify the process and lower the production costs, a new method has been developed. This method includes spray coating a glass insulated wire with a precursor solution of zinc acetate. This coating oxidizes after annealing at 500°C, forming a zinc oxide thin film coating on the surface of the glass. Once the glass insulated wire is coated, it is tested to determine if the current-voltage curves mimic those of an ideal FET.

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

Glen Nieman

College of Engineering
Chemical Engineering

Characterization of Neddle-Like Wires Created from Red Phosphorus and Copper(II) Bromide

Amorphous red phosphorus can be used to prepare a number of materials with interesting electric, magnetic, and optical properties. For example, red phosphorus can be prepared in a sealed ampoule with cuprous iodide at 580°C to form copper phosphide, a black solid with needle-like crystals with promising applications in battery charging. When cuprous bromide is used in the place of cuprous iodide, not only are black crystals formed, red needles are observed as well. These new needles were characterized using single crystal x-ray diffraction, attenuated total reflectance, and electron paramagnetic resonance. Electrical characterization using I-V curves revealed semiconductor properties, which opens applications in the fields of transistors and computers. Single crystal x-ray diffraction revealed CuP_2 and $Cu_2I_2P_3$ structures for the reaction with Copper(I) Iodide. Research for the structure of crystals from the Copper(II) Bromide is ongoing. A direct band gap of 1.05eV was obtained using attenuated total reflectance. Electron paramagnetic resonance was used to characterize the magnetic properties of the crystals in different orientations.

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

Pedro Amaral, *Graduate Student*

Pavel Stan

College of Arts & Sciences
English, Philosophy

Veterans' History ProjecT

Social science research offers a unique way to understand history and to help veterans to articulate war-related traumas in ways that might be useful to their healing. Primary research of interviewing two Vietnam war vets was combined with secondary research on communication studies. The importance of emotions, beliefs, and empathy to primary research is highlighted.

The by-weekly interviews conducted with each Veteran served to compile an outline of their life history, to be shaped into a video interview and documented onto the Library of Congress's Veterans' History Project. Emerging stories were found to be emotionally intense and traumatic, yet also containing powerful messages on military injustice, racial discrimination, and personal power.

Aside from the short-term goals to be achieved during this summer, the project sought to establish a base for future similar research, answering the question of "Is this a project that can successfully be conducted by a student?" in hopes of constructing a future community engagement course at Drexel. It did so by achieving intense personal development in the student researcher, and a positive reaction to the final product from the involved veterans.

Faculty Mentor: **Dr. Karen Nulton**
English & Philosophy

Michael Rinehart

College of Computing & Informatics
Computer Science

Sympy Form Analyisis

Proper forms of polynomials are of paramount importance in mathematics research, cryptography, and symbolic computation. While current frameworks to analyze the form of polynomials exist in proprietary computer algebra systems such as Mathematica, an open-source framework is necessary for researchers, educators, and security analysts to evaluate the code, identify improvements, suggest changes, and distribute freely to others.

Here we present an open-source framework for supplying standard expressions formed in the Sympy framework with various boolean evaluations, including reducibility in various fields and proper forms for singletons, monomials and polynomials. The framework has been built from the ground up for convenient modification, consistent style, and extensive documentation. Testing polynomial evaluation for efficiency and accuracy is implemented using Python's unittest and timeit modules. Extending the current offerings of open-source symbolic computation networks allows researchers to use software that respects user freedoms, and we hope that by extending Sympy we can work towards making it a more viable computer algebra system replacement for those in Mathematica, Maple and Matlab.

Faculty Mentor: **Dr. Pavel Grinfeld**
Mathematics

Dr. Jeremy Johnson, *Co-Mentor*

Pablo Zhou

College of Arts & Sciences
Mathematics

Orthogonal projections of vector configurations

In the setting of the d-dimensional Euclidean space, we study the orthogonal projections of unit vector configurations onto subspaces of fixed dimension. We search for the extremal configurations that have the largest minimum or the smallest maximum of the total projection length over all configurations of given size. Of particular interest are the corresponding maximin and minimax values. In some cases, for small values of d, we can provide definitive answers, while in general the problem remains open.

Faculty Mentor: **Dr. Anatolii Grinshpan**
Mathematics

Brian Milenki

Bennett S. LeBow College of Business
Business & Engineering

PROSPECT detector calibration using a boron 12 source

Neutrinos are charge-less and extremely small mass particles which are interesting because of their abundance and fundamental presence in many nuclear reactions. While the three currently known flavors of neutrinos interact primarily through the weak force, a hypothetical a 'sterile' neutrino would interact only via gravitational forces. Observation of sterile neutrinos would have significant implications in particle and nuclear physics. The Precision Oscillation and Spectrum Experiment (PROSPECT) is an experiment designed to precisely measure the antineutrino spectrum from a highly-enriched uranium reactor and to probe for the existence of sterile neutrinos. The PROSPECT detector consists of an array of 14 by 11 cells, which require a calibration plan. To create the calibration plan, we utilize simulation data to predict detector response under realistic conditions. We can determine the energy spectrum produced by the decay of a boron-12 calibration source, then compare the true spectrum to spectra obtained by different cells to determine if there is a dependence on cell positioning. We then produce a layout of the minute differences between cells for use in position-dependent calibration corrections. We will be able to apply this calibration to better understand the final detector response.

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

Yung-Ruey Yen, *Post Doctoral Fellow*

Poster Session C **74**

Nicholas Yurcaba

College of Arts & Sciences
Physics

The Characteristics of Sickled Blood Being Drawn Through a Narrow Tube By Capillary Forces

When blood is drawn through a narrow tube through capillary action a region of high concentration is formed directly behind the meniscus. This phenomenon is most apparent in sickled blood as the red blood cells are rigidified by the hemoglobin which is polymerized when deoxygenated. This is an area of study with many unanswered questions such as the exact causes and characteristics of this high concentration region. So, we analyzed the formation and attributes of the cap by using ¼ μL glass capillary tubes that are 32 mm long. We determined the length of the cap, its concentration and decay length at various distances along the capillary. These different measurements were taken when the capillary is horizontal as well as vertical and in full white light as well as specific wavelengths of light only. This data is useful as it helps with the detection of sickle cell trait in blood and further with the production of a low-cost device that can detect sickle cell trait being produced in this laboratory.

Faculty Mentor: **Dr. Frank A. Ferrone**
Physics

Christopher Brown, *Graduate Student*

Nick Giardetti

College of Arts & Sciences
Physics

Analyzing the Fractal Nature of Young Stellar Clusters

Young stellar clusters are thought to form in small groups which merge into a final cluster. One method to computationally test this theory is using numeric quantities such as the fractal dimension or minimum separation of members to measure the "clumpiness" of star clusters of different ages. In this work, I analyze the structure of simulated systems by calculating the Q parameter and the fractal dimension of these clusters during formation and early evolution in their natal gas clouds. I then attempt to correlate changes in these quantities to structural changes in the young clusters. We see that the fractal dimension goes to just under 1.6 and change in the Q parameter accelerates as a cluster ejects natal gas.

Faculty Mentor: **Dr. Stephen McMillan**
Physics

Joshua Wall, *Graduate Student*

Diana Solano-Oropeza

College of Arts & Sciences
Physics

Mock Observations of Simulated Star Formation

In astronomy, star formation is studied in two ways: observation and simulations. Observations give a snapshot of young stellar objects and their environments as they are today, while simulations allow for understanding the formation process itself, which spans millions of years. To compare the two, astronomers use mock observations of simulations, designed to create images with similar properties to true observations at specific wavelengths. In this work we compare new simulations of the formation and early evolution of young stellar clusters to real star forming regions using mock observations at infrared wavelengths. We use these mock observations to validate the simulations and gain insight into actual observations of young natal clusters.

Faculty Mentor: **Dr. Stephen McMillan**
Physics

Joshua Wall, *Graduate Student*

Matthew Seidman

College of Engineering
Mechanical Engineering

Filtration System for a Bubble Chamber Dark Matter Detector

Dark matter is suspected to comprise about 87% of the mass of the universe while conventional mass occupies 13%. Understanding these particles would give us a much greater understanding of how objects move in our universe and may help to verify fundamental models of the universe. Some organizations, such as SNOLAB, are devoted to sub-atomic particle research in underground laboratories where they are shielded from radiation.

To detect these particles, a bubble chamber detector is being built at SNOLAB in Canada by the PICO research collaboration. A prototype chamber has also been built at Drexel. The construction of these devices inevitably accumulates debris, regardless of the cleanliness precautions taken. This type of detector is very sensitive to particle interactions, but can also be easily falsely triggered by debris. By constructing a distillation loop, most particulate and chemical impurities can be removed from the gaseous phase. This system had to be designed without any internal moving parts (which would generate debris), so a thermodynamic pump was used to generate a differential pressure. Differential pressure is necessary to force the fluid through the system and allow for fluid to flow through the loop continuously.

Faculty Mentor: **Dr. Russell Neilson**
Physics

Matthew Bressler, *Graduate Student*

Manas Bharadwaaj Subramanian

College of Arts & Sciences
Physics, Mathematics

Near Earth Asteroid Characterization

Asteroids are being discovered at an exponential rate ~1500/ year as sky surveys have become more sensitive, by 1 magnitude every ~7.5 years. Surprisingly the discoveries of large (H ≤ 22) NEAs have increased slightly over the last three years to a stable ~500/year, showing some considerable increase from the previous decade. At this rate, however, the 2005 Congressional mandate to find 90% of 140m NEAs may not be met before 2030. Detailed characterization of asteroids is not happening at the same rate: it will take a century to fully analyze even the known population. This is particularly true for smaller (and thus fainter) asteroids as it is difficult to re-observe them at some later time (and thus generally further out in their orbits). The optical colors of ~30,000 asteroids are observed from a variety of sky surveys. The most recent data with the orbital parameters and multi-band photometric measurements are used to group the NEAs into "families". This helps in determining the chemical composition or ore nature of NEAs and determine that asteroids from particular family have a common origin.

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

Dr. Martin Elvis, *Astrophysicist - Harvard-Smithsonian Center for Astrophysics*

Lee DeHaas Webster

College of Arts & Sciences
Physics

Variability of Active Galactic Nuclei

Active Galactic Nuclei are supermassive black holes in the centers of galaxies that produce varying levels of light. Using data from the Kepler, SDSS, and Catalina telescopes, we are analyzing those variations in light to try to understand the mechanics behind black hole accretion physics. The current prevailing theory is that forces between gas and dust caught in the black hole's gravity will create incredible amounts of heat and light. The amount of energy output changes over 10 percent on timescales of days to over a year. The Catalina dataset is unique in that it has collected hundreds of photometric measurements (in short bursts) over a long period of time. This allows characterization of processes that may not be visible on longer timescales, and further analysis of objects already studied with datasets from other telescopes. We present preliminary analysis comparing the same objects viewed through the three telescopes to better constrain timescales of variability.

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

Jackeline Moreno, *Graduate Student*

Zack Levy-Dyer

College of Arts & Sciences
Global Studies

When and how do opponents of LGBT rights mobilize? Political Participation on the Societal and Elite Levels

From La Manif pour Tous' protests against same sex marriage in France to Elena Mizulina's anti-gay propaganda laws, opponents of LGBT rights have become increasingly mobilized politically. However, while the French organization failed to dissuade their government from accepting the same sex marriage bill, Russia's politicians accepted the anti-gay bill unanimously. What factors contributed to the different paths these countries, and others, have taken in regards to LGBT rights? This research focuses on the two interconnected, overarching questions of when and how opponents of LGBT rights mobilize in an increasingly polarized world. The analysis looks at global public opinion data, on a societal level, and documents on anti-LGBT organizers at an elite level. We find that states with more traditional sexual norms, where LGBT rights are not seen as "inevitable," will have greater political participation by opponents of LGBT rights both in organizational participation and voter participation.

Faculty Mentor: **Dr. Phillip Ayoub**
Political Science

Alexis Tsapralis

College of Arts & Sciences
Global Studies

The Quality of Mercy: Do Roma Children Favorably Sway French Eviction Rulings?

This research examines French courts' eviction rulings of Roma immigrants. It asks the question: is there a correlation between the involvement of children in these human rights cases and courts ruling favorably for the Roma people? This issue is understudied in the scholarly literature, but one would expect that courts would be more sensitive to children being involved which would therefore lead to fewer evicted families, or at least a longer period of delay in the eviction. Surprisingly, my research actually finds that the involvement of children is not correlated with fewer eviction orders or longer delays granted before evictions.

Out of 112 French eviction cases, all analyzed and coded in their original language, 50 involved children and 23 of those cases resulted in eviction. That means in 46% of cases involving Roma children, there is eviction. In terms of the court ordering an eviction with some form of delay, cases involving children received on average 2.28 months of delay compared to the 2.55 months of delay in cases not involving children.

The data clearly shows that the involvement of children in eviction cases makes an almost indiscernible difference in the leniency of eviction in French courts towards Roma people.

Faculty Mentor: **Dr. Zoltan Buzas**
Political Science

Poster Session A

Niayla-dia Murray

College of Arts & Sciences
Political Science, Philosophy

In France We Trust: Roma Immigrants, Trust, and Political Participation in France

The purpose of this research is to identify the relationship between Roma immigrants' political mobilization and Roma trust of French institutions. Existing literature currently has numerous theories on the relationship between trust and political mobilization. One theory offers distrust fuels political participation (Levi & Stoker, 2000) whilst another offers political trust fuels political participation that is institutionalized only (i.e., voting) but not non-institutionalized participation (strikes, demonstrations and signing petitions), (Hooghe & Marien 2012). To assess the claims of the literature, this research focuses on political participation such as voting, petition signing, strikes, and peaceful demonstrations, that are both institutionalized and non-institutionalized. I examine the impact Roma immigrants' trust in French institutions has on these acts of political participation. The results draw on 172 surveys collected in 2015 from Roma immigrants residing in slums in Grenoble and Paris, France. Interestingly, the Roma do not trust fellow Roma but show great trust in French institutions. I find trust in French institutions is positively correlated with all acts of political mobilization, institutionalized and non-institutionalized.

Faculty Mentor: **Dr. Zoltan Buzas**
Political Science

Taya N. Stevens-Allen

College of Arts & Sciences
Psychology

Mother Baby Connections: Impacts of Therapy and Intervention

Mother Baby Connections, an intensive outpatient program for pregnant and postpartum women in the Philadelphia region, provides individual and group interventions to improve women's symptoms of perinatal mental health problems such as depression and anxiety. Taking into consideration financial, and biological factors, this program helps to improve functioning and interpersonal relationships with their infant, as well as their partner and peers. Utilizing a compilation of eight surveys that are taken on a four week basis, this project examines the impacts of therapy and intervention for a subset of patients who participate in Mother Baby Connections. The sample was comprised of 10 women, 60% African-American, 30% White, and 10% Asian, ranging from ages 22-44. A detailed analysis and comparison of the preliminary baseline survey and the intermediate 4-week survey for the sample size (N=10) demonstrates a decrease of depressive (M=16.2, SD=6.9) symptoms and stress (M=28.5, SD=4.3), as well as an improvement in maternal functioning (M=81.2, SD=16.9). These preliminary results indicate that participating in Mother Baby Connections has a positive impact on mother's depressive symptoms and stress in the perinatal period.

Faculty Mentor: **Dr. Pamela A. Geller**
Psychology

Dr. Alexa Bonacquist, *Post Doctoral Fellow*

Shu Lin Zhao

College of Arts & Sciences
Biological Sciences
Frances Velay Fellow

Effectiveness of Telehealth in Social Problem-Solving Interventions

Telehealth, the provision of healthcare remotely by means of telecommunication technology, is rapidly gaining acceptance due to the evolution in technology in the healthcare landscape. Telecommunication technology includes but is not limited to services such as privacy-protected video chat software, phone calling, and the web-based education. Researchers are interested in telehealth because telecommunication aims to eliminate common barriers of treatment such as time, distance, and the unavailability of knowledgeable or specialized providers. If telehealth proves to be an effective intervention, there will be an increase in healthcare access for medically underserved populations. Since telehealth is a relatively new method of delivering services to patients and their caregivers as compared to traditional methods, there is not an extensive literature base. Therefore, my project is focused on reviewing existing literature to see if telehealth interventions are effective and whether telehealth could be used for future studies in the lab.

Faculty Mentor: **Dr. Christine Maguth Nezu**
Psychology

Winnie Chan

College of Arts & Sciences
Psychology

The Influence of Relationships: How Does It Affect Southeast Asian High School Students and Their Academic Experience?

"Model Minority" is a label commonly used to classify Asians as a minority group where all these individuals are successful (Tran & Curtain, 2017). While research has shown that Asian students may have the highest GPAs (Cherng & Liu, 2017; Le, 2017), the findings from these studies focus primarily on Chinese and Japanese students. Many scholars have failed to highlight the differences between the other ethnic minorities within this group (i.e., Vietnamese) when it comes to their academic achievement. Previous research has highlighted the significant effect different relationships (e.g., teachers, parents) have on students' academic achievement (Allen et al., 2016; Rodriguez-Operana et al., 2017). However, few have examined what these effects are for Southeast Asians. For this study, semi-structured one-on-one interviews were conducted with high school students who are of Southeast Asian descent. I examined how these relationships may positively or negatively influence their academic performance. Preliminary results suggests that students may be shaped positively by the support from their close friends. This is unique as previous research have focused primarily on parent and teacher influence on students' academic achievement.

Faculty Mentor: **Dr. Danette Morrison**
Psychology

Taryn Irving

College of Arts & Sciences
Psychology

Gay Men's Social Networks and Support for PrEP Adherence

Pre-Exposure Prophylaxis (PrEP) is a medication that prevents individuals from acquiring HIV. Men who have sex with men (MSM) are among the largest population that take PrEP. Prior trials and studies have demonstrated that PrEP is an effective prevention method, contingent on one's adherence to the drug. In the current study, we explore the attitudes of gay and queer men on PrEP, specifically regarding their social life and adherence. In the ongoing study, participants come in for a one-hour interview to discuss their PrEP experience. My analysis has revealed common themes appear in PrEP research: risk compensation, adherence and efficacy, interventions, counseling, and lack of education. However, very few focus on how PrEP has altered the lives of the individuals taking the drug. Expanding upon these themes, the current study focuses on analyzing the social aspect of PrEP i.e. social spaces, sexual negotiation, adherence motivations, and cultural/ethnic disparities. Data collected from the study should alter the way PrEP is both viewed by society and advertised by medical providers, and education/outreach programs.

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

Joseph Martin

College of Computing & Informatics
Computer Science

Application Development for the Analysis of Plan Recognition and Planning Data

Automated plan recognition and planning have applications in a number of diverse real-world applications including speech based interfaces (e.g. Siri, Amazon Alexa, Microsoft Cortana...), active network security, assistive systems for manufacturing, and even human-robot interaction. For plan recognition and planning algorithms to be most useful for these applications they must use the same representations for both problems and scale to real-world sized domains. Dr. Christopher Geib's work on the ELEXIR (Engine for LEXicalized Intent Recognition) system has both of these properties. In this project we are creating a Java-based analysis tool to evaluate the runtime performance of both the plan recognition and planning algorithms, aid in the development of the ELEXIR system and its domain representations, and verify the performance of the system as a whole. This tool will be invaluable to the development and evaluation of the ELEXIR system and future domains. As a result, it will enable significant improvements in a large number of diverse application areas.

Faculty Mentor: **Dr. Christopher Geib**
Computer Science

Adam Bengis

College of Engineering
Computer Engineering

QUIC vs TCP in the Glass to Glass Internet Ecosystem

The Internet is full of content, and nearly 20 billion devices connect to it and utilize that content every day. Each device connected to the Internet must utilize a standardized protocol in order to communicate. With so much to explore, it can become challenging to search, discover, and access information across the Internet.

According to the Cisco Visual Networking Index, 82% of all consumer Internet traffic will be video by 2021, when million minutes of video content will cross the network every second.

Given that video is growing so quickly, this work focuses on scalable architectures that create efficient ways to transfer faster and higher quality video without any buffering or delays.

Google has been developing an experimental data transfer language, or transport layer protocol, called QUIC. QUIC's main goal is to improve the perceived quality of experience and performance of applications that require connection oriented protocols. Using packet analysis and automated script-based testing, this work demonstrates the benefits of using the QUIC protocol against other current architectures that utilize TCP. Drastic improvements in poorer network conditions are observed where packet loss cases video transfer to suffer the most.

Faculty Mentor: **Dr. Gaurav Naik**
Computer Science

Pankaj Rai

College of Computing & Informatics
Computer Science

Analyzing performance of different file systems using different benchmarks

A file system can be thought of as an index or database containing the physical location of every piece of data on a storage device. Performance of file system is an important factor in determining the efficiency of a computer. Ext4, NTFS, FAT32, and XFS are some popular file systems. This study is intended to analyse the performance of different file systems using various benchmarking techniques. Our main focus is to compare the fossil file system of Plan 9 with others like ext4 and NTFS. Iozone, Bonnie, Postmark and IOmeter benchmarking tools are used to accomplish the task. The quality of file system benchmarking has not improved in over a decade of intense research spanning hundreds of publications, due to the lack of proper definition of what we want to benchmark in a file system. In our study we focus specifically on read and write operations followed by a comparison of the obtained data.

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

Widchard Faustin

College of Computing & Informatics
Computer Science

How Bias Affects the Interpretation of News

Since the 2016 Presidential election, the terms "fake news" and "credibility" have seen a spike in usage. The idea of not being able to trust the information that's provided to us through news sites is scary for any person, yet on the surface level, there has not been many ways offered up to fix this problem. Although not a complete solution, a start to solving this problem is to help people educate themselves on what to look for in news articles in order to wean the truth from the maybe exaggerated, altered, or even downright false facts. My research involves creating software that provides people with meta data about a news article, such as the valence of the language used throughout the piece, the percentage of the audience that read the article that belong to a particular political party, and where the work originated to help guide their evaluation. To assess the effectiveness of this approach, I will survey people to see how the availability of these meta data affect their judgement about the credibility of news articles.

Faculty Mentor: **Dr. Andrea Forte**
Information Science

Minh Le

College of Computing & Informatics
Software Engineering

Building a Mobile App to Connect Teenagers with Mental Health Issue

Mental health issues such as depression, anorexia, anxiety...etc. are affecting a large portion of society, especially teenagers. This research focuses on building a hybrid mobile app for The Buddy Project (www.buddy-project.org), a non-profit organization that aims to prevent suicide by matching teenagers with mental health issues based on mutual interests. Hybrid mobile app is chosen for its ability to run cross-platform on web application component (HTML, CSS and JavaScript) unlike native, which is dependent on whether the operating system is iOS (Objective C and Swift) or Android (Java).

For the past 5 years, more than 170,000 of matches from The Buddy Project are conducted by human, causing certain constraints (e.g matches can take up to weeks). Hence, an algorithm is developed to allow large volume of users to be matched through mutual interests in less than 1 second. The mobile app is powered by AngularJS, an open-source JavaScript framework that allows two-way data binding, and Google Firebase, a real time database that synchronizes information across multiple users. In additionally, the research will involve a task observation and interview study from human subjects to understand the effectiveness of the platform.

Faculty Mentor: **Dr. Andrea Forte**
Information Science

Nazanin Andalibi, *Doctoral Candidate*

Summit Singh Thakur

College of Computing & Informatics
Compuer Science

Emotive use of Voice Interfaces

This study aims to understand how humans express feelings when interacting with a computer via a voice interface. We aim to use an observational and interview protocol to better understand how people interact with a voice-interface app that asks them about their feelings. This research will inform improvements to an existing Alexa prototype, called, "Alexa Baymax," which was created by STAR Scholar Summit Singh Thakur. The goal is to improve the software and to make the product more user-friendly and robust so that it can be made available for public use. (https://devpost.com/software/alexa-baymax) We anticipate making a chatbot for Facebook Messenger and Slack as well. Also, make a custom Alexa powered device using Raspberry Pi. This research is evocative of a long-running thread in computer science that aims to develop interaction techniques that support conversational interaction between humans and computers to improve human well-being. One of the first efforts of this kind was "ELIZA," an early natural language processing program created in the 1960s at the MIT Artificial Intelligence Laboratory and a recent example is "Woebot," a chat app created last year by a team of Stanford University psychologists and AI experts.

Faculty Mentor: **Dr. Andrea Forte**
Information Science

COLLEGE OF COMPUTING & INFORMATICS

Raj B. Patel

College of Computing & Informatics
Data Science

Data Capital in Smart Building Design

Big data has been discussed as the new black gold, having value like capital. Smart data falls into the big data category and can be used for predictive analytics. The research pursued for this STAR scholar project investigated smart data as capital, its net worth, and how the value of data may appreciate or depreciate over the duration of a year's time. This poster displays research that explored this topic with data intensive activities with regards to smart buildings. A modified capital gains equation was used to estimate costs of operating a mid-size, data-driven, smart office building on a quarterly basis. A representative, artificial sample of 350,400 data points, extracted from smart technology sensors, was used to model three cases: Case 1 examined data capital in a transformed internal environment, and calculations valued at $61,950.00; Case 2 focused on internal environment remodeling, causing data value decay producing a lower value of $60,722.00; and Case 3 addressed the cumulative worth, with data valued at $61,643.00.This poster outlines the methods, steps, results, and highlights selected implications of this work for examining smart data as a valued asset.

Faculty Mentor: **Dr. Jane Greenberg**
Information Science

COLLEGE OF COMPUTING & INFORMATICS

Saugat Dawadi

College of Engineering
Computer Engineering

Empowering recruitment of research participants through a web-based application

Collecting data for large-scale public health research studies is a complex process. Barriers exist in identifying and recruiting eligible participants. Most current recruitment processes are either paper-based or constitute of an Excel sheet at most; this creates difficulty in navigating surveys, storing and analyzing collected data. The structure and rigor required in providing data also create complexity that may intimidate individuals or prevent them from participating. An automated and easily navigable system is needed to improve usability during the recruitment process.

This project explores the design of a web-based application for recruitment and enrollment with a focus on facilitating and increasing participation in research. We focus on three primary stakeholders: participants, participant caregivers or legal guardians, and researchers. Each stakeholder has a tailored portal within the application, enabling them to navigate through the appropriate data, while protecting confidential patient and human subject data. We aimed to ease and incentivize the navigation experience through the portal by using progress indicators throughout the user interface. This application has the potential to improve the usability and navigability impeding recruitment in research studies. We will evaluate the impact of the web application in a real-world setting through a deployment study in future research.

Faculty Mentor: **Dr. Gabriela Marcu**
Information Science

Daniel Ziegler, *Project Manager*

Ridwan Olawin

College of Engineering
Computer Engineering

DESIGNING A SYSTEM TO IMPROVE SURVEY DATA COLLECTION AT SCALE IN PUBLIC HEALTH RESEARCH

Conducting surveys and analyzing large amounts of incoming data for large-scale public health studies is complex. Challenges exist with identifying methods to accumulate self-reported data from a sample of an entire population. Paper surveys are often used to ensure data collection, even without regard to technology access of participants. This data collection method requires considerable effort in data entry and affects the reliability and completeness of the data collected.

To support population-based data collection, we explored designs such as login functionality, progress indicators, and flexible page navigation through a web-based user-centered design process. Login functionality constrains access to data entered and allows users to input data over multiple sessions, improving reliability of the data. Research has shown that progress indicators and page navigation increase the likelihood that surveys will be completed, when visual cues such as progress and flow are displayed. This research builds upon these design recommendations to improve the reliability and completion of surveys.

Our prototype, built using HTML, CSS, Bootstrap, JQuery, AJAX, and PHP, contains an organized data entry collection method geared towards improving information gathering at scale. Our next phase is testing this prototype in a deployment study to measure its feasibility and usability.

Faculty Mentor: **Dr. Gabriela Marcu**
Information Science

Daniel Ziegler, *Project Manager*

COLLEGE OF COMPUTING & INFORMATICS

Naimisha Rachakonda

College of Computing & Informatics
Computer Science

Designing Interfaces to Improve Participant Retention Rates in Longitudinal Health Studies

Conducting large scale public health studies involves challenges in information management. The goal of this work is to understand how information systems can support data collection activities to improve retention of participants in longitudinal studies. A major reason for participant drop-out is that ensuring confidentiality can mean compromising usability. Following a user-centered design process, I developed a prototype to explore the right balance between data security and usability.

To help researchers monitor the progress of multiple studies being conducted in parallel, the prototype groups data by study and helps users identify which study needs their attention. Dynamic updates of data allow researchers to see how many participants are enrolled in each study, and participants to see their enrollment in a study. Access permissions and user authentication will maintain information confidentiality, only displaying it when the appropriate user is logged in. User testing and heuristic evaluation will assist evaluating the usability and feasibility of this prototype in real-world settings. With improved awareness of data collection, information systems can support participant engagement and retention for longitudinal studies.

Faculty Mentor: **Dr. Gabriela Marcu**
Information Science

Daniel Ziegler, *Project Manager*

COLLEGE OF COMPUTING & INFORMATICS

Abir Razzak

College of Computing & Informatics
Computer Science

Big Data on the Interaction Amongst Smoking Cessation Treatment Patients

Every minute about 3.3 thousand posts are uploaded to Facebook. This vast influx of data offers opportunities for knowledge discovery in the field known as Big Data analytics. By utilizing Big Data, we can conduct an evidence based method to provide smoking cessation treatments to young adults. In collaboration with the University of California, San Francisco, young adults were recruited to partake in a Facebook smoking cessation project. The goal during STAR is to develop visualizations of the social networks to compare the groups and analyze the data. By analyzing the data from these Facebook groups, we can provide evidence using Big Data to display the interaction amongst all the members of the groups. By comparing these groups to one another, we can see how like minds interact and provide support to help one another overcome their addictions. This can provide a cost-effective way to conduct rehabilitation and guidance without the need of direct contact with therapists. Not only that, this project shows that there is a significant reduction of smoking in those young adults who are not ready to quit smoking. Social media proves to be an expanding field, ready to challenge many of every day's problems.

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

Mengnan Zhao, *Graduate Student*

Poster Session B

Renee Saraka

College of Engineering
Chemical Engineering

Methods of Electrode Fabrication

Processing conditions of battery slurries into electrodes are known to affect final battery performance. However, there is a lack of fundamental understanding of how to control processing conditions to achieve better batteries. Previous work has focused on the formulation step of the battery manufacturing process. This study concentrates on two of the slurry processing steps, namely coating and drying, and their effect on film quality and electrode performance. We use rheological measurements to determine the starting slurry microstructure as well as determine the effect of flow on microstructure evolution. Well-characterized slurries were subjected to a series of shear rates and drying temperatures to examine the effect of flow and drying rate on final electrode performance. The data suggests that there is a complex relationship between surface roughness and shear rate/temperature. While more data is needed to make concrete conclusions, the preliminary data presented here shows for the first time quantitative relationships between processing conditions and battery performance.

Faculty Mentor: **Dr. Nicolas Alvarez**
Chemical and Biological Engineering

Samantha Morelly, *Graduate Student*

Zachary Hoffman

College of Engineering
Chemical Engineering

Characterization of tin-doped hematite films as a photocatalyst for water splitting

Due to rising energy demands and the growing issues with fossil fuels, much research has been devoted to solar energy conversion. Photocatalytic fuel production offers an alternative to photovoltaics (solar to electricity). Hematite (Fe_2O_3) has been the focus of extensive research for its photocatalytic properties due to its favorable bandgap for water splitting (2.2 eV), relative abundance, chemical stability, and environmentally benign composition. While hematite is a promising option for a hydrogen-based fuel economy its poor electrical conductance, among other inhibitive properties, make hematite currently impractically inefficient as a solar absorber. Previous research has been directed at trying to improve the conductive properties of hematite by the inclusion of various dopants into thin films. This project addresses the effects of tin as a dopant in planar films of hematite. Using selective ionic layer adsorption and reaction (SILAR), thin films of tin-doped hematite were produced. Specifically, our research focuses on the effects of dopant concentration in uniform films. Films doped with 0.5% tin were optimal, showing an improvement of 320% over undoped films at 1.23V_{RHE}, at 0.18mA/cm2 under one sun illumination.

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

Anthony Abel, *Graduate Student*

COLLEGE OF ENGINEERING

Abinishaa Sivaraj

College of Engineering
Chemical Engineering

Effectiveness of Reactive Technologies on Removal of Sulfur from Waste Grease Biodiesel

Removal of sulfur contaminants from waste grease biodiesel is difficult and can be improved using reactive technologies. Biodiesel is made from renewable feedstocks but the availability of feedstock that can be converted into fuel is a major limitation. Lipids extracted from grease trap waste can be converted to Fatty Acid Methyl Esters (FAME), commonly known as biodiesel. Waste greases contain impurities that can be removed by pretreatment reactions but removal of sulfur contaminants in FAME to comply with fuel specifications is an ongoing challenge. In this research, three reactive desulfurization techniques were explored: 1. Mild Oxidation followed by Adsorption, 2. Thiol-Disulfide Exchange, and 3. Raney Nickel Hydrogenation. Oxidation of FAME with hydrogen peroxide followed by adsorption on silica showed 60% sulfur reduction. Usage of thiol-activated silica to form disulfide bonds with sulfur-containing FAME showed 25% sulfur reduction. Hydrogenation of FAME with Raney nickel to convert organically bonded sulfur to nickel sulfide, showed 90% sulfur reduction. There are trade-offs to each of these reaction technologies including cost, yield, and side reactions that need to be evaluated to determine their commercial potential.

Faculty Mentor: **Dr. Richard A. Cairncross**
Chemical and Biological Engineering

Vincent Spina

College of Engineering
Chemical Engineering

Nanofiltration of Grease Trap Waste Biodiesel

Grease trap waste can be transformed into ecofriendly biodiesel, effectively converting a low-value waste stream into a sustainable energy source. However, efficiently removing sulfur impurities to meet fuel specifications remains a major challenge to biodiesel refiners. Accordingly, this research was aimed to investigate nanofiltration for its potential to reduce costs, energy, and time as compared to the standard means of biodiesel desulfurization and purification which include distillation and adsorption. Unlike ordinary filtration which aims to remove large solid particles from an aqueous mixture, nanofiltration utilizes various solvents to aid in the separation of a solution on a molecular level through a semipermeable membrane with either a molecular weight cutoff or a nanometer-scale pore size. Eight commercially-available nanofiltration membranes were tested with ranging pressures, temperatures, solvents, and biodiesel concentrations. Membrane performance was evaluated by measuring flux, selectivity, total acid number, and sulfur content values of the permeate and retentate. Of the membranes tested, only Puramem Selective has removed color bodies and is being further evaluated to determine its efficacy for desulfurization.

Faculty Mentor: **Dr. Richard A. Cairncross**
Chemical and Biological Engineering

Shawn Bittman, *Undergraduate Student*

Sara Corson

College of Engineering
Chemical Engineering

Nickle Oxide Hole Transport Layer for Perovskite Solar Photovoltaic

Perovskite solar photovoltaics has garnered a lot of interest in research during recent years due to its unprecedented acceleration of 22% solar to electric power conversion efficiency (PCE). Within the years of research, the perovskites are now comparable to much more matured technologies such as thin-films and silicon photovoltaics. In solar cells, the perovskite absorber layer is sandwiched between two carrier transport layers and the PCE is highly sensitive to the selection of these layers which are responsible for extracting the photo-generated carriers. In this work, nickel oxide (NiOx) has been explored as a possible hole transporting material (HTM) for a perovskite solar cell. Inorganic HTM layers, such as NiOx, are thermally and photochemically more stable than the conventional organic HTM layers. NiOx is a wide band gap (3.4 - 3.8 eV) material and electronically compatible to the perovskites to facilitate to extract the photo-generated mobile holes. The focus of this work is to synthesize solution processed NiOx thin film on transparent substrate (such as, glass, ITO) and perform spectroscopic and electrical measurements.

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

Subham Dastidar, *Graduate Student*

Douglas Gerichten

College of Engineering
Computer Engineering

Automated Hall Effect Measurement System for Characterization of Thin-Film Charge Carrier Properties

Automating experimental procedures in research labs helps produce a higher volume of results more efficiently and accurately than manual methods. This project aimed to design, develop, and implement a robust, configurable MATLAB application to automate the voltage measurements and various calculations routinely conducted by the Nanocrystal Solar Lab to characterize semiconductor thin-films. Also required was scalable architecture for future modifications, the ability to import/export spreadsheets, and control options for accurate testing of both high- and low-resistance films. Engineering this program required knowledge of current measurement procedures, equations for relevant electrical properties, native automation scripting for the Keithley 2634B in Task Script Builder, and application data management for user interfaces created with MATLAB. The software produced communicates between the user and several hardware pieces to send commands and receive data using a single graphical user interface (GUI), offering the user command of all functions and access to all data in an intuitive layout. This turn-key program replaces hands-on measurements which previously could take hours and is easily programmable for possible future changes.

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

Andrew Dillon, *Doctoral Student*

Poster Session A

104

Edgar Omar Maldonado Castillo

College of Engineering
Mechanical Engineering

Electrospun Carbon Nanofibers/S as Free-Standing Binder-Free Cathodes for Li-S Batteries

Lithium-Sulfur (Li-S) batteries are getting attention as potential substitutes for Li-Ion cells. However, their low cyclability, shuttling of lithium polysulfides, and low sulfur utilization impede their practical uses. Combining sulfur with conducting materials can reduce these effects. This STAR project explores the role of carbon nanofibers (CNF) as a sulfur host in Li-S batteries.

The project involves the development of free-standing binder-free CNF/S cathodes using electrospun CNFs and a rapid sulfur melt-diffusion technique. For CNF preparation, a blend of PAN/DMF was electrospun. The collected material was stabilized at 280° for 5h, and then carbonized at 1000° for 1h. A heat press at 140°C with a pressure of ~200 psi was used to infuse sulfur into the inter-fiber spaces. Li-S coin cells were assembled using as-prepared cathodes with ~48 wt% sulfur loading and cycled at C/2 rate after conditioning at C/10 and C/5. The assembled cells showed stable discharge capacity of ~700 mAh/g over 100 cycles. The CNFs provide innate conducting channels for electron transport during charge/discharge and reduce shuttling effect through adsorption. This feature allows Li-S cells to achieve high capacity alongside good cycling stability.

Faculty Mentor: **Dr. Vibha Kalra**
Chemical and Biological Engineering

Dr. Arvinder Singh, *Post Doctoral Fellow*

Oluwadamilola Bolarin

College of Engineering
Chemical Engineering

Synthesis and Characterization of Plant-Based Reactive Diluents for Additive Manufacturing

Additive manufacturing is currently at the forefront of the seemingly impending industrial revolution as researchers are investigating new ways to improve and optimize the manufacturing of machine/tooling components (Statista: Additive Manufacturing and 3D Printing - Statistics & Facts). Widely understood as 'Industrialized 3-D printing', additive manufacturing provides the promise of manufacturing entire machines and machine parts such as jet engines, hearing aids and gas turbines. According to studies conducted by the Fraunhofer Additive Manufacturing Alliance, approximately 150 companies currently operate in this services market; an interesting prospect as market researchers forecast a 300% growth in additive manufacturing niches over the next decade. Although currently used for rapid prototyping, additive manufacturing is expected to grow past conventional production methods as it is projected to be 50% cheaper and 400% faster in the next five years (Siemens: Pictures of the Future). This work aims to show the synthesis and characterization of carvacrol methacrylate (CMA), a plant based reactive diluent (RA), that can potentially be integrated into additive manufacturing resins. Plant and bio-based monomers have a potential to replace petroleum based monomers and RAs with the added benefit of incorporating molecular structures unique to plant and bio-based feedstocks.

Faculty Mentor: **Dr. Giuseppe R. Palmese**
Chemical and Biological Engineering

John H. Vergara, *Graduate Student*

Poster Session C

106

Lucas Etim

College of Engineering
Chemical Engineering

The Effect of Aliphatic Chain-Extenders on Thermomechanical and Barrier Properties in Epoxy-Amine Based Anticorrosive Coatings

The annual costs related to corrosion has been estimated to be $2.5 trillion globally per year. In addition to economic costs, corrosion can lead to structural failures that have dramatic consequences including failures of bridges, buildings, aircraft, automobiles, and gas pipelines. An anticorrosive coating must possess intrinsic durability, efficient adhesion to substrates, adequate flexibility, and toughness, and possess ideal water/oxygen barrier properties. Epoxy resins have found wide use in surface coatings in various industries, having favorable mechanical and thermal properties. Complexity of commercial amine curing agents for anticorrosive coatings causes difficulty in gaining fundamental understanding of structure-property relationships regarding water barrier properties. Previous work has shown that altering the chemistry of epoxy and amine monomers, specifically the concentration of oxygen within the polymer in the form of hydroxyls, ethers, and carbonyls, has a profound effect on the transport properties of water in epoxy/amine coatings.

This work aims to expand this understanding by using an aliphatic chain-extender to effectively reduce the polymer oxygen concentration and probe its effects as it relates to water barrier properties. It is envisioned that good fundamental understanding of these structure-property relationships will lead to the design of better anticorrosive coatings.

Faculty Mentor: **Dr. Giuseppe R. Palmese**
Chemical and Biological Engineering

John H. Vergara, *Graduate Student*

Spencer Kociba

College of Engineering
Architectural Engineering

Data Integration of Non-Destructive Evaluation Techniques for Concrete Structures

Addressing the declining health of road infrastructure of the United States is at a high priority level for the federal government. The latest data from the Federal Highway Administration indicates that over 9% of all bridges in the 2016 National Bridge Inventory were classified as â€œstructurally deficientâ€ [1]. Identifying structural defects in functioning bridges depends heavily on non-destructive evaluation (NDE) techniques. The results of NDE data are used by bridge owners in the informed decision-making process. Dozens of NDE methods are available to measure various characteristics; however, the most efficient process combining these techniques to model a structureâ€™s condition is still largely unexplored. The International Bridge Study (sponsored by the FHWA) was created to develop a process to optimize and integrate NDE data. Using this process, engineers can create a model that depicts the condition of the structure in question to present to bridge owners and log in a massive database. The revision and publishing of this data integration process will be the continuation of this study.

Faculty Mentor: **Dr. A. Emin Aktan**
Civil, Architectural, and Environmental Engineering

Dr. Shi Ye, *Post Doctoral Fellow*

Robert B. Howell

College of Engineering
Mechanical engineering

Thermal energy storage using Phase Change Materials

Phase change materials (PCMs) are heat storage materials that can absorb thermal energy from external sources (as their latent heat) and release the energy during phase transitions. This project examines the thermal energy storage capability of PCM for use in large building materials. The thermal behavior of PCM was tested using a low-temperature differential scanning calorimetry (LT-DSC) in different conditions: (1) bulk, (2) infused in porous lightweight aggregate (LWA), and (3) encapsulated with an inert polysiloxane shell. The PCMs were paraffin based oils whose phase changes occur at temperatures of 6, 18, 24, and 28 degrees Celsius. Two types of LWA were used including buildex marquette, and a noralite blend. For LT-DSC test five different rates of cooling and heating were used: 0.5, 1, 2, 4, 8 degrees Celsius per min. During phase change moments (i.e., freezing and melting), enthalpy of fusion, onset temperature and temperature associated with the maximum of phase change heat peak were recorded. This research could be used to save energy in the heating of homes and buildings. By using this data, new construction techniques could be developed, ones that would reduce the energy consumption of the average home. Reducing the uses of natural gas, oil, and coal in powerplants.

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

Rayna Newkirk

College of Engineering
Chemical Engineering

Microstructural Change in Self-Healing Concrete

Today, producing the cement that is used in buildings, bridges, drainage pipes, manufacturing facilities, and countless other structures accounts for more than 5% of carbon emissions worldwide. Bioconcrete is an emerging class of materials designed to increase the longevity of concrete structures, thereby decreasing overall cement production and associated carbon emissions. This study examines the use of bacteria S. pasteurii (Sporosarcina pasteurii) in ordinary portland cement samples as the biological component to improve the microstructure of the cementitious material. A solution of nutrients was also added to provide a source of energy for the bacteria. This is a part of a broader enquiry into the self-healing effects of microbially induced calcium carbonate precipitation on samples like this under varying conditions. Dynamic vapor sorption analysis was used to determine the micropore structure of three different samples, one with cement paste and water, one with cement paste and nutrient solution, and one with cement paste, nutrient solution, and bacteria. The difference in the micropore structure of these samples was analyzed to determine the effect that bacteria has on this characteristic of cementitious materials.

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

Elrod Owusu-Asumeng

College of Engineering
Environmental Engineering

On the Inactivation of Legionella In Water Distribution and Premise Plumbing Systems

Legionella, an opportunistic pathogen responsible for a type of pneumonia known as Leginellosis. Legionella caused…" of water-borne disease outbreaks associated with drinking water in the US from 2011-2012. Even after water treatment, Legionella is difficult to control in drinking water distribution and premise plumbing systems because they are likely to grow within biofilms on long sections of pipes that can contain stagnant water. Since the USEPA Safe Drinking Water Act does not address water in premise plumbing, guidance is needed to prevent outbreaks of Legionnaires' disease.

This project will focus on the inactivation of Legionella through batch experiments. Legionella will first be grown in culture and exposed to various conditions of temperature and disinfectant dosage to observe the corresponding die-off rates. The data from these experiments will then be modelled using various decay functions to produce constants that are useful in predicting risks. The decay constants will ultimately be used in a larger model for providing users with guidelines regarding health risk management for a given water quality situation in a building.

Faculty Mentor: **Dr. Kerry Hamilton**
Civil, Architectural, and Environmental Engineering

Dr. Patrick Gurian, *Co-Mentor*

Ilana Gorberg

College of Engineering
Civil Engineering
Frances Velay Fellow

Analyzing Sensor Data Across New York City

Rain occurs when warm moist air cools and condensation follows. Some of the factors that affect the amount of precipitation include air temperature, barometric pressure, wind speed and direction. The purpose of this project is to investigate spatial distribution in precipitation in New York City by using tipping bucket rain gauges. This will help New York City model its green infrastructure and manage its storm water. In this project, precipitation data was gathered from nine sites over the course of a year. This data was then analyzed in R where cumulative curves and box plots were generated. These graphs were then analyzed to show which sites had similar levels of precipitation. They were also analyzed in order to see if sensors in the same location showed a similar amount of precipitation. Some sensors did not receive much data over the course of the year, which was taken into account when analyzing the data. The ultimate question that the project attempted to answer was if it is a good idea for New York City to have multiple rain gauges or if one rain gauge would be enough.

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

Dr. Ziwen Yu, *Post Doctoral Fellow*

Poster Session C

112

Shannon Belfield

College of Engineering
Civil Engineering

Algae to Treat Wastewater Systems

This research project focuses on the use of a high density bioreactor (HDBR), for the purpose of cultivating and studying the growth of algae under different conditions. This project studies the removal of nitrogen, which can be applied to use algae for cleaning wastewater systems. Studies have been conducted in the past to observe the specific loading rates of nitrite (*NO_3^-*), and ammonia (*NH_4^+*), and this current research will collect more data for different specific loading rates of these two nitrogen sources. For this experiment, there are two HDBR set ups running in parallel to each other. Having two reactors running under the same condition will show the variability. Samples are collected from the recycle vessels every day to calculate the suspended solids within the HDBR. Twice a week samples are collected from the reactor vessels in order to calculate the biomass. The condition for the specific loading rate is calculated from the biomass measured, the rate of the feed being pumped into the recycle vessel, and the desired specific loading rate. The composition of the feed and recycle vessels is found through high performance liquid chromatography (HPLC).

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

Jacob Price, *Graduate Student*

Melody Wu

College of Engineering
Environmental Engineering

Effect of 6:2 FtS on Bacteria Growth in the Vadose Zone

Just outside of Philadelphia in the Bucks and Montgomery counties, contaminated water has become a rising issue. This is particularly the case in communities near military bases and private plants that use a fire-fighting substance called AFFF. The active ingredient in some formulations of AFFF is 6:2 FtS. In addition to its hazardous chemical structure, 6:2 FtS has been shown to act as a sulfur source for bacterial growth in saturated systems. However, few studies have focused on the effect of 6:2 FtS on bacteria growth in the vadose (unsaturated) zone in the subsurface.

This project tested for the growth of the bacterial isolates Rhodococcus jostii RHA1 and Rhodococcus rhodochrous IGTS8 in saturated and unsaturated media using DNA concentration and quantitative polymerase chain reaction to measure cell accumulation. The saturated and unsaturated environments were set up with sulfur free minimal media, hygroscopic polyethylene glycol beads, non-hygroscopic polyethylene beads, and 6:2 FtS. Equal or superior bacteria growth in unsaturated and saturated phases as compared to an aqueous control gives insight as to how dangerous 6:2 FtS can be for people exposed to AFFF contaminated environments.

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

Saeed Keshani Langroodi, *Graduate Student*

Poster Session A **114**

Mohammad Adib

College of Engineering
Electrical Engineering, Computer Engineering

Visualizing the State of Radio Waves using Augmented Reality

Making Wireless Communications efficient has been one of the most important goals of this field since its creation. The main goal is to improve utilization of available spectrum, allowing more simultaneous communications. Radios should be sharing the spectrum in an intelligent way, avoiding collisions and maximizing its collective throughput.

To visualize this area of research an Augmented Reality framework called BeamViewer was developed at the Drexel Wireless System Laboratory. BeamViewer visualizes, in real-time, the state of a Radio: it's encryption key, IP address etc. BeamViewer integrates Firebase, a mobile backend service, to store data used for visualization.

As a STAR Scholar, I have developed the backend scripts that connect all the radios to the database used by BeamViewer. First, I developed a server using the python library Flask that runs on one computer and posts each radio's state to the database. After that, I developed a client script that runs in each host computer and posts the configuration of each radio to the server script. I successfully connected the host computers to the server and fed real-time radio configuration data to the Firebase database. This platform will serve as a testbed for further research

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

Joshua G. Cohen

College of Engineering
Computer Engineering, Electrical Engineering

Internet of Things: Novel LoRa-Enabled Research Test-bed

Wireless communications throughout the world have evolved exponentially over the last three decades, facilitating research for new and innovative applications on a home, city, and global scale. Internet of Things (IoT) is a new set of applications that requires a large network of interconnected devices with specific low power and long range needs. Low Power Wide Area Networks, specifically LoRa, aims to satisfy these needs. Significant progress towards multi-kilometer range, sub-milliamp power consumption, and obstacle resistance makes LoRa stand out significantly in the market. However, since the protocol is brand new and proprietary, research with LoRa has had a slow start. The purpose of this project was to further assist with research in this area by creating tools that assist with network modularity, executability, and scalability. A full LoRa IoT research grid was successfully designed and implemented using Software Defined Radios. The final design includes an implementation of LoRa on the Drexel Wireless Systems Lab multi-radio testbed, received signal strength visualization, as well as the introduction of a novel technique for audio-based radio-based radio frequency monitoring to detect illegal use of frequency bands.

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

Ilhaan Rasheed, *Graduate Student*

Jui Hanamshet

College of Engineering
Computer Engineering

Using RFID based RTLS for Bellyband signal motion filtration

The Bellyband smart textile detects respiration rate using passive Radio Frequency Identification (RFID). When worn around the belly, this device allows wireless respiration rate detection of a mobile person through variation in RFID signal strength caused by breathing. These signals however, are susceptible to motion artifacts, which results in inaccurate respiration rate estimations . One way of solving this is using xArray, an RFID gateway reader that can determine two-dimensional location of tags in real time. The xArray has 52 polarized antennas which can be turned on and off via software control. It must be configured depending on the environment and situation. A test bed was created to study the functioning of the 52 antennas and to optimize their performance for power and time efficiency. Studies related to coverage area, fluctuation of signals due to reflecting and refracting surfaces, functioning of reader in different environments, and reader-tag interaction in different setups were conducted for further optimization. These studies will help in optimization and configuration of xArrays which can be integrated into the current software eliminate motion related inaccuracies in Bellyband signals.

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

Ilhaan Rasheed, *Graduate Student*

Mannika Kshettry

College of Engineering
Electrical Engineering
Frances Velay Fellow

Multiple Antenna based Motion Detection for Bellyband System

The researchers at Drexel Wireless Systems Laboratory have designed the Bellyband, a biomedical smart textile device. The Bellyband enables wireless monitoring of biosignals such as respiration or uterine contractions using Radio Frequency Identification (RFID) technology. A RFID antenna is knitted into the Bellyband using conductive fibers. The RFID interrogator sends signals to the knitted RFID antenna and the antenna modulates a response to convey the biosignal reading. Bellyband readings are sensitive to ambient motion of the patient, making it susceptible to false alarms when patients are mobile. This is a challenge in the signal processing of the Bellyband device; therefore, motion artifact filtering of signals from the device is highly desirable. In this project, experiments were conducted to test different motion filtration methods from Bellyband readings. Multi-antenna and multi-reader configurations were explored to identify signal patterns that were a result of ambient motion. Using these configurations, data was collected by simulating various possible patient motion patterns and visualized using MATLAB. Certain configurations provided better motion detection, which will help improve Bellyband biosignal accuracy.

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

Ilhaan Rasheed, *Graduate Student*

Brent Lee

College of Engineering
Computer Engineering

Signal Processing in Wearable Wireless Biomedical Devices

Currently, to track the breathing of infants, hospitals and medical professionals place tethered, adhesive sensors on the baby's body. The Drexel Wireless Systems Laboratory is developing the Bellyband, a non-intrusive way to monitor infant breathing that uses wireless, powerless Radio Frequency Identification (RFID) technology. The Bellyband is a knitted fabric antenna with an RFID chip sewn into it that wraps the midsection of the user. The antenna moves as the user breathes and its movement is indicated by changes in the reflected power of the wireless interrogation signal that is sent from several feet away. The changes in reflected power can be tracked by software to determine the state of the subject. Since the whole system is wireless, there is a lot of interference in the interrogator's received signal. To remedy this problem, I used various mathematical formulas and data smoothing techniques to remove unwanted interferences in the received signal data. One such approach involved the use of a reference tag that just collected wireless interference data. Using that data, I was able to correct the signal through a multisensory fusion through a two dimensional orthographic projection. As future work, we plan to address challenges in the areas of the user moving around and foreign objects getting in the way.

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

Dr. Bill Mongan, *Co-Mentor*

Saloni Purswani

College of Computing & Informatics
Computer Science

Augmented Reality Application to Visualize and Control Wireless Router Configurations

The average digital consumer owns three Internet connected devices. Our increasing dependency on such devices and the integration of wireless technology in our lives, demonstrates the importance of a user to be aware of processes taking place in a network. Additionally, issues caused by wireless communication can be difficult to diagnose, as these signals are not visible to the human eye. Thus, to maximize the use of this technology, an interface displaying router configurations is needed in order to easily detect a network problem. The Drexel Wireless Systems Lab has conducted research to build a smartphone application allowing users to utilize Augmented Reality(AR) to visualize and control the configurations of a wireless router. Through 3D components, this app depicts details of a router, such as the MAC address, signal strength, data rate and devices connected to the network. AR markers developed for routers retrieve device configurations from a database when scanned. The app also displays the directions of electronically steerable antennas on the router, which are impossible to visualize otherwise. Through the interface, users can view and alter various factors affecting wireless communications, to achieve better performance.

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

Xaime Rivas Rey, *Graduate Student*
Logan Henderson, *Undergraduate Student*

Poster Session B **120**

Mike Brace

College of Engineering
Computer Engineering

Facial Recognition for Learning

The concept of facial tracking and recognition has been explored in a variety of ways in the past. The goal of this research is to use these concepts for learning, to measure attention and concentration of subjects. The application is the real time analysis of the level of difficulty a person is undergoing and the amount they are concentrating when performing a task in front of a computer. The test being used for this research is the "n-back test", a psychological test designed to measure cognitive capacity. So far, webcam videos have been recorded using different difficulty levels of this test, with various amounts of concentration. These videos have been analyzed in a few different ways, such as with feature extraction, to see if there is a noticeable correlation between the facial features and the test being given. A neural network does not appear to be able to tell the difficulty on its own, so the procedure is being modified and alternative methods to determine difficulty and level of attention, such as response time, are being studied.

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

Dr. Andrew Cohen, *Co-Mentor*

Jacob Baron

College of Engineering
Computer Engineering, Electrical Engineering

General Purpose Programming using the GPU

Today, most processors are single-core solutions with clock rates stagnant at 4GHz. To enhance these processors, companies have added more cores and implemented instruction-level parallelism. The shift from a single-core processor with a higher clock rate to many core-processors with a lower clock rate began and the graphical processing unit (GPU) was born. NVIDIA began to develop GPUs that are capable of handling computational heavy tasks and parallelize these tasks over many cores. The NVIDIA GeForce GTX 1080, the GPU used for this project, has 2560 cores clocked at of 1.86 GHz each. The objective of this project is to recognize the differences between the CPU and the GPU and develop algorithms to take advantage of the GPUâ€™s power. Through understanding parallel computer architecture and the GPU memory hierarchy, the power of the GPU can be utilized to complete tasks at a much faster rate than the CPU. To demonstrate the speed-up, the CPU and GPU were both timed conducting matrix-vector multiplication of size 16384 x 16384 and 16384 x 1, respectively. The GPU performed the calculation 10 times faster than the CPU when using global memory and 35 times faster when using the shared memory component of the GPU.

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

Cameron J. Calv

College of Engineering
Electrical Engineering

STEAM to Encourage an Interest in STEM

Schools are searching for the best methods to encourage an interest in STEM (Science, Technology, Engineering, and Mathematics) education for students. At the Expressive and Creative Interaction Technologies (ExCITe) Center, we employ STEAM (Science, Technology, Engineering, Arts & Design, and Mathematics) education to inspire students. Due to budget cuts, public schools tend to drop arts programs thereby prioritizing STEM courses. However, STEAM turns the paradigm on its head by encouraging students to actively take an interest in STEM fields without need to exclude the visual and musical arts. At ExCITe, we research methods to combine arts with science by creating projects to motivate students. Music combined with technology was used to reveal the applications of STEM to high school students during our Summer Music Technology program. We guided projects utilizing musical controllers to observe how students become more interested in STEM with the inclusion of the arts. By including the arts in STEM education, students can think creatively as they learn, which allows for healthier learning. As the program ends, students are left with a drive to continue their STEAM education and a base for improved learning.

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

Jeff Gregorio, *Graduate Student*

COLLEGE OF ENGINEERING

James A. Froio, Jr.

College of Engineering
Computer Engineering

Web Design with WordPress

In a recent study it is proven that 46% of small businesses in underserved neighborhoods are disconnected digitally [1]. In order to address this in the local Philadelphia community, Drexel's ExCITe Center, Rebrand Cities (an organization whose mission is to help local businesses across the country develop their digital presence), and WordPress are exploring getting local businesses online. In June of 2017, the ExCITe Center hosted a web development hack-a-thon bringing 12 small businesses from the Lancaster Avenue Business Corridor and the West Philadelphia Business Association together to build websites. These websites were designed with the help of experts from WordPress (an online website creation tool). My role in this endeavor was to act as a student developer and help further the initiative through continuing to meet with business owners after the initial hack-a-thon and assist them in the design and development of their websites. Throughout the summer, I worked with three small businesses with different needs for their website and was able to accommodate their requests in order to get their sites up and running.

References
"Digital Badges." HASTAC. Web. 15 Aug. 2017.
Okyle, Carly. "It's 2016, But Nearly Half of U.S. Small Businesses Still Don't Have a Website." Entrepreneur. 19 Feb. 2016. Web. 15 Aug. 2017.

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

Dr. Brandon Morton, *Drexel App Lab Manager*

Poster Session A **124**

Hunter Heidenreich

College of Engineering
Electrical Engineering

Simplified Learning for Image Generation

Machine learning (ML) is a complex and intriguing topic that has allowed us to teach computers to execute complicated tasks like the identification of objects in images and the composition of music. Despite many advancements, it remains difficult to explore ML due to the mathematical theory it is built upon. The focus of this research was to create a friendlier way to explore ML. This was done by utilizing a high-level ML library that allows code to be simplified and less rooted in mathematical models to create a system for generating realistic images.

The specific strategy used to generate images involved a two-sided network. Given a list of images, half of the code learns to take random numbers and translate them into an image that fits in the list. The other half determines if an image is from the real set or the fake. Training these sides together is like a game where one side is always trying to beat the other, and becomes very complex due to its duality. This project resulted in an easier approach to creating systems for image generation for future research in ML.

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

Richard Vallett, *Graduate Student*

Maggie May Mulhern

College of Engineering
Mechanical Engineering

Mentorship and Fitness Tracking Application Development

Recently, mentorship programs have gotten high praise in large companies for their results on employee retention, and loyalty, but many minorities are not feeling the benefits of these initiatives [1,2]. Thus, the Drexel Center for Advancement of STEM Teaching and Learning Excellence (CASTLE) and the Drexel App Lab have teamed up with researchers at Ohio State University to develop a mobile application that will track male minorities as they progress through a formal study. Mentorship will be promoted through group exercises with Black, male faculty. The mobile application will use an Android Wear device to collect biometric data (i.e. heart rate, steps taken, etc.) during workout sessions. My role in this project is to create the mobile and wear applications in Android Studio, a platform used specifically for the creation of Android apps. In addition, the applications will provide daily surveys which will be used to analyze the development of mentor relationships and be correlated with the data from the Android Wear device. This study shows how improved wellness practices affect mentorship relationships and leadership skills in underrepresented groups.

[1] Jones, M. (2017). Why Can't Companies Get Mentorship Programs Right? The Atlantic Media Company. Retrieved from https://www.theatlantic.com/business/archive/2017/06/corporate-mentorship-programs/528927/
[2] Delaine, D. & Joseph, J. (2017). Leadership Development through Wellness-Integrated Informal Mentorship. Fisher Leadership Grant. 3-4.

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

Dr. Brandon Morton, *Drexel App Lab Manager*

COLLEGE OF ENGINEERING

Jason Ngo

College of Engineering
Computer Engineering

Encouraging Budding Engineers Through STEAM

When a child imagines an engineer, they might picture someone who works at an auto shop, on a train, or in a garage, but those who understand the field know that â€œbeing an engineer" means so much more. The Center for Expressive and Creative Interaction Technologies (ExCITe Center) at Drexel University aims to introduce students to the basics of science, technology, engineering, and mathematics through artistic activities (STEAM). ExCITe's 11-year-old flagship program, Summer Music Technology (SMT), is a week-long program where high school students can learn about the physics of sound, create their own electronic musical instruments, and more. Young Dragons, a new program at ExCITe, is aimed at an even lower age range of children in Philadelphia's Promise Zone. By demonstrating to youth that the sciences can be applied in entertaining ways, we can encourage more people to develop an interest in the field at an earlier age, and by relating concepts unknown to younger students to those they are familiar with, we can facilitate their learning. Five STAR scholars at ExCITe served as helpers and project mentors for the many modules held during these weeks. Data gathered from surveys will be used to streamline future programs.

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

Jeff Gregorio, *Graduate Student*

Jihwan Park

College of Engineering
Electrical Engineering

Exploring Creative Expression through Robotics

The existence of HUBO—an adult-sized humanoid robot developed at the Korea Advanced Institute for Science and Technology (KAIST) at Drexel's ExCITe Center provides a great opportunity to explore the field of Humanoid Robotics. My research focuses on maintenance and programming of HUBO. Since Humanoid Robotics is a relatively new area of study, it hasn't been approachable to a wide variety of people. The goal is to render HUBO more accessible by creating various expressive movements such as dance moves. HUBO is originally operated on a low-level programming language, which means that there's little or no abstraction from a computer's instruction set architecture. However, using Python interface, I'm able to program HUBO in a high-level language that allows easier coding for more precise work and complex tasks. HUBO is commanded by Python scripts whose combination of built-in functions and user-defined functions leads to different sequences of movements. The demonstration of each expression is done in MAESTOR, a software developed specifically for HUBO that enables the visualization of code in simulation. The use of virtual HUBO has permitted the greater exploration of creative movements such as dabbing and crouching that can be tested on the actual robot in the near future.

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

Richard Vallett, *Graduate Student*

Jeechieu Ta

College of Engineering
Computer Engineering

Floorplanning Algorithms for 3-D Integrated Circuits

Most modern electronic devices include integrated circuits (IC) for computing. An integrated circuit is a collection of nano circuits that are fabricated on a single piece of semiconductor material. A topic of significant interest in IC research is 3-D ICs; an IC made of multiple device layers that are vertically interconnected using through-silicon vias. A 3-D IC allows for greater transistor density and heterogeneity, both of which increase circuit functionality. Our research focuses on the design of 3-D ICs, specifically the floorplanning of the IC under more severe thermal constraints. Floorplanning encompasses tentative placement of major functional blocks of the IC while accounting for constraints in area, power, and performance. Floorplanning for 2-D ICs is typically completed algorithmically and heuristically as a non-deterministic polynomial (NP)-hard problem. Floorplanning for 3-D ICs is a more complex problem than 2-D ICs, and therefore, requires novel algorithms and methodologies to properly exploit the benefits of the third dimension. Our goal is to review methods already developed by other researchers and examine algorithms and techniques utilized for 2-D ICs to develop improved algorithms for 3-D IC floorplanning.

Faculty Mentor: **Dr. Ioannis Savidis**
Electrical and Computer Engineering

COLLEGE OF ENGINEERING

Sarah R. Andrieux

College of Engineering
Mechanical Engineering

First Law of Thermodynamics Learning Module

Thermodynamics concepts are involved in numerous educational and career fields such as engineering, biology, chemistry, medicine, and other general sciences, which are all important and growing fields in the job industry. Therefore, learning the basics of thermodynamics and fluid mechanics is vital in the education of students. Learning about energy and energy efficiency is fundamental to engineering students as well. Theoretical concepts are better understood if students are involved in practical approach of learned concepts. Specifically, the first law of thermodynamics describes the natural and proven law that all energy is conserved and allows quantification of energy. This project describes the design and construction of an apparatus that demonstrates the First Law of Thermodynamics along with learning modules to be used in an educational setting. The apparatus consists of a gear water pump actuated by an air motor. Both air and water cycles are evaluated using temperature and pressure sensors as well as the energy conversion between the air motor and gear pump. Students will be able to use various forms of energy conservation equation to evaluate the principles of energy and mass conservation and energy efficiency.

Faculty Mentor: **Dr. Irina Ciobanescu Husanu**
Engineering Technology

S. Justin Li

College of Engineering
Materials Science & Engineering

Alternating Current Electrophoretic Deposition of Two-Dimensional Titanium Carbide (MXene) Films

Electrophoretic deposition is a simple and cheap technique for forming coatings and films by utilizing the movement of charged particles in a suspension under the influence of an electric field. The fabrication of freestanding, high conductivity Ti3C2Tx MXene films has been demonstrated using DC EPD, but outgas from electrolysis disrupts film homogeneity, severely limiting the voltage that can be applied for MXene suspensions in water. AC EPD of a variety of ceramics has been shown to being able to form thicker films due to reduced gas generation. Ti3C2Tx MXene films were formed by AC EPD at a variety of voltages and frequencies. The morphologies and compositions of the freestanding films were characterized via XRD, SEM, and EDS, while resistivity measurements were also taken. MXene films formed by EPD show promise due to their deposition speed and ability to be formed on electrodes of various shapes and sizes.

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

David Anthony Raczkowski

College of Engineering
Chemical Engineering

Doping Ternary Borides

Recently, the ternary layered MAlB phases have been an increasingly popular research topic. The MAlB phases are orthorhombic, atomically layered solids, consisting of a transition metal (M) boride sublattice separated by one layer (M_2AlB_2-type) or two layers (MAlB-type) of Al, much like the layered carbide and nitride MAX phases. Among the many MAlB phases, MoAlB has many appealing properties such as oxidation resistance up to 1350°C in air, high compressive strengths, and high stiffness values maintained to 1200°C.

To invoke new functionalities to this compound, herein we try to substitute different transition metal elements for Mo in MoAlB (space group *Cmcm*) to make $(Mo_{1-x}M_x)AlB$ or Si on the Al site to make $MoAl_{1-y}Si_yB$. The transition metals, M = Cr, Fe, Mn, W, were chosen because most of them form stable end-members MAlB phases. The as-synthesized compounds were analyzed by SEM and XRD to ascertain which elements were doped successfully. Based on initial screening studies, Mn appeared to be the most successfully doped to yield $(Mo_{0.8}Mn_{0.2})AlB$, which we attempted to pressureless sinter to full density and study its properties. It is worth noting that this is a new compound that is synthesized here for the first time ever.

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

Sankalp Kota, *Graduate Student*

Hubza Syeda

College of Engineering
Chemical Engineering
Frances Velay Fellow

Study of Protein Corona Variation on Nanoparticles by Gel Electrophoresis

Nanoparticles have numerous applications in pharmaceutical sciences. When nanoparticles are introduced to blood, they are coated with a protein layer called protein corona that largely determines the fate of nanoparticles. One of the best ways to reduce non-specific cellular uptake of drug-delivering nanoparticles is to reduce protein adsorption by attaching polyethylene glycol (PEG) graft. The aim of this research was to understand how polymer grafts on nanoparticle surfaces affect corona formation and composition. We hypothesized that when PEG shells with different structural conformations are presented on nanoparticles, the protein coronas vary in a way that can render particles to have distinguished circulation times in the blood and accumulations in organs. For this, the nanoparticles were fabricated using nanoprecipitation with different PEG conformations and incubated with fetal bovine serum (FBS) to form protein coronas in vitro. Protein coronas were analyzed using SDS-PAGE gel electrophoresis with silver staining and Coomassie blue along with liquid chromatography-mass spectrometry (LC-MS). These results were used to elucidate previous experiments.

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

Zhiyuan Fan, *Graduate Student*

Samantha Dehais

College of Engineering
Materials Science & Engineering
Frances Velay Fellow

Wireless Wearable MXene Electronics

Recently, there is an interest in wearable technology to meet the demands of modern society. Perhaps a shirt that could charge a phone, or monitor the heart rate of someone with high blood pressure. Wireless applications in textiles is something that is currently underdeveloped, but something that could potentially be beneficial. In the discovery of 2012 MXenes, a family of 2D materials, MXene has shown to have a conductivity of 10,000 S/cm. In the case of $Ti_3C_2T_x$, MXene opened new avenues in fabricating wearable antennas. Thus, the goal of our project is to fabricate the first MXene-textile based receiving and transmitting device. Incorporating MXene in the textiles (cotton, polyester, and nylon) was achieved after functionalizing the fabric with chitosan or polyaniline. MXene was applied on the functionalized textiles by the dip-dry method commonly known in textile industry. Here, we were able to obtain conductive cotton with a sheet resistance of 3Ω/sq. Based on these results, cotton was used to construct 2.4 GHz dipole antennas. The hope for the future is that the antennas will be assembled out of the actual commercial threads and fabric, which will lead to a breakthrough in wearable wireless communication devices.

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

Asia Sarycheva, *Graduate Student*

Jonathan Hollenbach

College of Engineering
Materials Science & Engineering

Electrochemical Properties of various MXenes for use in Supercapacitors

Two-dimensional (2D) transitional metal carbides and nitrides (MXenes) were discovered in 2011. The list of successfully synthesized MXenes is constantly growing, each with their own distinct properties. Supercapacitive behavior is one such property that shows ample opportunity for innovation in energy storage. Most supercapacitor research with MXene electrodes studies use only one specific MXene called Titanium Carbide (Ti3C2TX). In order to gain a wider understanding of MXeneâ€™s potential for capacitive energy storage, we have synthesized, tested, and compared several of the discovered MXenes. We hope to provide a platform on which further research will expand upon. This platform consists of specific capacitance values, gravimetric and volumetric, which builds a reference table that will ideally direct future research towards the optimal MXene supercapacitor.

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

Tyler Mathis, *Doctoral Student*

Neil McNair

College of Engineering
Materials Science & Engineering

Two-Dimensional Double Transition Metal Nitrides

Computing and information storage devices have the potential to be miniaturized. Two-dimensional (2D) materials, which are merely a few atomic layers thick, have been a focus of research for miniaturization. However, no suitable 2D materials have been developed that can accomplish this goal. Two-dimensional double transition metal nitrides that exhibit magnetic properties, such as chromium tungsten nitride ($CrWN_2$), may be suitable. $CrWN_2$ was created in this project using a salt-templated synthesis method with varying precursor weight ratios, ethanol concentration, ammoniation temperature, rate of heating, and omission/inclusion of pre-ammoniation vacuum-drying. Each sample was analyzed via XRD, XPS, and TEM techniques to determine its dimensionality, crystal structure, and ferromagnetic properties. The resulting samples of $CrWN_2$ proved to be two-dimensional. Additionally, the analytical techniques showed the desired crystal structure, in which chromium, tungsten, and nitrogen are bonded to each other within the individual crystals in the compound. The development of $CrWN_2$ could revolutionize computers and databases, smartphones, and electrical/technical equipment for usage in medicine, communication, air travel, and beyond.

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

Patrick Urbankowski, *Graduate Student*

William E. B. Reil

College of Engineering
Materials Science & Engineering

Electrochemical Actuation of 2D Metal Carbides (MXenes)

Developing inexpensive and energy-efficient actuating materials is one of the challenges in electrochemical actuators and their various applications, such as robotics for non-invasive surgeries, artificial muscles, and micromachinery. Electrochemical actuators are devices that utilize expansion and contraction during electrochemical reaction to produce mechanical energy; however, candidate nanomaterials for electrochemical actuators should have high electrical conductivity, high flexibility, and long cycle life.

Transition metals carbides, known as MXenes, are one of the novel materials that can be processed into films with metallic conductivity, but in contrast to metals they are lightweight and highly flexible. Here we built a bimorph-type electrochemical actuator device based on sandwiching ionically conductive gel of polyvinyl alcohol between two strips of MXene films. This device showed a displacement of 2 to 3 mm at low voltage of 0.3 V. This displacement is higher than many ECs-based materials such as carbon nanotubes, graphene, and dichalcogenides, which required higher than 0.8 V to produce comparable displacements. The future work will focus on optimization and study the effect of device geometry on the performance of MXene ECs, as well as further develop devices such as micro-grippers and micro-cranes from produced actuators.

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

Mohamed Alhabeb, *Graduate Student*

COLLEGE OF ENGINEERING

Jacob Nantz

College of Engineering
Materials Science & Engineering

PET-RAFT Mechanistic Revelations Through Radical Quenching With TEMPO

Photoinduced electron transfer reversible addition-fragmentation chain transfer (PET-RAFT) was utilized to polymerize a range of monomers, including (meth)acrylates and acrylamides, with moderate to narrow molecular weight distributions (MWDs). Eosin Y, a common cell-staining agent, was used as the photoredox catalyst because of its lower cost compared to rare metal catalysts typically employed in PET-RAFT. In many of the systems explored, PET-RAFT exhibited characteristics of a controlled-living polymerization yielding low dispersity polymers ($Đ$ = 1.1-1.2) with pre-determined molecular weights. In addition, the polymerization kinetics of N-isopropylacrylamide were elucidated along with preliminary results revealing insights into the PET-RAFT mechanism. These mechanistic explanations were developed using a novel radical trapping procedure based on precise additions of a stable free-radical, 2,2,6,6-tetramethylpiperidinoxyl (TEMPO). As the precise mechanism for PET-RAFT is still debated, new information is greatly beneficial into fully understanding this polymerization process. The present work was, in part, accomplished through the development of a new analytical technique for calculating monomer conversion using size exclusion chromatography enabling rapid and streamlined analysis of polymerization kinetics.

Faculty Mentor: **Dr. Andrew J. D. Magenau**
Materials Science and Engineering

David Howe, *Graduate Student*

Poster Session C

138

Mark Petrovic

College of Engineering
Materials Science & Engineering

Biomimetric Mineralization of Poly(ε-caprolactone) Nanofiber Shish Kebabs Crystallized with Poly(ε-caprolactone)-b-Poly(acrylic acid) Block Copolymer

Bone is the second most commonly transplanted tissue after blood with 2.2 million transplants performed annually. The current standard for treatment are autografts wherein the patient's own bone is used to repair the damaged site. This approach offers the optimum chance at tissue regeneration, however, it is often painful and requires a long recovery period. Recently, hybrid polymer biomaterials have emerged as a promising alternative strategy due to their biocompatibility and their resemblance to the nanotopography of natural bone. A subset of these biomaterials—nanofiber shish kebabs (NFSKs)—have been shown to nucleate the growth of polymer crystals that follow a periodic pattern with the period ranging from tens to hundreds of nanometers, analogous to collagen fibrils in natural bone. When mineralized in simulated body fluid, NFSKs were shown to be the first synthetic matrix that facilitated intrafibrillar mineralization similar to that found in collagen fibers of bone. Based on previous results showing that fiber alignment affects fiber mat cell proliferation, these experiments were extended to explore the effects of crystal periodicity on mineral orientation. Mineral orientation in bone is known to have effects on mechanical properties, degradation behavior, and biocompatibility, so greater control of this characteristic is critical for the implementation of NFSKs as an alternative to autografts.

Faculty Mentor: **Dr. Michele Marcolongo**
Materials Science and Engineering

Tony Yu, *Graduate Student*

Michael Barsoum

College of Engineering
Materials Science & Engineering

Growing a Three Component Superlattice

Perovskites are a class of electro ceramic materials with a wide variety of uses, including ultrasound technology, motors, conducting cables, and sonar, stemming from compositional control of optical, piezoelectric, ferroelectric, and magnetic properties. Perovskite oxides consist of a large/rare-earth cation (*A*-group element), a smaller transition metal ion (*B*-group element), and oxygen, with the formula ABO_3. Previous work in the field has demonstrated how to elicit unusual properties, through partial substitution of the A site, and by ordering the substituted structure into a superlattice, i.e. $ABO_3/A'BO_3$. Furthering this concept, this project focused on breaking inversion symmetry in superlattices utilizing three components on the *A*-site as opposed to two. Molecular beam epitaxy (MBE) was used to deposit perovskite films under ultrahigh vacuum with atomic precision. MBE is easily scalable and currently used in several industries, most notably in large scale semiconductor fabrication. Through the course of this project, films of $La_{1/3}Sr_{1/3}Ca_{1/3}FeO_3$ (*A*-site disordered) and compositionally equivalent superlattices of $(LaFeO_3)_{n/}(SrFeO_3)_{n/}(CaFeO_3)_n$ were deposited using MBE, with a focus on processing and assessing film properties; structural, compositional, and electronic properties were characterized by means of X-ray diffraction (XRD), X-ray reflectivity (XRR), X-Ray photoelectron spectroscopy (XPS), Rutherford backscattering Spectrometry (RBS), and electronic transport measurements.

Faculty Mentor: **Dr. Steven May**
Materials Science and Engineering

Benjamin Lefler, *Graduate Student*

Poster Session A

140

Monica L. Keilsohn

College of Engineering
Materials Science & Engineering

Electrospinning Conductive Nanoyarns for Integration into Smart Textiles

With the ever-growing field of smart textiles, there is a need for novel yarns that are not only functionable but also processable. Currently, there are few commercially available conductive yarns which can be implemented into smart textiles. Commercial yarns have limited performance due to their inability to withstand laundering, corrosion upon exposure to sweat, and difficulty in manufacturing. To solve these issues, a new process to create conductive yarns using the electrospinning of nanoscale fibers has been introduced.

The goal of this work is to design electrospun conductive nanoyarns that can be seamlessly integrated into textiles. Ideally, these specialty yarns can withstand industrial-scale textile manufacturing, and withstand environmental factors by creating a yarn that doesn't need secondary coatings.

Through an innovative dual needle design, we electrospin nanofibers using different techniques to create unique shapes of yarns that can be implemented into a multitude of scenarios. These nanoyarns undergo tensile testing to analyze the strength and SEM imaging to identify the fiber morphology. Additionally, we electrospin specialty polymer solutions to produce conductive fibers that could be used to form conductive yarns. Using a traditional electrospinning set-up, we perfected the process to find the exact parameters that produce the most ideal nanofibers.

Faculty Mentor: **Dr. Caroline L. Schauer**
Materials Science and Engineering

Ariana S. Levitt, *Graduate Student*

Kyle Matthews

College of Engineering
Materials Science & Engineering

Microstructural Stability of Additively Manufactured Soft Magnetic Composites

Additive manufacturing can be used for efficient rapid prototyping, and the design of complex geometries. The process of additive manufacturing is particularly useful in the production of parts such as electric motors, but as this is a new and expanding process we need to gain a better understanding of the benefits of additive manufacturing of soft magnetic composites. In this project, iron-based soft magnetic composites will be 3D printed using binder jet methods as well as powder bed fusion methods. The composition, morphology, and microstructure of the printed parts will be compared with the use of scanning electron microscopy. These tests will be followed by tests on the mechanical and magnetic properties of the parts. Overall this project provides a deeper understanding of the additive manufacturing process of soft magnetic composites as well as the challenges faced when printing iron-based soft magnetic composites using bother powder bed fusion and binder jetting methods.

Faculty Mentor: **Dr. Mitra Taheri**
Materials Science and Engineering

Emma Snelling

College of Engineering
Chemical Engineering

Testing the Strength of Porous Compacts

The purpose of this project was to design a testing method for the strength of porous compacts. Porous compacts are formed by compressing powders and are common in many industrial applications. There are several strength tests that impose on the part a combination of tensile and compressive stresses. The proposed test evaluates the strength of powder compacts under tensile pressure by varying the pressure of the air in the pores of the compact. A pressure vessel was designed to impose this condition. The compacts were exposed to high air pressure for a desirable amount of time allowing the pressurized air to reach equilibrium within the pore space of the compacts. Once the compacts were held at high air pressure for an amount of time, a quick release valve was activated. The pressure in the pressure vessel was rapidly reduced while the reduction of pressure within the sample was much slower. This pressure difference causes weak compacts to break. While the procedure is tedious in terms of gradually increasing the pressure till failure occurs, the setup allows for simultaneous testing of multiple compacts. This test will be useful in the design and optimization of processes that produce powder compacts.

Faculty Mentor: **Dr. Antonios Zavaliangos**
Materials Science and Engineering

Henrietta Tsosie, *Graduate Student*

Chase Foley

College of Engineering
Mechanical Engineering

Cost Effective Multirotor Dynamic Modeling Methods

Drones are becoming a common sight in today's society. It is imperative for researchers, manufacturers, and hobbyists to understand how different motors perform to accurately model vehicle flight dynamics. These models are critical to control system development for reliable autonomous systems. While larger multi-rotors typically use powerful brushless direct current (dc) motors, smaller size aircraft often use smaller, lower power, brushed dc-motors. Low-cost, convenient test methods for small brushed dc-motor aircraft have not been well reported.

The objective of this research is to create a simple but effective means to measure the force and torque produced by component motors prior to integration. A testing apparatus was designed to amplify a small motor's thrust and torque to allow measurement via low cost sensors, such as kitchen scales or inexpensive load cells. The motor test fixture is entirely 3D printed allowing for quick and easy fabrication as well as scalability for different sized motors. In addition, motor speed control and measurement is provided using a low-cost microcontroller and infrared sensor. Finally, a mass moment of inertia matrix was estimated to complete a dynamic model of the vehicle.

Faculty Mentor: **Dr. Bor Chin Chang**
Mechanical Engineering and Mechanics

David Hartman, *Doctoral Candidate*

COLLEGE OF ENGINEERING

Maria Zhdankina

College of Engineering
Mechanical Engineering

Design, Fabrication, and Evaluation of 3D-Architectured Materials

Advanced manufacturing opens new frontiers in design of materials to produce spatially complex 3D structures capable of unlocking new performance regimes (e.g. lightweight & high strength). This research leverages advanced manufacturing methods and specifically the fused deposition modeling 3D printing approach to produce performance-optimized architectured materials subjected to tensile and compressive loads. A testing and characterization framework was created to enable such performance-driven design of architectured materials. Dog-bone and cylindrical structures with varying fill-densities and internal geometries were designed & tested. Across a range of material volume fractions, architecture-dependent behavior effects were observed. Autodesk Fusion 360 was employed to design and virtually probe the tensile and compression responses, while tensile and compression tests were performed to characterize such mechanical behavior. Finally, non-contact optical metrology (3D Digital Image Correlation) was used to produce full-field strain maps under tensile and compressive loads, and directly compared against finite element simulation results to probe load transfer pathway in 3D architectured geometries.

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

Daniel Christe, *Graduate Student*

Yigit Can Alparslan

College of Engineering
Electrical Engineering

Effect of Three-Dimensional Flow Field Design on Power Density Performance of Vanadium Redox Flow Batteries

One of the major challenges that limits the widespread commercialization of vanadium redox flow batteries (VRFBs) is their relatively low power density, which often results in higher cost. In recent years, significant effort has been put on understanding the effect of flow field design on the power density performance of VRFBs . Flow fields play a crucial role in effective delivery and removal of active species from the electrode surface. However, research on flow field designs has been limited to conventional designs such as parallel, serpentine and interdigitated.

Effect of varying channel depth has remained unexplored. Motivated by this, various forms of channel obstructions and ramped flow field designs have been investigated to understand the effect of channel depth and delivery of electrolytes on the power density of the VRFBs. Results have shown significant improvements in power density (up to 90%) with a significant decrease (up to 50%) in pumping losses. These findings suggest that engineering of the flow field designs in all three dimensions can help further improve the power density of VRFBs.

Faculty Mentor: **Dr. Emin Caglan Kumbur**
Mechanical Engineering and Mechanics

Bilen Akuzum, *Graduate Student*
Lutfi Agartan, *Graduate Student*

Jacob Dexter Manera

College of Engineering
Mechanical Engineering

Dynamic Mode-I Fracture Analysis of Piezoelectric Ceramics

Lead Zirconate Titinate (or PZT) is a perovskite ceramic material that displays clear piezoelectric/ferroelectric properties. PZT-5 was cut into 3 mm x 4 mm x 45 mm samples, and had 3 Vickers indentations made in the center of the 3 mm wide face to act as a pre-crack, and were loaded to failure in a quasi-static three-point bending configuration. From the three-point bending fracture load, the quasi-static fracture toughness was calculated as 1.32Â±0.08 MPaâˆšm. In a separate experiment, 26 mm x 50 mm x 3 mm PZT-5 plates were loaded in a mode-I single edge notch fracture configuration. The plates were impacted with a long, spring-driven steel bar to instigate dynamic mode-I fracture. A high-speed camera recorded at 1,000,000 fps to capture the impacts. The sample was painted with a random speckle pattern in order to perform digital image correlation, and find the localized full field displacements during fracture. Utilizing these displacements, the critical stress intensity factors at initiation of the stationary crack were extracted using a linear least squares regression procedure. The fracture toughness of the dynamically loaded samples was found to be 10.09Â±.32 MPaâˆšm, 7.4 times that of the quasi-statically loaded samples.

Faculty Mentor: **Dr. Leslie Lamberson**
Mechanical Engineering and Mechanics

Peter Jewell, *Graduate Student*

Ryan J. Garvey

College of Engineering
Mechanical Engineering

Cube Satellite Integrated Linkage (COIL) Mechanism Improvements

A Cube satellite is a 10 cm cube launched as a secondary payload. The base cube is known as a U. Cube satellites can be several U in size, most commonly 1U or 3U, and must weigh no more than 1 kg per U. Cube satellites are much less expensive than larger satellites, and are often used for missions where it is too dangerous or costly to use larger satellites. However, the capabilities of these satellites are limited due to size and mass constraints. The COIL mechanism was devised to allow cube satellites to link, communicate, and share power; which helps to overcome the deficiencies of single cube satellites. COIL uses an electromagnet mounted on a spring, which also has a wire attached to a motor, to attract each satellite to the other. Once they are close enough a clamp system activates via a gear train, locking them together. The goal of the project was to identify issues with the existing design and then research and implement new/modified solutions. I inherited the project from a senior design team. The issues I focused on were in the mechanical design of the COIL. Most of them were within the wire, spring, and gear train assemblies. I then implemented design changes to correct those issues, and create a functional prototype.

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

Poster Session B

Joshua Glynn

College of Engineering
Mechanical Engineering

Morphing Airfoils

For most airplanes today, variable flight characteristics are controlled by extensions of an airfoil shape in the form of ailerons and rudders. The idea behind morphing airfoils is to change the shape of the whole airfoil rather than just a part of it. This idea has great potential to change the aviation industry as it creates potential for wings to be able to meet the needs of many more flight conditions with greater efficiency and control. This project focuses on changing a single aspect of the airfoil but with a concept that can be extended to change a much greater portion of the airfoil. The idea is to move cylinders relative to one another such that when they move, the maximum thickness is changed. This idea can be easily extended as many cylinders can be attached to one another to control many points of the airfoil surface with a single force. The end goal is to be able to demonstrate the ability of this mechanism to change the flight characteristics of the airfoil through wind tunnel testing.

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

Alex J. Kalesnik

College of Engineering
Mechanical Engineering

Double-Hulled Rigid Airship Drop Vehicle

In the interest of developing a droppable payload design competition, previous efforts of members of the Drexel Space Systems Lab have included the design and construction of a tethered balloon supporting a hanging platform. This method, however, proved ineffective, as its performance proved to be at the mercy of the wind. Because of this, it was difficult to stabilize the platform. To solve this problem, while maintaining an acceptable level of control, this project consisted of the design of a dirigible rigid airship to be used in place of a tethered balloon. To lift itself, as well as two five-pound payloads, to a height of 250 feet, the ship had to be large (enclosing 500 ft^3 of helium). To reduce the effect of a side wind, a double-hulled design, which reduces the ship's lateral cross-sectional area was chosen. This also provided an area in the middle of the ship to easily attach the payloads. Autodesk Inventor was used to run wind tunnel simulations to determine motor thrust requirements. Fins were added to the design to help the ship turn into a headwind. The ship is currently in construction.

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

Surya Saket

College of Engineering
Mechanical Engineering

Gimbal Propulsion System

Drones are revolutionary machines that will play a huge role in future technologies. They are used for everything from taking pictures and videos to carrying payloads. Modern day drones use a steering system based on changing the speed of propellers to navigate through an area. However, this method changes the drone's orientation making it hard to navigate through small areas or have a stable horizontal payload on top of it.

A gimbaled propeller is one of the possibilities that could allow drones to have a stable horizontal platform while steering in any direction. Gimbal unit systems use a mechanism that allow them to rotate freely around a plane. My star project was to design and build a gimbal unit that attaches under a drone propeller giving it several degrees of freedom. The gimbal unit was inspired by the actual gimbal system used to propel rockets. The unit uses miniature actuators to push and pull a platform supporting the propeller. The push and pull action of the actuators rotates the platform along its original normal, thus allowing the drone propellers to act in a different direction.

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

Keyanna Bynum

College of Nursing & Health Professions
Nursing

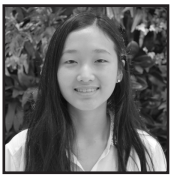
Monitoring Fluid Intake in Heart Failure: Patient Technology Preferences

Excessive fluid intake in heart failure (HF) patients is a major contributor to hypervolemia, and monitoring fluid intake is problematic for patients, caregivers, and clinicians. Too much fluid intake results in weight gain, a worsening of symptoms, poor quality of life, and hospitalization to treat HF symptoms. Manually measuring and logging beverage consumption is not practical. Patient self-reported fluid intake is notoriously unreliable and health care provider efforts are too labor intensive. The long-term goal of this study is to improve the quality of life and health outcomes in HF patients by promoting HF self-management of beverage consumption with smart health technology. The purpose of the current project is to identify mobile health technology preferences in our target population. Heart failure patients were interviewed during their visit at the Cardiology Clinic at Drexel Medicine. The survey consisted of 34 questions related to patient demographics (including their current HF status), current technology use, and smartphone application preferences. Participants were reimbursed with a $20 gift card for their time. Findings will help contribute to the development of future self-management technology for HF patients.

Faculty Mentor: **Dr. Rose Ann DiMaria-Ghalili**
Doctor of Nursing Practice Department

Young Eun Park

College of Nursing & Health Professions
Nursing



Genetic Literacy among Health Professions Students Compared to General Students

There is a need for health professionals to possess genetic knowledge, as new advances in health technology target patients' genetic information. Therefore, it is necessary to assess the genetic literacy of health professions baccalaureate students to understand their knowledge levels and augment the proper concepts into the curriculum. There is no research on the genetic literacy of nursing students at Drexel University. The purpose of this survey study was to describe knowledge of genetics among undergraduate students enrolled in health professions programs compared to those in general programs at Drexel University, using the Genetic Literacy Assessment Inventory (GLAI). This self-administered, anonymous, online questionnaire contained seven sociodemographic questions and thirty-one questions from the GLAI. The scores of this test illustrated that the average score of general students (81.9%) exceeded the health professional students (62.6%) by 19.3%. College of Arts and Sciences held the highest average (84.8%) while College of Nursing and Health Professions held the lowest (60.6%). The question stating genetic differences does not represent a substantial portion of the human genome had the greatest incorrect responses (53.1%). Drexel University should augment the health professions curriculum to integrate genetic topics, especially those that related to the relationship between genotype and phenotype.

Faculty Mentor: **Dr. Ellen Giarelli**
Doctor of Nursing Practice Department

Amarah Malik

College of Nursing & Health Professions
Bennett S. LeBow College of Business
Health Services Administration, Finance

The Impact of the Affordable Care Act on the Incidence of Retirement among Near-elderly Adults

Individuals seeking early retirement face a number of planning challenges, the most significant of which is locating and financing an affordable health insurance plan on the individual insurance market. Following the passage of the Affordable Care Act (ACA) in 2010, community and age rating policies were introduced, which ensured the increased availability and affordability of health insurance plans sold on the individual market. To date, studies have broadly examined the impact of the ACA on the acquisition of health insurance across the general population, but few studies have examined the potential impact of the increased availability of affordable insurance under the ACA on early retirement decisions. We utilized the Medical Expenditure Panel Survey (MEPS) from 2008 to 2014 and logistic regression to examine the impact of the ACA on the incidence of early retirement in the U.S. population. The analysis revealed that although healthcare cost declined significantly following the passage of the ACA, the probability of early retirement declined within the general population. This evidence suggests that non-healthcare factors potentially play a larger role in determining the timing of retirement decisions.

Faculty Mentor: **Dr. Jerome Dugan**
Health Systems and Sciences Research

Dr. Layla Booshehri, *Co-Mentor*

Katy S. Vieira

College of Nursing & Health Professions
Health Sciences

Maximal Oxygen Consumption vs. Time Spent in Vigorous Physical Activity

Maximal oxygen consumption (VO_2max) is the maximum amount of oxygen used by the muscles and is an important cardiorespiratory fitness indicator. It is measured using "a metabolic cart", an instrument that measures oxygen consumption by breath. Athletes tend to have a higher VO_2max than individuals who are less active. Engaging in vigorous physical activity can improve VO_2max compared to engaging in moderate physical activity. In this study, we examined the correlation between time normally spent in vigorous physical activity and VO_2max. We hypothesized that athletes engaged in vigorous physical activity would have a higher VO_2max than those who were moderately physically active. Maximal oxygen consumption was assessed via the metabolic cart and a treadmill, via a graded exercise test. After testing, athletes were given accelerometers to record their physical activity and intensity levels for one week. Data were obtained for 42 female and 32 male athletes of all levels, ranging from 26 to 64 years of age. There was no significant correlation between time spent in vigorous physical activity and VO_2max (Pearson's correlation = 0.74; $p = 0.541$), after adjusting for age and sex. More research is required in a larger sample size to determine if any such correlation exists.

Faculty Mentor: **Dr. Stella Volpe**
Nutrition Sciences

Samantha Stein

College of Arts & Sciences
General Humanities and Social Sciences

Medical Narrative within the Evidence Based Medicine Context

We are preparing a narrative literature review which explores how medical knowledge and the physician/patient relationship are influenced when clinicians use narrative methodologies to ascertain and to report outcomes of medical practices. We research peer-reviewed journals and engage in ethnogeriatric field work to determine current uses and potentiality of narrative methodologies within the context of Evidence Based Medicine (EBM). While blind, randomized studies constitute Level I of EBM's evidence hierarchy, medical narrative, though formally Level IV evidence, serves as a substantiating and humanizing force when considered alongside Level I evidence. Stories of illness enrich the breath, depth, and scope of medical knowledge enabling clinicians to better attend to patientsâ€™ individuality; and, the dialectic experience transforms the traditional patient/physician roles. We continue to explore the use of narrative methodologies as an endeavor in human-centered design, and to understand their value when integrated with EBM.

Faculty Mentor: **Dr. Elizabeth Adams-Eilers**

DREXEL UNIVERSITY
COLLEGE OF MEDICINE

Rebecca Genovese

School of Biomedical Engineering, Science, & Health Systems
Biomedical Engineering
Frances Velay Fellow

Organ on a Chip 3D Liver Model

Research related to the liver has long been constrained by the disparity between where testing takes place and the actual environment of the liver. While cell plates provide a hard surface, the liver is a dynamic organ, far more complex than any simple, plastic plate. As a result of this disparity, liver cells respond and act differently once taken out of their natural environment, lessening the accuracy of drug testing and other liver related research. The "liver on a chip" creates an environment that resembles the liver far more than any previous solution. This chip consists of dual layers of polydimethylsiloxane (PDMS), a porous membrane, and tubing that form inlets and outlets for cell culturing. Oxidative plasma is a commonly used method in PDMS-PDMS bonding. A study of the surface oxidation's variables was done to maximize the strength of the bonding between the two layers of PDMS. These variables include power generation time, base pressure, and plasma power. Additionally, HepG2 cells were cultured in a multilayer design, indicative of the biology of the liver, as proof of chip design viability.

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

Lahari Uppuluri, *Graduate Student*

Priyanka Shah

College of Arts & Sciences
Biological Sciences

Ethanol consumption is reduced by PACAP-27 in the nucleus accumbens

Alcoholism is a detrimental disorder, both physically and emotionally, but the few medications available to treat alcoholism are not very effective. The goal of this project was to examine a new candidate molecule for reducing alcohol drinking. We have previously shown that neuropeptides in one area of the limbic system, the paraventricular nucleus of the thalamus (PVT), can affect alcohol drinking. We identified the presence of the neuropeptide pituitary adenylate cyclase-activating polypeptide (PACAP) in the PVT. Importantly, the less common protein isoform of PACAP, PACAP-27, was dense in neurons in this brain region. Neurons in the PVT project strongly to another brain region, the nucleus accumbens shell (NAcSh), and PACAP-27 is presumably released into the NAcSh to affect behavior. Therefore, to examine the ability of PACAP-27 to influence alcohol drinking, Long-Evans rats were trained to voluntarily drink alcohol and were then microinjected in the NAcSh with two doses of PACAP-27 compared to saline vehicle. The lower dose of PACAP-27 led rats to decrease both alcohol drinking and food intake but not water intake. The results of this study indicate that PACAP-27 may be a promising new target for the treatment of alcoholism.

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

Andrew T. Gargiulo, *Graduate Student*

DREXEL UNIVERSITY
COLLEGE OF MEDICINE

Justina Toma

College of Arts & Sciences
Biological Sciences

Chemogenetic inhibition of the paraventricular thalamus to reduce excessive ethanol seeking and intake

According to the World Health Organization, alcohol abuse contributes to more than 200 diseases, including alcohol dependence, liver cirrhosis, and multiple cancers. Understanding the neurobiological mechanisms behind alcohol abuse is crucial to determining how to successfully treat it. The paraventricular nucleus of the thalamus (PVT) has recently been shown to modulate aspects of excessive alcohol drinking in rats, but the general contributions of the anterior (a) and posterior (p) subregions of the PVT to alcohol seeking and intake have not yet been determined. Therefore, rats were trained to press a lever for an alcohol reward in an operant chamber and were then injected in the aPVT or pPVT with an inhibitory Designer Receptors Exclusively Activated by Designer Drugs (DREADD) virus. After the virus expressed its receptors within the neurons of the PVT subregions, an inert drug-like molecule, clozapine-N-oxide (CNO), can be injected, which will lead to neuronal inhibition of the PVT. At the conclusion of this study, there will be a better understanding of how specific subregions of the PVT are involved with alcohol seeking and intake, thereby providing novel information for treatment development.

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

Surya Pandey, *Graduate Student*

Hannah Claire McCausland

Dornsife School of Public Health
Public Health

Investigating Failure to Thrive and Potential Co-occurring Behavior Problems in Children

Failure to Thrive (FTT) is a condition in which a person fails to gain adequate weight for healthy development. FTT can impair neurodevelopment, potentially impacting behavior. This study compares the behaviors of children presenting at a clinic for FTT (n=202; age 18 to 59 months) to normal-weight children presenting at the same hospital for a well-child visit (n=18). The children's internalizing and externalizing problems were assessed using their caregiver's responses on the Childhood Behavior Checklist (CBCL). This study is ongoing and thus current findings are preliminary given the small sample size of the comparison group. Therefore, a p-value of ≤.20 was used to identify emerging trends. A series of independent sample t-tests were performed for all CBCL subscales. Somatic complaints (p=0.14), affective problems (p=.20), and ADHD (p=.16) were more common among children with FTT. Eating-related problems (e.g., doesn't eat well) fall under somatic complaints on the CBCL, raising the possibility that somatic problems and eating problems are related. Affective problems may be linked to underactivity from undernutrition. Finally, ADHD may be due to feeding problems (e.g., inability to stay seated at meals) associated with ADHD.

Faculty Mentor: **Dr. David Bennett**
Psychiatry

EXTERNAL SITE:
CHILDREN'S HOSPITAL OF PHILADELPHIA

Dharman Anandarajan

College of Arts & Sciences
Biological Sciences

Observing Geographical Trends in Opioid Prescription for ACL Patients over a Five-Year Span

The recent opioid epidemic that has been sweeping the nation has been widely documented. However, a little studied topic has been the variability of opioid prescription in different regions of the United States, specifically among youth and adolescent patients.

In this study, the Pediatric Health Information System Database was used to identify patients aged 10-18, who had an ACL injury, from 2012-2016. 11,452 patients over the five-year span from 39 children's hospitals were identified, with a total of 27,444 opioids prescribed.

Four regions (Northeast, Midwest, South, and West) were broken down into the average prescriptions per Patient for the top four most commonly prescribe opioids in the patient cohort: Fentanyl, Hydromorphone, Morphine, and Oxycodone, as well as average opioid prescription per patient. The South and the Midwest were found to prescribe significantly more opioids per patient than the North and the West. Fentanyl was found to be the most commonly prescribed drug in the Midwest, South, and West by a significant margin. This is especially troubling because the CDC has found Fentanyl to be 100x stronger than many opioids, and there has been an increase in Fentanyl deaths from 2013-15.

Faculty Mentor: **Dr. Lawrence Wells**
Attending Orthopedic Surgeon, CHOP

Dr. Murugan Anandarajan, *Co-Mentor*

EXTERNAL SITE:
INDIAN INSTITUTE OF TECHNOLOGY – MADRAS

Arun S. Balaji

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

Analysis of Thermal Profiles of the Dominant Hand Pre- and Post- Fatigue Using Infrared Thermography

Despite humans' extensive usage of the dominant hand, very little has been done to understand the development of Upper Extremity Musculoskeletal Disorders. In this study, the potential of infrared thermography (IRT) to measure muscle fatigue is explored by monitoring changes in the thermal profile of the hand prior to and following fatigue-inducing exercise. Subjects are tested using pinch grip based isometric contraction exercise until fatigue. Baseline and post-test thermal images are acquired using a Meditherm IRIS infrared camera and thermal profiles are extracted using an image segmentation process. Results show wide variations in the intensities depicted by the thermal profile of each subject's hand. The temperature distributions of the hands are heavily left-skewed, and there is an average hand temperature decrease of 1.23% in the palmar hand and 1.17% in the dorsal hand following fatigue in the thenar eminence region. P values of 0.075 and 0.083 respectively indicate that this temperature decrease is non-statistically significant (P>0.05). Thus, while this study highlights the potential of infrared thermography in fatigue and stress monitoring of muscles in the human body, it also shows the need for developing better techniques to use IRT as a predictive and analytical tool.

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

Navaneethakrishna Makaram, *Graduate Student*

Poster Session B **162**

EXTERNAL SITE:
INDIAN INSTITUTE OF TECHNOLOGY – MADRAS

Mayank Patel

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

Analysis of Muscle Fatigue Using Surface Electromyography Signals in the Gastrocnemius Muscle During Isometric Plantar Flexion

Fatigue during plantar flexion and the gastrocnemius muscles causes an increase in mediolateral sway and postural control impairment. The purpose of this study is to analyze the variation in the surface EMG characteristics during isometric plantar flexion. For this, sEMG signals are recorded from the medial and lateral gastrocnemius muscle from 8 subjects and a minimum of 3 trials each. The subjects performed isometric plantar flexion and are asked to hold the position until fatigue. The result shows that the endurance time of each subject vary. On comparing the endurance between legs, a marginal difference is observed. The recorded signal is nonstationary in nature. On visual inspection, the EMG signals show an increase in amplitude with fatigue. The features such as RMS show an increase in value with 20.311% in right leg and 13.930% in the left leg for the signals from medial gastrocnemius. In the case of lateral gastrocnemius an average increase of 17.510% while the medial has one of 16.720%. The endurance time of the right of leg is longer by 7.29%. The right gastrocnemius can reach higher levels of fatigue than the left gastrocnemius. This study can be extended to analyze other neuromuscular conditions.

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

Navaneethakrishna Makaram, *Graduate Student*

EXTERNAL SITE:
JOHNS HOPKINS UNIVERSITY

Anjali Ganguly

College of Arts & Sciences
Biological Sciences

Astroglia Subset is Lost During ALS Disease Progression

Astroglia are the most abundant glia cell type in the central nervous system (CNS). They play critical roles to maintain the homeostasis of the CNS, including roles in ion homeostasis, neuronal synaptogenesis and elimination, and blood brain barrier maintenance. Historically, astroglia have had two defined groups based on neuroanatomical identity. However, recent scientific evidence has begun to elucidate astroglia heterogeneity based on functionality. To further investigate astroglia subsets, a transgenic mouse model that labels layer II/III and V astroglia with tdTomato fluorescence was established. Using fluorescent-assisted cell sorted we identified molecular details of this astroglia subgroup for instance we identified protein and RNA markers that were enriched in this astroglia subset. Their molecular profiles were evaluated with genomic and histological tools to categorize these cells based on these markers. We then evaluated their distribution in a neurodegenerative model of amyotrophic lateral sclerosis (ALS). In these models and in human post-mortem tissue, this subset of astroglia was ablated in areas of neuronal death. We continue to evaluate this cell population in ALS to understand their functional significance in correlation with neurodegeneration. This project provides a novel approach to understanding identified astroglia subpopulations, and creates opportunities to use cell-specific therapies for ALS.

Faculty Mentor: **Dr. Jeffrey D. Rothstein**
Neurology

Sean James Miller, *Graduate Student*

Poster Session B **164**

EXTERNAL SITE:
JOHNS HOPKINS UNIVERSITY

Josh Maret

College of Arts & Sciences
Biological Sciences

Tau-mediated disruption of neuronal nucleocytoplasmic transport in Alzheimer's disease

Tau is a microtubule-associated protein essential to the assembly and stabilization of neuroaxonal microtubules. Despite the naturally high solubility of tau, tauopathies, including Alzheimer's disease (AD) and frontotemporal dementia (FTD), are characterized by the aggregation of tau in the form of neurofibrillary tangles (NFTs). Loss of hippocampal neurons in tauopathies leads to subsequent memory loss and cognitive decline, characteristic of dementias such as AD and FTD. The mechanism of tau-induced neurotoxicity, however, is not fully understood. We postulated that abnormal expression of tau in AD pathology may disrupt neuronal nucleocytoplasmic transport. We found that in primary neuronal cultures, transgenic mouse models, and human brain tissue, RanGTP and phospho-tau were mislocalized to the cytoplasm and Nup98 co-aggregated with phospho-tau in AD. Employing immunohistochemistry and immunofluorescence, we were able to identify evident Ran gradient abnormalities as well as co-localization of Nup98 with phospho-tau. Our findings demonstrate that mislocalized phospho-tau can disrupt neuronal nucleocytoplasmic transport, likely through co-localization with components of the nuclear pore complex, and underline the probability that tau-mediated impairment of nuclear transport can contribute to neurodegenerative diseases.

Faculty Mentor: **Dr. Jeffrey D. Rothstein**
Neurology

Dr. J. Gavin Daigle, *Postdoctoral Fellow*

EXTERNAL SITE:
UNIVERSITY OF SUSSEX

Celso Jose Delatorre Neto

College of Arts & Sciences
Chemistry

Optimising the Photo-epoxidation of Styrene in Liquid Phase

Epoxides are difficult and often costly to make, and much work has been done in researching the best catalysts to create these compounds. Our work is focused on improving selectivity and general yield of epoxides in oxidation reactions by using a new method of gas-phase oxidation, which involves coating fine silica beads with various catalysts, and flowing gaseous-phase alkenes through the beads under UV light.

In order to test the efficiency of Styrene epoxidation, multiple condition-varying tests were done to examine the photooxidation in a liquid solvent, acetonitrile. Other conditions, such as reaction temperature, catalyst loading, and oxygen concentration were moderated. The main products in the reaction were aldehyde and epoxide, and the selectivity of the reactions were measured in a ratio, in the form of a percentage, between epoxy styrene and benzaldehyde. It was possible to achieve 26.4% and 73.6% for the epoxide and aldehyde, respectively, using the following conditions: 0.015g of TiO_2 loading, 10% oxygen concentration, and ambient temperature.

This work will serve as the basis for future inquiries into oxidations reactions involving styrene, and potentially revolutionary ways to utilize bead-mediated photocatalysis for this chemical.

Faculty Mentor: **Dr. Qiao Chen**
Chemistry

Emmanuel Kamba, *Graduate Student*

Poster Session A

166

EXTERNAL SITE: UNIVERSITY OF SUSSEX

Raman Y. Mathur

College of Engineering
Mechanical Engineering

Using Graphene-oxide and graphene composites as a back electrode in perovskite solar cells to improve photoconversion efficiency

During my 8-week stint at the University of Sussex I pursued various areas of research. Orientation lasted a week and once the lab's goals etc. were understood well enough I set out to contribute the best I could. This involved constructing a spin-coater using a PWM fan and an Arduino. This lasted from the second to fourth week. The main challenges faced were the wiring and controlling the fans RPM using PWM and a relay to interface between the high and low voltage circuits. Once that was completed we moved on to synthesising graphene using the Modified Hummer's method, which yields graphene oxide from graphite. Once the material obtained was proven to be graphene oxide we set out to determine what method is best to reduce the graphene oxide given the lab setup and cell architecture. We seek to reduce the graphene oxide as graphene is the conductive material while graphene oxide is an Ohmic resistor. This led to varying degrees of success and the perovskite cell constructed with the reduced graphene showed photo-activity but did not yield conclusive data. Future considerations are finding ways of synthesising pristine graphene oxide i.e without graphite remnants, and setting up a 2 electrode PCE measurement setup.

Faculty Mentor: **Dr. Qiao Chen**
Chemistry

Daniel Holt, *Graduate Student*

EXTERNAL SITE: UNIVERSITY SUSSEX

Joshua P. McGuckin

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

Crosslink Nanorods for Enhanced Water Splitting Efficiencies

Hydrogen production via solar water splitting has shown to be a suitable process by which energy from light can be stored in chemical bonds as fuel. Solar water splitting is a direct process that generates viable fuel from the sun's rays, however, it is limited by the efficiency of the photoelectrochemical reaction (PEC). The redox reactions in these cells require expensive catalysts that optimize the water splitting process. Previous studies to achieve greater PEC efficiencies with less expensive catalysts have utilized ZnO nanorods or similar nanostructured substrates as photoanodes to enhance performance due to its high charge mobility, improved surface area, and superior surface conductivity. The efficiencies of such system could be further improved if narrow bandgap materials can be used. To address this problem, a 3D composite metal oxide photoanode was designed and constructed. A thin hematite (α-Fe_2O_3) film was deposited onto 1% Y doped ZnO nanorods. Hematite has a very small band gap (2.2 eV) which absorbs wide wavelength of light into visible range, while Y doped ZnO is highly conductive for transporting photogenerated electrons to the cathod. Water splitting efficiency (0.447%) was enhanced in 1% Y doped Fe_2O_3/ZnO nanorods that were electrically deposited in $Fe(NH_3)_2(SO_4)_2$ compared to pristine Fe_2O_3 samples, and pristine ZnO nanorod samples.

Faculty Mentor: **Dr. Qiao Chen**
Chemistry

Daniel Holt, *Graduate Student*

Poster Session A

168

EXTERNAL SITE: ZSX MEDICAL

Amy Tieu

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

In-vitro Degradation of Polydioxanone Surgical Clips

Laparoscopic hysterectomy, the minimally invasive, surgical removal of a woman's uterus due to uterine cancer and high pain, is a common procedure performed using absorbable sutures. Zip-Stitch is a surgical closure device that uses absorbable clips. This alternative mechanism allows for a faster and easier method to close the vaginal cuff. The objectives of this study were to determine the in-vitro degradation profile of heated and ambient polydioxanone clips and the change in clip retention force in two weeks. To mimic surgical closure, clips were deployed onto a nylon rod and stored in a 7.4 pH solution at 37°C. Masses were taken after 1, 2, 5, 10, 20, 30, and 35 weeks of in-vitro degradation to create a mass loss curve. To measure the change in clip retention force, one group of polydioxanone clips were tested at time 0, and another group was tested after two weeks in-vitro degradation. Based on preliminary data from weeks 1, 2, and 5, the graphs estimate the ambient and heated polydioxanone clips will be fully degraded and absorbed in the body by 35 weeks. The average retention force of the degraded clips was approximately two-thirds of the non-degraded clips' average retention force.

Faculty Mentor: **Dr. Josa Hanzlik**
ZSX Medical

Dr. Dan Mazzucco, *ZSX Medical - President, Cofounder, & CEO*

EXTERNAL SITE: ZSX MEDICAL

Hang Truong

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

Insertion and Retention Rate of an Absorbable Surgical Clip

Zip Stitch, a surgical closure system involving absorbable polydioxanone (PDO) clips and an applicator was developed by ZSX Medical to close internal wounds more efficiently. This study verifies that the PDO clips can be inserted into the Applicator with a force less than 95 N.The setup of this clip insertion test includes attaching a force gauge to the clip to measure the peak insertion force. Then, an Applicator is manually advanced towards the clip until the clip is fully seated within the Applicator.

During this test, no nonconforming samples were observed. The clips had no visible deformation or misalignment. However, some insertion forces were greater than the acceptance criteria of 95 N. The risk that a higher insertion force presents is the inability to properly insert the clip into the applicator, which will delay treatment and increase surgical time. To mitigate this risk, a clip insertion hand tool was designed and created to assist with overcoming the force required to insert a clip into the applicator.

Faculty Mentor: **Dr. Josa Hanzlik**
ZSX Medical

Dr. Dan Mazzucco, *ZSX Medical - President, Cofounder, & CEO*

Deja C. Collins

Antoinette Westphal College of
Media Arts & Design
Film & Video

A Girl Like Me: The process of creating black characters in a fantasy novella

There's Katniss Everdeen, Percy Jackson and Darrow: three protagonists tasked to save their world from evil. These heroes have captured the hearts or emotions of countless readers throughout the years, including me. As a result, they have inspired my writing, however, I noticed something: there were few persons of color in my stories because they were a rarity in the books I read. In the world of speculative fiction there are few published stories being written by black authors or with a focus on black characters.

In this work, I wrote a piece of fantastical prose including strong persons of color as main characters. As this is my first extensive writing project, my experience as a writer will be documented in an autoethnography. The reflections, drafts and data included can serve to instigate a discussion on the racial/cultural limitations unconsciously placed on speculative fiction, open readers' perspectives to fantasy literature inspired by non-European cultures and also express the challenges writers can potentially encounter during the writing phases.

Faculty Mentor: **Dr. Melinda Maureen Lewis**
Center For Cultural Media

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

Ancy John

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

Analysis of Normative Pelvis Morphology Using MATLAB-assisted Point Identification and Parameter Calculation

Adolescent Idiopathic Scoliosis (AIS) is the most common type of spinal deformity that affects 4 in 100 children between ages of 10 and 18 years. Scoliosis is a three-dimensional (3D) abnormality that occurs when the spine becomes curved and rotated. Additionally, changes in pelvis geometry accompanied spinal deformity. The deformity progression is debilitating especially during the stages of rapid growth. Clinically, physicians can predict growth rate of pelvis dimensions with age. Radiographic images can be used to calculate pelvic measurements but this method is limited in accuracy. The objective of this project is to identify landmark points and quantify pelvis geometry in pediatric subjects. 3D reconstructions of pelvic Computed Tomography (CT) scans from 52 skeletally normal children ages 10 - 18 years were evaluated using a MATLAB script that automatically found 17 landmark points and 21 morphological parameters. With the data displayed as a function of age, we can determine the linear regression to show the correlation of age and pelvic parameters, which can potentially aid in the treatment of AIS-related pelvic deformity.

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

Jeffrey Hoffman, *Graduate Student*

Poster Session C

172

Victoria McDonald

College of Engineering
Mechanical Engineering
Frances Velay Fellow

Analysis of Occupant Shoulder Belt Loads in Low-Acceleration Time-Extended Swerving Events

The Centers for Disease Control and Prevention identifies car crashes as a leading cause of death. Therefore, researchers are attempting to improve restraint systems to better protect occupants and decrease mortality. Current research has assumed ideal occupant positioning, which is often inaccurate due to pre-crash maneuvers. The study team identified several maneuvers as low-acceleration time-extended (LATE) events. Evasive swerving is considered a novel LATE event that is currently understudied. This study uses a custom human volunteer oscillating sled to simulate evasive swerving, and quantify realistic pre-crash occupant kinematics. Human volunteers complete four oscillations, or cycles, with a peak lateral acceleration of 0.75 g.

In the test setup, a load cell was located on the shoulder belt of a standard 3-point restraint. The data were analyzed with a MATLAB code to determine the peak force exerted by the shoulder into and out of the belt. Peak shoulder belt loads were compared between directions and over the four cycles. Data from nine healthy male adults (age: 26.8 ± 5.2 years) during the baseline condition (standard seat, no countermeasure) are included in this study. A comprehensive qualitative video assessment, cataloguing information about the occupants' shoulder motion, was used to contextualize the torso kinematics.

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

Christine Holt, *Graduate Student*

Marina K. Lilieholm

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

Dual Mechanical Support in the Pulmonary Arteries for Children with Fontan Physiology

Thousands of babies are born annually with significant malformations to their heart chambers such that they have a single ventricle Fontan physiology. The treatment of children with dysfunctional or failing Fontan involves pharmacologic therapy, surgical reconstruction, and heart transplantation. The limited number of donor hearts and complexity of reconstruction require alternative therapies. Existing heart pumps are inadequate since these devices were designed for adults and for a biventricular circulation, not a Fontan. As a new therapeutic approach, this project considers a new configuration of dual-axial flow blood pumps located in the pulmonary arteries. We designed the pumps to have an impeller and support cage within the blood vessel. The dual pump performance was assessed using robust ANSYS turbomachinery software. Pressure and energy augmentation were determined for several operating conditions. The study revealed that the pumps demonstrated pressure and energy augmentations within and above the needed range for circulatory improvement. The current research was successful and demonstrated a compelling proof-of-concept result in the development of a dual-support system for thousands of children.

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

Samantha Cassel, *Graduate Student*

Poster Session A **174**

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

Roze Alzabey

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

Engineering Neural Synapse Using Teneurin

Neurodegenerative diseases remain a highly complex problem in which advanced genetic investigation is constantly being conducted focusing on mechanisms to promote repair. This repair process requires multiple highly refined steps in which the neurons must grow, find the correct synaptic partner and accurately perform their desired function. Our research focuses on the last step: engineering genetic tools capable of establishing specific, functional synaptic connections.

We hypothesize that Teneurins, a highly-conserved family of transmembrane synaptic adhesion molecules, can be utilized to control neuronal wiring. During development, Teneurins promote and organize synapse assembly, enable proper neuron adhesion, as well as regulate target selection between specific neurons (Mosca, 2015). We will test our hypothesis in established neural circuits of the fruit fly Drosophila melanogaster. In this project, the native expression pattern of teneurin was analyzed to further understand its role in synapse specificity and assembly. In addition, novel teneurin based genetic tools were evaluated for engineering neural synapses and generating novel connections.

Reference: Mosca, T.J. (2015). On the Teneurin track: a new synaptic or

Faculty Mentor: **Dr. Catherine von Reyn**
Biomedical Engineering

Linda Solomon, *Graduate Student*

175 **Poster Session A**

Daniel Gallagher

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

Development of the Giant Fiber's Dendrites in *Drosophila melanogaster*

The goal of our laboratory is to engineer novel neural connections in vivo. This requires identifying molecular cues used to establish synaptic connections and understanding when they must be expressed. Here, we build and evaluate tools to track and quantify the stages of synaptogenesis during development. We use a well characterized and genetically accessible escape circuit in the fly *Drosophila melanogaster* as our assay. In this circuit, the Giant Fibers (GF), descending interneurons, receive visual input from lobula columnar type 4 neurons (LC4) and output information to motor neurons.

Here, we applied our tools to characterize the anatomy of the GF throughout different stages of development. Using the GAL4/UAS system, we expressed a reporter protein, spaghetti monster GFP, in the GF. Confocal microscopy revealed the structure of the GF in the location where LC4 eventually synapses in 12-hour increments from start of pupation to 72 hours afterward. Quantification of presynaptic, chemical terminals was performed to detect when the synapses form. Our results enable further work by providing a more precise time to express synaptic adhesion molecules to create new, or modify old, connections.

Faculty Mentor: **Dr. Catherine von Reyn**
Biomedical Engineering

Brennan McFarland, *Graduate Student*

Poster Session A **176**

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

Kah Young

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

Proprioception and Visual Stimulation in *Drosophila* Escape Circuit

To select an appropriate action, an animal's nervous system must integrate multiple streams of sensory information. For example, the fruit fly *Drosophila melanogaster* selects between two distinct sequences of escape behavior – a longer stable response and an unstable but more rapid one – when faced with an approaching predator. While kinematic studies suggest that escape circuits integrate both visual cues from the predator's approach and proprioceptive cues about the fly's own body position to generate an escape, the input and effect of proprioceptive, tarsal feedback on escape response circuits has not yet been characterized. To examine this process, we compared the escape responses of tethered flies across three levels of tarsal contact, and both with and without genetic silencing of neurons within escape circuits through the expression of a rectifying potassium channel using the GAL4/UAS system. Flies were prepared and placed within the escape response assay. After acclimation, flies were shown an expanding black disk on a projection screen every 15 seconds for 20 trials. Responses were recorded by high speed video and classified manually. We found, in the presence of tarsal contact, short mode escape responses are diminished.

Faculty Mentor: **Dr. Catherine von Reyn**
Biomedical Engineering

David Goodman, *Graduate Student*

Vincent G. LoPinto

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

Incorporation of Genetic Material into Microbubbles for Targeted Delivery

Every year, 250,000 to 500,000 people worldwide suffer from a spinal cord injury (SCI). One of the major reasons spinal injury fails to repair is the development of scar tissue that blocks growth of nerve fibers. An injectable platform that will deliver a genetic signal to block production of major component of scar tissue could help enable nerve fiber growth. Small interfering RNA (siRNA) is a signal that binds to specific messenger RNA inhibiting the target protein from being translated. siRNA is very unstable in vivo, so the incorporation of siRNA into the wall of polymeric microbubbles (MB) that can provide targeted delivery was investigated. Polymeric MB are used to enhance an ultrasound signal, and shatter when subjected to ultrasound energy, which can deliver the siRNA. Short double strands of DNA, used to model siRNA, were successfully complexed with positively charged polyethyleneimine to make charged complexes for incorporation into negatively charged polymeric MB shells. Acoustic testing verified that the acoustic properties of MB were maintained after encapsulation. The efficiency of DNA loading was also investigated. Polymeric MB show promise as an injectable platform for siRNA delivery.

Faculty Mentor: **Dr. Margaret A. Wheatley**
Biomedical Engineering

Brian Oeffinger, *Graduate Student*

Poster Session A **178**

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

Raj S. Patel

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

Investigating the Potential of Microfluidics in the Applications of Microbubble Formation

Ultrasound contrast agents are used to enhance ultrasound images by increasing the impedance mismatch between tissues and consist of microbubbles which can also house drugs in their shells for targeted drug delivery. The contrast agent developed in our lab, SE61, is created by sonicating a surfactant solution composed of Span 60 and vitamin E under perfluorocarbon gas purging. However, this method cannot form bubbles with uniform diameter and drug load. Microfluidics is a field in science which deals with manipulating liquids constrained on a micron scale and patterned on a chip. Recent research shows monodispersed droplets can be formed using microfluidics. This project's aim was to investigate the potential of microfluidics to produce uniform SE61 agents. A functional chip with an asymmetric flow focusing structure was assembled in a flow regime employing two syringe pumps. The microchip produced water-oil emulsions consistently having a uniform diameter of 75 microns. Valuable insight into the parameters necessary to create SE61 by microfluidics were obtained, including the critical flow rates of the pumps and the need to break down the surfactant solution's particle size to a size small enough to be pumped through the chip.

Faculty Mentor: **Dr. Margaret A. Wheatley**
Biomedical Engineering

Brian Oeffinger, *Graduate Student*

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

Kate Medrano

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

Comparison of silicon and borosilicate glass surfaces in a DNA linearization process for optical mapping

The field of personalized medicine could help millions get the specific treatment they need, but genome-level information needs to be readily accessible. A successful method of obtaining such information is optical mapping, and it is a straightforward, low cost, and high throughput option. In optical mapping, borosilicate glass is a common substrate for the linearization of DNA, but there are downfalls to the use of this that complicate the benefits of optical mapping. In the silanization step of select optical mapping methods, glass requires extensive cleaning steps, which can be time consuming and strenuous [1]. When imaging DNA linearized on a glass surface, there will be background noise due to the autofluorescence of the substrate, which makes image analysis more difficult [2]. This study focuses on the benefits of using a silicon wafer in place of borosilicate glass, as silicon wafers are initially cleaner [1] and completely free from autofluorescence [2]. It was found that the use of silicon wafer in place of borosilicate glass reduced the need for additional pretreatment steps for silanization and decreased the background noise by half in comparison. Better DNA linearization was also achieved using the silicon surface.

References
[1] J. W. Grate et al., "Silane modification of glass and silica surfaces to obtain equally oil-wet surfaces in glass-covered silicon micromodel applications," Water Resour. Res., vol. 49, no. 8, pp. 4724–4729, 2013.
[2] M. Bras et al., "Optimisation of a silicon/silicon dioxide substrate for a fluorescence DNA microarray," Biosens. Bioelectron., vol. 20, no. 4, pp. 796–805, 2004.

Faculty Mentor: **Dr. Ming Xiao**
Biomedical Engineering

Eric LaBouff, *Graduate Student*
Dharmateja Varapula, *Graduate Student*

Poster Session C **180**

Alexandra M. Coleman

School of Education
Elementary Education: Middle Level Math and English

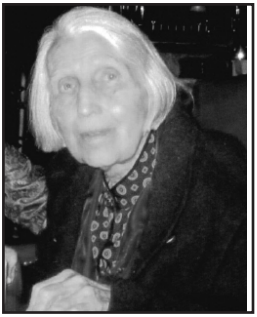
Understanding Teachers' Noticings and Connecting Them to Feedback

According to the National Council of Teachers of Mathematics, in 2012, the U.S. ranked 26th out of 34 cohorts of 15-year-olds in the Programme for International Student Assessment, and our mathematical rankings have remained mostly stagnant for decades ("Principles to Actions: Executive Summary," n.d., p. 2). With emphasis on procedural efficiency rather than conceptual understanding, students often struggle to adapt their learning for novel problems. This research provides insight into the teachersâ€™ role in fostering conceptual understanding through attention to student work and associated feedback. Teachers were surveyed about what they â€œnoticeâ€ and â€œwonderâ€ about authentic student solutions, and then what feedback they would give in response to students' work. The goal is to classify students' mathematical thinking and examine how that connects to their thinking about students' next mathematical steps (feedback). When teachers properly attend and respond to student work, they gain a better understanding of how students reason about mathematics and can better provide instruction (e.g., Linsenmeier, 2014; Shute, 2008; Taylan, 2017; Cirillo, 2013). This research contributes to the design of professional development in this area.

Faculty Mentor: **Dr. Valerie Klein**
Teaching, Learning, and Curriculum

FRANCES VELAY FELLOWS

The 2017 STAR Scholars cohort includes our second cohort of Frances Velay Fellows, thanks to the generous support of the Panaphil and Uphill Foundations. This cohort of 9 women in STEM have participated in the full STAR Scholars Experience while also having the opportunity to engage in additional programming, including a book club, digital badging, 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.

INDEX

by student last name

INDEX

by student last name

SPECIAL THANKS

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

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

We applaud and thank you.

DREXEL UNIVERSITY
Office of
Undergraduate Research
Pennoni Honors College

15 YEARS OF STAR SCHOLARS

2002 - 2017

2002

The STAR (Students Tackling Advanced Research) Scholars Program for First Year students is founded with a cohort of 31 students.

2003

2004

2005

The STAR Scholars Program becomes a part of the Drexel University Strategic Plan

2006

2007

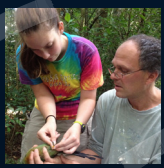
The STAR Scholars Summer Showcase is implemented to allow students the opportunity to create and present their research during an on-campus poster session.

2008

2009

The Office of Undergraduate Research is established within the Pennoni Honors College.

2010



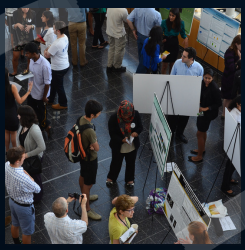
2011

STAR Scholars begin writing abstracts to be published in the STAR Scholars Summer Showcase program.

2012

2013

First STAR Scholars participate in iSTAR by conducting research in Germany, Crete, & Costa Rica.



2014

2015

OUR received grant funding to increase the # of women in STEM participating in STAR through the Frances Velay Fellowships Program

2016

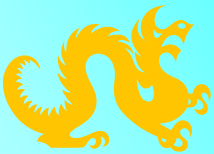
173 STAR Scholars representing 49 majors make up this year's cohort.

2017

DREXEL UNIVERSITY
Office of Undergraduate Research
Pennoni Honors College

STAR SCHOLARS

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



DREXEL UNIVERSITY
Pennoni
Honors College
Office of Undergraduate Research