2020 STAR SCHOLARS ABSTRACT BOOKLET

DREXEL UNIVERSITY
Undergraduate Research & Enrichment Programs
Pennoni Honors College

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Pennoni Honors College

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

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STAR IN THE TIME OF COVID

As a result of the COVID-19 pandemic, Drexel University pivoted to remote learning in Spring Term of the 2019-2020 academic year. At that time, more than 150 students were committed to participating in the STAR Scholars Program, with the expectation that this would involve living on campus and working side-by-side with faculty mentors and with their peers. In response to the pandemic, and in an effort to preserve the opportunity for our early undergraduate students to conduct research while still prioritizing their health and safety, we offered our students a contingency plan for the STAR Scholars Program.

Students enrolled in the program were able to choose one of two options: 1) participate in a remote research or creative experience with a faculty mentor of their choosing during the summer after their freshman year or 2) defer their participation to work part-time over two terms in the following academic year, with the hope of engaging in in-person research at that time.

Nearly 100 of our STAR Scholars elected to participate in remote research over the summer term, while the remaining 50 students delayed their participation in the program until the Fall/Winter or Spring/Summer terms of the 2020-21 academic year. Students who completed remote projects in Summer 2020 presented their work at our first-ever Virtual STAR Scholars Summer Showcase. Students who complete their STAR experience over Fall/Winter will present their work at a mini-Showcase at the end of Winter Term, while students who participate in Spring/Summer will join our 2021 STAR Scholars in presenting their work at the 2021 STAR Scholars Summer Showcase. All 2020 STAR Scholars - whether participating in Summer 2020, Fall/Winter, or Spring/Summer - will have their abstracts published in this booklet.

A MESSAGE FROM THE DEAN

The 2020 summer STAR Scholars have navigated a challenging year with stellar results. We in the Pennoni Honors College are enormously proud of them. We look forward to seeing many go on to engage in further research and mentor future STAR Scholars.

Paula Marantz Cohen, PhD

Dean, Pennoni Honors College

A MESSAGE FROM THE DIRECTOR

For nearly twenty years, the STAR Scholars Program has enabled a cohort of highly motivated first-year students to conduct faculty-mentored research, scholarship, or creative work during the summer after their freshman year, culminating in the annual STAR Scholars Summer Showcase. Almost 2,000 Drexel students have participated in STAR over the past two decades, and the Summer Showcase has been a signature event of this program for almost 15 of those years.

This year, of course, has been different. With the COVID-19 pandemic, the STAR Scholars Program was required to pivot, but our students still participated in knowledge creation in their field. While much of the program has looked very different this year, many things about the STAR Scholars Program have stayed the same - including the scope of our students' projects, the caliber of their work, and the commitment of our faculty. Without our faculty agreeing to mentor STAR Scholars every year, this program would simply not be possible. STAR Mentors routinely go above and beyond in their work with our students to challenge them, to engage them in deep and immersive learning, and to guide them in their intellectual, personal, and professional development, and that is more true this year than ever before. Faculty mentors, we are so grateful to you and for you.

We are incredibly proud of our 2020 STAR Scholars who participated in a remote capacity this year. This cohort of students has been so adaptive and resilient in the face of our current challenges, and have done absolutely the most with the circumstances they've been handed. We also look forward to continuing to celebrate this cohort of students, as the remainder of our STAR Scholars complete and present their work throughout the rest of the academic year. Congratulations to all of our 2020 STAR Scholars!

Jaya Mohan, MA

Director, Undergraduate Research & Enrichment Programs

OUTSTANDING MENTOR OF THE YEAR

The critical piece of the STAR Scholars Program that makes it such a valuable experience for the students is, without a doubt, their Mentors. The STAR Mentors give much to their students' summer experiences and do so with no compensation.

In Summer 2011, we created a process to recognize the STAR Mentors and to particularly celebrate the Outstanding Mentor of the Year. STAR Scholars are given the opportunity to nominate their faculty mentors or graduate student mentors for the "Outstanding Mentor of the Year" award, which provides the awardee with a $1,000 award to futher his or her research with undergraduate students.

Each nominated mentor receives a letter signed by the Provost that outlines the common characteristics held by all nominated Mentors, and each letter includes excerpts from the students' nomination letters to provide an individualized account of just how these Mentors have contributed to those specific students' experiences.

Based on these nominations, outstanding Mentors:

- Are passionate experts in their field who freely share their expertise with students
- Care deeply about their students and treat them with respect
- Generously foster students' intellectual and professional development
- Actively engage students in learning and celebrate their success
- Go above and beyond in supporting their students

All of our mentors go beyond the call in their work with STAR Scholars, and we are genuinely grateful for the time and effort they commit to furthering the education of undergraduate students.

2019 STAR SCHOLARS
OUTSTANDING MENTOR OF THE YEAR

We are pleased to honor Dr. Hugo Woerdeman (COAS) and Dr. David Becher (LeBow) as our 2019 Outstanding Mentors of the Year. Thank you, mentors!

Dr. Hugo Woerdeman

Hugo Woerdeman is a Professor of Mathematics in the College of Arts & Sciences. Dr. Woerdeman received his PhD from the Vrije Universiteit in Amsterdam, The Netherlands in 1989. In that same year he was appointed assistant professor at the College of William and Mary. During his tenure there he received a 1995 Alumni Fellowship Award for "Excellence in Teaching," and he was awarded the title of Margaret L. Hamilton Professor of Mathematics. In December 2004, he joined Drexel University as Professor and Department Head. Dr. Woerdeman, thank you for your contribution to our program and to our students' learning.

"Dr. Woerdeman has taken the time to explain fascinating math topics tangentially related to my primary problem so that I have a greater context in which to explore it. One of these tangents may actually hold the key to solving the problem, but his main goal is for me to learn and explore—and to know and enjoy the intricate connections between branches of math like he does. We may find the solution—as currently seems likely—or the problem may not even have one, but either way I will have learned and grown, and we will have explored and connected paths that lead to future discoveries and solutions. In sum, I could not have asked for a better mentor." - Micah Quillen, Engineering

2019 STAR SCHOLARS
OUTSTANDING MENTOR OF THE YEAR

Dr. David Becher

David Becher is the Dean's Industry Fellow, Professor of Finance, faculty for Corporate and Executive Education, and Fellow for the Raj & Kamla Gupta Governance Institute at Drexel's LeBow College of Business. He has been a Fellow at the Wharton Financial Institution Center at the University of Pennsylvania since 2006 and was formerly the David Cohen Research Scholar (2016-2019) and Distinguished Fellow in the Center for Research Excellence (2009-2012) at LeBow. Dr. Becher's specializations include mergers, governance, and banking. He earned a B.A. in Economics and International Relations at the College of William and Mary, specialized in International Economics at the University de Montpellier, France, and obtained his Ph.D. concentrating in Finance at the Pennsylvania State University. Prior to Drexel, he worked for PNC Bank and the Office of the Comptroller of the Currency. Dr. Becher, thank you for your contribution to our program and to our students' learning.

"He is quick to discern problems we have during our meetings and provides strong recommendations and information to direct us in the right direction. Instead of directly telling us what should be done, he always gives us the power to solve problems on our own with him to support us whenever we need him." - Kevin Gao, Finance

"Many times, this solution is worked out together with us students and he always ask us for input and includes us in decisions which really makes us involved in the project and making us feel truly valued. He trusts us and allow us to take parts of our research our own direction, but he is always ready to help us if something comes up." - Filip Krueger, Business & Engineering

REMOTE SUMMER 2020 ABSTRACTS

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

ANNA LOUISA WENTZ

Antoinette Westphal College of
Media Arts and Design
Product Design, Art History

Faculty Mentor: **DR. JOSEPH GREGORY**
Art & Art History

CHANGING THE NARRATIVE: CAMILLE CLAUDEL AND AUGUSTE RODIN

When we force historical figures to fit within modern narratives, they are done a disservice. Gender relations are socially constructed but individuals experience these power dynamics in diverse ways. Sculptor Camille Claudel has been portrayed as simply a martyr to patriarchal oppression as represented in the figure of Auguste Rodin, but this reductive view simplifies her historical identity. The historical records of their lives and careers reveal a complex relationship with gendered systems of identity as exemplified in their art. Thus, a more nuanced portrait of Claudel's psychology and behavior emerges that provides the historian with the basis for a fuller and more accurate appreciation of her life and work.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

KIRSTIN NEWELL

Bennett S. LeBow College of Business
Business Analytics, Marketing

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

NEXT IN RETAIL

Any sense of normalcy anticipated for the year 2020 has been disrupted by the COVID-19 pandemic. The United States in particular, has faced an abrupt reestablishment in lifestyle, ethical priorities, and consumerism. A new wave of highly introspective individuals are using their voices, votes, and dollars, to support businesses and organizations that uphold their morals and essential needs. So, where does this leave the arguably elastic industries such as fashion? Preceding the pandemic, fashion retail was grappling with a dramatic transition from bricks and mortar retail to e-commerce. Catering to the e-commerce audience has forced retailers to reevaluate their business models and sacrifice the traditional in-store retail experience for financial stability. Today, mass store closures in response to the pandemic have expedited this very dilemma. This study aims to gain an improved understanding of how post-pandemic apparel retail can thrive through optimal marketing, internal and external brand integrity, and the promotion of inclusivity. Companies such as Urban Outfitters and Aritzia will be examined for their exemplary performance throughout the year and used to further investigate consumer habits strategy during 2020.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

SARAH L. ROACH

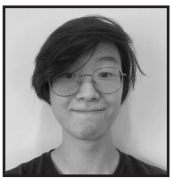
Pennoni Honors College
Custom-Designed Major

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

WORLD CONSISTENCY THROUGH SEQUELS

For the 2020 STAR Scholars Program, I worked under Dr. Frank J. Lee at the Entrepreneurial Game Studio. While I worked on several projects, my main task was a narrative analysis of Ni no Kuni II: Revenant Kingdom for the GDC Game Narrative Summit. I examined the consistency of locations and maps between the game and its prequel, Ni no Kuni: Wrath of the White Witch. I found that various world traits seemed inconsistent. This included divine-right forms of government, missing key species, and a general lack of mention of the previous game's events. I concluded that the narrative continuity was held together by only a single character: the Conductor. However, even this character's origin and general nature were different between the two games. Due to his late introduction in the game, the character held little influence for most players of the game.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN



JONATHAN LIM

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

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

DIGITALLY RECREATING PEALE'S MINERALS

The long term goal of this project is to virtually reconstruct an historically accurate model of Charles Willson Peale's Philadelphia Museum housed in Independence Hall in the early 1800s. The Museum featured exhibits in natural history, art, science and technology. The virtual reconstruction will provide an augmented reality tour of the lost space. Previous STAR scholars have researched and worked on this project over the years and I decided to research and model digital insects and minerals to contribute. I read through Peale's biographies, books that were written at the time that referenced items within the museum, and online historical sites to generate a list of minerals and insects that Peale exhibited in his museum. After multiple attempts using several Autodesk programs to create realistic minerals, I was able to sculpt a black silver ore specimen in Mudbox and texture it using Maya.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

PARIS LUCKOWSKI

College of Engineering
Mechanical Engineering

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

Co-Mentor: Richard Vallett

LEARNING MODULES FOR CAPACITIVE TOUCH SENSING FABRICS

Functional fabrics is a transdisciplinary field which utilizes the knowledge of many backgrounds towards creating fabric-based devices. The Center for Functional Fabrics (CFF) has created a textile capacitive touch sensor (CTS) that measures input along a knitted circuit. The underlying sensing principles of the CTS are nuanced and require an understanding of electronics which informs the physical design of the knitted sensing circuit. Teaching tools are necessary to educate staff and collaborators unfamiliar with electronics in order to design fabric circuits capable of measuring touch. The goal of this STAR project is to leverage accessible, visual, and interactive presentation tools to teach core concepts in electronics and signal measurement. This work uses Jupyter Notebook as a platform to convey lessons presented using both static text and diagrams and interactive plots and user controls. This project produced learning modules which cover relevant topics in electrical components, wave-form measurement and filtering, and complex electrical networks to provide a basic understanding of the sensor's working principles.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

ALINA N. WOLFENSON

Antoinette Westphal College of
Media Arts and Design
Fashion Design

Faculty Mentor: **PROF. ELIZABETH QUINN**
Fashion Design

SUSTAINABLE FASHION PRODUCTION

The Fashion Industry is one of the largest contributors to climate change, and without refining its individual practices we cannot reverse any of our damage. In order to fix this problem we have to rework the way that fashion is produced and consumed. The goal of my project is to illustrate that it is possible and sustainable to make the fashion industry more eco-friendly. My research involves creating a line of clothing from recycled fabric and using eco-friendly sewing and production methods. I created eleven total pieces of clothing that can be mixed and matched, are made to last, and some can even be worn in multiple different ways. All of the garments are designed to reduce waste by using recycled materials and being versatile to encourage proper wear. The results of my line prove that not only is it necessary to produce eco-friendly clothing, but it is also realistic for the industry today and where it needs to be in the future.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

JAMES BERNER

Antoinette Westphal College of
Media Arts and Design
Screenwriting & Playwriting

Faculty Mentor: **PROF. MATTHEW KAUFHOLD**
Film & Television

MARIA AND THE DREAMWALKERS

Maria and the Dreamwalkers is a two-part teleplay pilot designed to appeal to children and adults alike. The series follows the adventures 15-year-old Maria Maxwell and her friends as they defend the town of Fogvale from monsters called nightmares which are created by humanity's darkest emotions. As the series progresses it seeks to explore themes of mental health, compassion and the necessity of human beings relying on each other. The show plays like a "monster of the week" show with the premise allowing for episodic conflicts that center around isolated incidents as well as for season-long and series-long conflicts that blend plot and character. Each character from the central cast to the side characters can have their arcs personified in their conflicts with nightmares. The show takes aesthetic inspiration from shows like Soul Eater and narrative influences from shows like Code Lyoko. At its core Maria and the Dreamwalkers is about fighting your inner demons the only way you can, with the help of those who love you.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

ANNA J. EASTERDAY

Antoinette Westphal College of
Media Arts and Design
Game Design & Playwriting

Faculty Mentor: **DR. FRANK J. LEE**
Game Design & Production

THE THRESHOLD OF BEAUTY: AN ANALYSIS OF NAISSANCE

The purpose of this research was to critically deconstruct and analyze NaissanceE [nay-sahns], an exploration puzzle/platformer game released in 2014 by Limasse Five. The goal was to examine the various elements of NaissanceE in light of the sense of isolation brought on by COVID-19. The analysis examines the game within the context of various psychological design techniques to better understand how NaissanceE created a narrative without dialog. The research uncovered three core thesis that led to the culmination of a final paper, which is still in progress. These are (1) NaissanceE's use of liminal spaces to tell a cohesive and thought provoking story about the beauty that can be found when confronting our individual isolation, (2) creating atypical experiences within a heavily saturated industry, and (3) the potential connection between actions and its effect on the understanding of a narrative, immersion retention, and empathy. I plan to continue this work beyond the STAR experience, and hope the resulting product will promote more psychological study within the game industry from an artistic and academic perspective.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

BHAVNA GANESAN

Antoinette Westphal College of
Media Arts and Design
Graphic Design

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

THE ART OF FEAR: AN EXPLORATION OF POLISH POSTERS AND AMERICAN HORROR AND THRILLER FILMS

For the STAR Summer session, I created a virtual gallery containing Polish posters for American horror and thriller films to explore the relationship between imagery and the effect it has on the viewer. This exhibit focused on the imagery and visual symbols utilized in horror and thriller films, as well as how deliberate artistic choices impact the overall appearance of the poster. Currently housed in Westphal's URBN Center, the Frank Fox and Kenneth F. Lewalski Polish poster collections totals at over 2,600 posters, representing one of the largest collections of Soviet era posters in an institution in the United States. The immense creativity displayed by the Polish School of Poster Design has had a lasting and significant impact on Graphic Design in the modern era, and the allusions and metaphors in many of the posters created for film, theatre, opera, the circus, and music are known to have made implicit statements on life under a totalitarian regime. Creating a virtual exhibit for a particular genre of the Polish poster collection allows for a better understanding of the Graphic Design discipline, especially in regards to the historical context of popular metaphors and visual tactics used in communicating ideas and messages.

Summer 2020

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

FIONA TRAN

Antoinette Westphal College of
Media Arts and Design
Graphic Design

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

DESIGNING A CURATED VIRTUAL ART EXHIBITION BASED ON THE TWENTIETH CENTURY POLISH POSTERS

Due to the COVID-19 pandemic, those who would visit art museums cannot explore and learn about the various works of art. Since technology has advanced over the years, people can access anything by a digital device. With that said, art museums created virtual exhibitions for their visitors to prevent the spread of the virus. Although the experience is not the same as if it were in person, virtual exhibitions still contain valuable information about art. It is important to tackle these issues not only because of the global outbreak that limited these visits but also to preserve the rich history of art in these collections. Being that the STAR Scholars Project for Graphic Design centers on Drexel's large collection of Frank Fox and Kenneth F. Lewalski Polish posters, I have researched and curated a virtual exhibition found under the extension of the Polish Poster tab of the Graphic Design website at Drexel University. Through extensive research and detailed analysis, this exhibition focuses on the history of Polish posters, symbolism, and several well-known Polish Poster artists and their portrayals of mask imagery during the twentieth century.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

MAX FARRELL

Antoinette Westphal College of
Media Arts and Design
Music Industry

Faculty Mentor: **PROF. TOBY SEAY**
Music Industry

INVESTIGATING MUSIC STREAMING SERVICE RECOMMENDATIONS: THE FREQUENCY OF RECOMMENDATIONS TO ARTISTS OF DIFFERENT RACES AND GENDERS

Metadata is the glue that holds the streaming music industry together by "tagging" songs with words and data about music style. An important use of metadata is recommendation algorithms that analyze tags in the metadata of a user's playlists or streamed music to recommend other songs the user might like or create playlists for similar users. In this project, I use an experiment to investigate patterns in music recommendations produced by algorithms. Specifically, do the algorithms tend to suggest songs by artists of particular races or genders even though a user's playlist is evenly split across artist race or gender? To design the experiment, I learned technical aspects of metadata and algorithms, conducted a literature review on the use of algorithms across industries, and interviewed an industry professional. My analysis suggests that one streaming service's recommendation algorithm does not seem to take into account artist race or gender. Thus, demographic information may be absent in the metadata itself, or if it does exist it may not be used by recommendation algorithms.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

CATHERINE STAGLIANO

Antoinette Westphal College of
Media Arts and Design
Music Industry

Faculty Mentor: **PROF. ROBERT WEITZNER**
Music Industry

STRONGER IN HARMONY

Record Union, 73% of musicians struggle with depression, anxiety and stress. Stronger in Harmony is an initiative aimed to reduce the onset of mental health disorders within the entertainment industry. This program, aimed at university students, will bring together those who understand the issues plaguing the business and educate its members through panel discussions, support groups and finding ways to raise money for those who need additional assistance. No other nonprofit aims to engage college students from the start, especially in the entertainment industry. Some ways to raise money include putting together concerts, creating products to sell to the public and developing exhibits to show works of art or film. Ultimately, the goal is to bring this organization to cities all across America. In the first year, the hope is to hold an event each quarter and by the fifth year, one each month. Together, we will save creative minds.

Mission statement: Educate the younger generation about the mental health crisis in the entertainment industry by increasing awareness and helping those who may already be struggling.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

JACKSON PEDEN

Antoinette Westphal College of
Media Arts and Design
Product Design

Faculty Mentor: **PROF. RAJA SCHAAR**
Product Design

"GARBAGE GORGE" AN ENVIRONMENTAL EDUCATION MOBILE GAME

Current Environmental Education Programs use a one-size-fits-all approach where all students learn about the same, foreign topics, which alienates students from environmental problems that they could have an actual impact on. In order to create a more effective and impactful program I have devised an educational mobile game that focuses on teaching users about their local environments and the main causes of pollution in their area. I focused on the Portland Oregon area, as that is where I'm from, which largely suffers from water pollution caused by litter and dumping. I chose the game format because games can reach a wide audience and create emotional connections to the content.The mobile game relies on recognizable Portland landscapes and local wildlife as playable characters to establish the appropriate lens on the environment. The game is designed to be explorative and promote the users curiosity to develop a personal connection with their environment in an open world setting.The goal of the game is to teach users the impact of pollution on their environment and incentivise them to take real world actions for in-game benefits such as unlocking new characters or gaining access to new areas in the game.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

BRIANNA ROSE SWALLOW

Antoinette Westphal College of
Media Arts and Design
Product Design

Faculty Mentor: **PROFESSOR RAJA SCHAAR**
Product Design

BUZZING MINDS

Buzzing Minds is a program for design learning, something people of all different careers have expressed that they wish they learned in school. Design thinking focuses on problem solving methods that go through the process of organizing ideas, prototyping, and defining the specific problem in a user-centric way. Rather than thinking through ideas and determining if they're good immediately, designers use all their ideas and refine them through the user's needs and limitations to create something new. This connection of ideas is what makes people creative, no matter what the output is. Through Buzzing Minds, students will learn how to be creative, and that finding a career in design is just as worthwhile as a career in science, technology, engineering, or math.

MELANIE KAMINSKY

Bennett S. LeBow College of Business
Finance

Faculty Mentor: **PROF. JONATHAN LISS**
Accounting

THE IMPACT OF ECOMMERCE ON STATE AND LOCAL TAX POLICY IN THE UNITED STATES

The U.S. Supreme Court Case South Dakota v. Wayfair (2018) overturned the longstanding requirement that a physical presence was required for sales tax collection and established an economic nexus standard. Prior to Wayfair, many republican policymakers led the charge for the Internet Tax Freedom Act (ITFA) which established a moratorium on the authority of states and political subdivisions to impose taxes on access to the Internet or discriminatory taxes on eCommerce. Due to the growth of eCommerce, Republicans had also pushed for simplification of sales tax regimes. This research studied the impact of eCommerce on six states with different political dynamics - Wyoming: Solid Republican State, Tennessee: Strong Republican State, Texas: Slight Republican State, Pennsylvania: Slight Democratic State, Washington: Strong Democratic State, California: Solid Democratic State. In conclusion, while a state's political leaning generally influences eCommerce taxation policies, many other factors play a role, including the size and density of the state, history of political representation, and existing legislature. Ultimately, state tax policy is not always driven by political affiliation.

BENNETT S. LEBOW COLLEGE OF BUSINESS

SHIVANI ACHARYA

Bennett S. LeBow College of Business
Business - Undeclared

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

Co-Mentor: Irina-Marcela Nedelcu

UNDERSTANDING STUDENT SENTIMENT: DEFUNDING POLICE ON UNIVERSITY CAMPUSES?

With the recent catalyzation of the "defund the police" movement, the demands to defund police departments in the U.S. have increased tremendously. Many students have also called for their universities to defund campus police and/or cut ties with their local police departments. But, how do university students, at large, feel about this? This project aimed to understand student sentiment towards the defunding of police using text analytics. A questionnaire was developed to gather information on the following: Student's race, perception of local and campus police (determined by student's past experiences and perceived impact of police on others), sense of safety in relation to the presence of police on campus, view on police budget, and opinion regarding the defunding of police on campuses. 151 responses were received from students at over 30 different universities. Throughout the weeks, text analytics and the programming language R was studied. A Lexicon-based sentiment analysis was then conducted on the data using R. The analysis revealed that although there was a shared perception of possible issues with the impact of police, there was not a conclusive enough sentiment to defund police on university campuses.

ADEOLA AWOTUNDE

Bennett S. LeBow College of Business
Accounting, Finance

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

IS DIVERSITY A DISADVANTAGE?

Considering the recent social and economic unrest around gender and racial biases, we investigate diversity in companies. Diversity can improve a company's boards' performance through increasing the range of perspectives embodied on the board. With diversity, a company can maintain its competitiveness within the market by creating opportunities to hire more diverse board members, such as directors that are foreign, female and people of color. To understand whether diversity is valued, we investigate how companies compensate diverse directors in comparison to all others.

Generally, we find that the value of diversity within a company is significant; on average, foreign directors receive higher average total compensation than domestic directors at the same firm. We also find that minority and female directors receive higher compensation in comparison to other directors. In addition, more women sit on outside public boards and more minorities are represented as well. Overall, our results suggest that firms value diversity, as it improves their image regarding their 'acceptance of all' and companies are willing to compensate more for directors with varied perspectives and different backgrounds.

DANNY KELLY

Bennett S. LeBow College of Business
Economics

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

DIRECTOR AND EXECUTIVE COMPENSATION IN HEALTHCARE FIRMS

Many health companies are racing to create a COVID-19 vaccine. The Leaders (boards of directors and CEOs) of these companies play a vital role in strategy, direction, and risk aversion. Most focus has centered on the largest publicly traded companies, with much less attention on the smaller healthcare companies outside of the S&P 1500 index. As a result, we know less about monitoring at the small firms. Our key research question is to understand if the way that these leaders are paid impact the firms.

Using a machine learning program, we collect compensation data on hundreds of thousands of firm leaders and analyze the correlation between compensation and performance. Overall, we find that if a health firm is performing poorly, it is more likely to pay its directors in incentives to motivate future performance. How these incentives are provided, however, makes a big difference. In general, option payments do not lead to better performance, while stock compensation is associated with better future performance, but only for the largest health care firms. Our results suggest that compensation data and performance are linked. These results will be significant to analyze how healthcare firms will perform during this pandemic.

BENNETT S. LEBOW COLLEGE OF BUSINESS

STEVEN ZHAO

Bennett S. LeBow College of Business
Economics

Faculty Mentor: **DR. JIE CAI**
Finance

THE IMPACT OF INTERNET ACCESS ON INDIVIDUALS FINANCIAL DECISIONS

The ever-increasing network of information that is available to individuals through the internet can provide the opportunity for people to make informed financial decisions. It is important to identify the influence that internet access can have on the financial decisions of an individual and highlight the importance of network expansion. This project utilized the data from the U.S. census. Specifically, we highlighted the variables of population, age over 65, female, male, employment, poverty, median age, and median age. To get a finer level of granularity, we collected data specifically at the tract level down to the block level. We worked with the sources that census offered such as their website, FTP server data, and census API. We used all three to source the data for this project. Working within excel, we were able to manipulate the data into a meaningful and easy to interpret format. Using SAS we developed a program that would assist in reading all the data that was collected. Some technical issues and time limitations prevented more detailed tests using other internet databases. However, with the tests that did get completed we found results that link the increased access of internet with other socioeconomic factors.

BENNETT S. LEBOW COLLEGE OF BUSINESS

BRIANNA MORRISON

Bennett S. LeBow College of Business
Finance

Faculty Mentor: **DR. EDWARD NELLING**
Finance

INVESTING IN SOCIALLY RESPONSIBLE MUTUAL FUNDS

In recent years, public companies have faced greater pressure to reduce their carbon footprint and consider the welfare of their employees, the environment, and the needs of the local community in their business practices. There is also increased interest by investors in "socially responsible" mutual funds. These funds are also known as ESG (environment, social, and governance) funds.

When evaluating ESG funds, it is important to understand their performance and risk characteristics. /// This project examined monthly returns on ESG mutual funds over eight years (2010-2018). Their performance was measured using a regression analysis of the Fama-French three-factor model and the Capital Asset Pricing Model (a one-factor model). The results from both models indicate that ESG funds do not exhibit positive risk-adjusted performance; in a three-factor model, their performance is negative. ESG funds are as risky as the broader stock market, and their returns are similar to those of mid-cap stocks that are balanced between growth and value.

BENNETT S. LEBOW COLLEGE OF BUSINESS

SHYAM ATTUR

Bennett S. LeBow College of Business
Finance

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

PRIVATE EQUITY AND VENTURE CAPITAL: INVESTMENT ANALYSIS 2010–2020

Private equity funds provide financing to developing firms in the private sector. Our objective is to understand the relationship between the funds provided by private equity companies to the investment industry while factoring risk. We believe that all things equal, riskier industries require more capital as riskier investments yield greater returns. After the 2001 Dotcom crash and the 2008 financial crisis, investors have been wary of the technology and real estate industries. The post-2008 financial regulation led to the emergence of more diversified portfolios of PE funds, offering better long-term returns and complementing the long timespan of PE funds (8-10 years). Concurrently, post-2001, Venture Capital has been underperforming, while Buyout funds have been producing above-average returns as to public markets. This performance variance prompted PE investors to change their industry asset allocations, hence we studied those trends. All project data came from Preqin, an online database. Various PE fund types and their deals from the past decade were analyzed. Conclusively, IT is the most popular industry across all fund types, with real estate as the opposite. IT is high-risk, high-reward and duly has the greatest funding.

SANJIT SHELUKAR

Bennett S. LeBow College of Business
Marketing

Faculty Mentor: **DR. MICHAEL HOWLEY**
Marketing

Co-Mentor: Xin Huo

HEALTHCARE CONSUMPTION DYNAMICS IN AMERICA

In this project I explored consumption dynamics of healthcare in America. To do this, I examined the Medical Expenditures Panel Survey (MEPS). Analysis of existing research on healthcare distribution in America showed inconsistencies in how healthcare was distributed among patients of five different quintiles of incomes. 30% of healthcare consumption went to the first quintile, or the lowest income. I examined the specific relationship between healthcare charges and ER visits in thirteen age categories.

There was a correlation found between the amount of healthcare charges and number of ER visits. The pattern found was that patients aged 0-2 and 51-70 had the greatest number of healthcare charges and ER visits. Patients aged in the teenage or young adult categories had the lowest healthcare charges and ER visits. Those age categories had a similar value for the two variables. Another relationship that was researched was how six different income groups varied in their healthcare charges and BMI. The BMI among the different income groups was not significantly different, except for the BMI of the $0 income group. The overall results show that people of different demographics have different healthcare spending habits.

JORDAN GALLAGHER

Bennett S. LeBow College of Business
Finance, Business Analytics

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

THE ART OF ATTRACTING DONORS: HOW EFFECTIVE ARE CHOP'S DONOR RECOGNITION PROGRAM BENEFITS?

The Children's Hospital of Philadelphia (CHOP), one of the nation's best children's hospitals, is running an ongoing campaign titled For Tomorrow's Breakthroughs, with a goal of raising $1 billion within three years to fund pediatric research. To incentivize and maintain donors, the campaign employs a donor recognition program, which offers both in-person and remote benefits. Our research examines the effectiveness of these two types of benefits in donor retention and donation likelihood/amount and the underlying cause. Through conducting a survey, we gathered both quantitative and qualitative data on the opinions and attitudes in regard to the program benefits from existing and potential donors. Our results found that in-person benefits are more preferred over remote benefits due to reasoning of being "more personal." In-person benefits were more strongly agreed to build personal relationships between the donor and CHOP versus remote benefits. We also found that donor commitment level was highly scaled when under the premise that an organization-donor relationship has been built. Our results found that in-person benefits have a greater impact on the likelihood to donate to CHOP and the commitment to be a continuous donor to CHOP.

REA K. CHRONEOS

College of Arts & Sciences
Science - Undeclared

Faculty Mentor: **DR. DENISE GARCIA**
Biology

Co-Mentor: Anh Duc Le

DIFFERENTIAL ASTROCYTE COVERAGE OF SYNAPSES

Astrocytes, a type of glial cell, are not very well understood although their interaction with neurons is essential in order to fully study the nervous system. They play an important role in ionic and neurotransmitter homeostasis and perform behavioral modulation. We decided to study astrocytes in the *Drosophila melanogaster* visual circuit which involves visual input neurons synapsing onto descending neurons. These circuits function to execute a take-off behavior in response to a looming stimulus. Using the FlyWire database, we identified neurons in the visual circuit and classified astrocytic contacts in the vicinity of each synapse. Based on our results, we confirmed that there are anatomical tripartite synapses in the *Drosophila* system. Our data suggests that cleft coverage is independent of neuron pair strength and activity level. We also found that there is differential cleft astrocyte coverage between visual input neurons. This heterogeneous astrocytic coverage coincides with how different visual input neurons synapse at different regions of the integrator neuron, suggesting that individual escape pathway behaviors may require contrasting astrocytic coverage.

ELAINE ROSE FICARRA

College of Arts & Sciences
Biological Sciences

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

Co-Mentor: Dana Venditti Mitchell

UNCOVERING SIV PATHOGEN RESISTANCE IN WILD CAMEROON CHIMPANZEES

Simian Immunodeficiency Virus (SIV) found in chimpanzees is the precursor to Human Immunodeficiency Virus (HIV). The SIV pathogen resistance theory explores immunity to SIV, a possible contributing process to the genetic diversification of the *P. t. ellioti* and *P. t. troglodytes* chimpanzee subspecies separated by the Sanaga river in Cameroon. To test this theory, I investigated a list of genes related to outlier single nucleotide polymorphisms (SNPs), which are significant genetic variations among the two subspecies. I searched NCBI and Kegg databases for the functions and roles of the genes in their biological pathways. After I identified the genes related to immune response, I assessed whether the SNPs associated have varying frequencies between the populations. I analyzed the relationship using a linear regression model. IL16 displayed a strong correlation between SNP frequency and temperature seasonality and NCAM1 displayed the same with latitude. These results support the theory that *P. t. ellioti* may be resistant to SIV. Understanding chimpanzee resistance to SIV infection is vital to determining conservation priorities for SIV-immune populations. These findings can even help to develop treatments for HIV in humans.

ADAM CLARK HORNBAKER

College of Arts & Sciences
Biological Sciences

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

Co-Mentor: Dana Venditti Mitchell

INVESTIGATING HOW THE DIET OF WILD CAMEROON CHIMPANZEES PROMOTES NATURAL SELECTION AND DIVERSIFICATION

There are three genetically distinct populations of chimpanzees in Cameroon. The theory of natural selection could help explain their diversification and more specifically, why *P. t. ellioti* chimpanzees living in the ecotone habitat sometimes have a higher volume of animal parts in their diet. I examined a set of single nucleotide polymorphisms (SNPs) sequenced from chimpanzee DNA to test the hypothesis that natural selection is acting on regions of the chimp genome connected to diet. To investigate this relationship, I performed a spatial analysis to view the separation of SNP frequencies across Cameroon. An SNP near the gene ACAT2, which functions in lipid metabolism, showed differentiation that I then further investigated using a linear regression model. This SNP was significantly correlated to temperature seasonality (p=0.0009, R^2=0.56). These findings provide evidence that differentiation of the ACAT2 gene among populations may contribute to natural selection by allowing the propagation of behavior associated with consumption of lipid-rich animal products in ecotone individuals. Understanding the connection chimpanzee behavior has with genetics and their environment can aid conservation and identifying critical habitats.

FRANCIS JUSTINE L. VIRTUCIO

College of Arts & Sciences
Biological Sciences

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

Co-Mentor: Emily Sterner

UNCOVERING THE EPIGENETIC RELATIONSHIP BETWEEN KISMET AND HDACS IN AXON PRUNING

Axon pruning (AP) is a crucial process in neurodevelopment whose defects are associated with numerous developmental disorders. AP is initiated by the steroid hormone ecdysone binding to the ecdysone receptor (EcR) within the neuron. The chromatin reader Kismet (Kis) drives AP in Drosophila by regulating acetylation marks in EcR transcription. A loss of Kis results in decreased EcR transcription and thus AP defects, but can be rescued through inhibition of a group of chromatin erasers called histone deacetylases (HDACs). This study sought to identify the specific HDAC (or HDACs) that are responsible for rescuing defective AP with decreased Kis. To accomplish this work, I used the Gal4-UAS system to induce Kismet RNAi or HDAC1 RNAi. Flies of these phenotypes were crossed and the offspring brains dissected for image analysis, wherein the axon surface areas were measured to determine any effects of HDAC loss on axon pruning. RT-qPCR was used to quantify EcR mRNA levels. Our data trends suggested loss of HDAC1 is associated with AP defects analogous to that in loss of Kis function. This provides a better understanding of epigenetic interactions in neurodevelopment and a potential drug target if this interaction is conserved in mammals.

BRITTANY E. HOOD

College of Arts & Sciences
Biological Sciences

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

Co-Mentor: Pragati Chengappa, Donna McKeon

EPITHELIAL CELL MIGRATION

Epithelial cells that line our body and organs are held together in monolayer sheets via junctional E-cadherin proteins. Stationary epithelial cells can undergo a process called the Epithelial to Mesenchymal Transition (EMT), wherein they become single, migratory cells. EMT allows for the facilitation of processes such as wound healing and development. During this process, junctional E-cadherins that hold epithelial cells together are down-regulated into lysosomes for degradation. While regulation of intracellular pressure is known to govern cell migration, it is not yet clear how intracellular pressure contributes to the degradation of E-cadherins during EMT. This project investigated whether the changes in intracellular pressure cause EMT within epithelial cells, thus affecting E-cadherin localization. It was hypothesized that osmotic pressure controls E-cadherin localization. This hypothesis was tested by treating epithelial cells with different osmotic conditions and measuring the intensity of the E-cadherin proteins in the cytoplasm and plasma membrane to be determine whether junctional E-cadherin is being internalized. It was found that there is some correlation between osmotic pressure and E-cadherin localization.

KEVIN CISNEROS VELASQUEZ

College of Engineering
Mechanical Engineering

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

THE SHOCKING FUTURE OF METAL–ORGANIC FRAMEWORKS

The recent discovery of Metal-Organic Framework, MOF, has brought up a lot of questions. Normally Metal-Organic Frameworks, are defined by their three-dimensional framework and the physical properties they have. Now, we are pushing their chemical properties to their full extent to see what they are capable of. Normally they are insulators and don't have many electrical applications. However, lately there have been new MOFs that have been used as conductors, in photovoltaic solar cells and many other electrical applications. The data that was gathered suggest that the untapped potential of MOF's is deep. There are families of MOFs that have been found that may be suitable replacements for current materials. The high yield and low cost of MOF synthesis are valuable enough in some instances to replace the industry standard. Such as MOF electrodes in solar cells. Now that we are finding out more about MOFs, who know what applications await.

BEN MATTHEWS

College of Arts & Sciences
Chemistry

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

IMPROVING SOLAR CELL EFFICIENCY WITH NANOPILLARS

Solar power is an important frontier for renewable energy generation of the future. Nanopillars are a relatively novel approach to fabricating solar cells, but the extent of their efficacy is unknown. This literature review focuses on the impact nanopillars have on various aspects of solar cell performance and efficiency. Papers were selected for review by keyword searches and their inclusion of performance data relative to planar cells. The findings show that nanopillars cause an increase in light absorbance compared to planar cells, which is important for increasing efficiency. Further, nanopillar glass applications show a decrease in reflectance and an increase transmission, and show promise for use in glass coverings or tandem cells. Nanopillars have also shown an improvement in electrical performance, with higher power conversion efficiencies than planar cells. Nanopillars show great potential for improving the efficiency of solar cells of the future.

ISABEL PRATT

College of Arts & Sciences
Political Science, Global Studies

Faculty Mentor: **DR. RACHEL REYNOLDS**
Communication

Co-Mentor: Sreyashi Mukherjee, Ian Zimmerman

THE COLONIAL MINDSET: CULTURAL COMMODIFICATION IN TOURISM AND ITS IMPACT ON NATIVE COMMUNITIES

Tourism has evolved into a major sector of the global economy and its various forms rely on the commodification of any aspect of life in a particular place. The industry feeds off of exoticism of land and culture and encourages the people of a region to sell parts of themselves to make a living, often shifting the historical or sacred value of items, practices, and places. How does this rapidly growing industry affect native communities whose cultures have been a target for exploitation for centuries? How is cultural consumption harmful to these communities and how does it mirror colonial practices? In this project, I explore the ways in which tourists describe authenticity and how this devalues what authenticity means for local people. I collected scholarly sources describing concepts that shape our perception of foreignness and familiarity and how these ideas impact the way we travel and consume. I used travel review websites to get a wider view of the language everyday tourists use to describe their international experiences. While my theoretical research spans different regions across the globe, I concentrated the travel reviews on Peru specifically.

AMIRAH BREW-SYDERS

College of Arts & Sciences
Criminology & Justice Studies

Faculty Mentor: **DR. JORDAN HYATT**
Criminology & Justice Studies

MORE THAN A CRIMINAL: LABELING THEORY AND ITS INFLUENCE REGARDING PERCEPTION OF CRIME, RECIDIVISM RISK, AND EMPLOYMENT SUITABILITY

Labeling Theory emphasizes the significance of the processes through which people are characterized by others and how this may impact how they evaluate themselves. This study examines judgments concerning deviant individuals from three discrete groups: university students, church members, and previously incarcerated individuals, all of whom are residents of a North Philadelphia neighborhood (N=23). A 20-question online survey was implemented to measure attitudes toward deviant individuals, likelihood of recidivism, and impact on employment opportunities for previously incarcerated individuals. Based on the current literature, we hypothesized that each subsample would respond differently to the presence and nature of a label indicating a criminal history. The results of the survey indicated students respond positively to individuals with criminal histories, church members had the lowest expectations of recidivism, and previously incarcerated individuals believed the presence of a label would meaningfully limit opportunities of employment. Overall, these data emphasize the impact of a deviant label and questions the relationship between diverse criminal backgrounds and formerly incarcerated individuals' expectations of employment.

JADE UMSTEAD

College of Arts & Sciences
Criminology & Justice Studies

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

WHAT WE KNOW: THE EFFECTS OF OVERLY-AGGRESSIVE, RACIALIZED POLICING ON STRUCTURALLY DISADVANTAGED INDIVIDUALS

A renewed call for police accountability emerged in early June as protests erupted worldwide in the wake of the George Floyd murder. These demands come just six years after Ferguson, which seems to have resulted in little actual reform. This research uses a mixed methodological approach to analyze how the use of aggressive, racialized police strategies such as stop and frisk, drug arrests, and shootings in communities characterized by structural disadvantage (i.e. high poverty, high crime, high unemployment) can affect the perspectives and lived experiences of local residents. This research draws from theories of legal cynicism and procedural justice to help interpret the consequences of these aggressive applications of police coercion. Our findings suggest that this style of policing results in common themes of dehumanization, humiliation, violation, and harassment among other things being prevalent in the dialogue of the residents of these communities. Future reform should focus on bias training, the building of community ties and trust, and a greater understanding of systemic abuses of power. The video below is a short film I created that will give the reader a better visual of the magnitude of this issue and its implications.

DA YEON CHOI

College of Nursing & Health Professions
Health Sciences

Faculty Mentor: **DR. STEVE DOLPH**
Global Studies & Modern Languages

A SUSTAINABLE SOLUTION FOR MANAGING DIABETES IN PUERTO RICO

There are more than 350,000 diabetics facing a dangerous shortage of doctors and healthy, accessible food in Puerto Rico, an environmentally vulnerable island. With limited resources on an island where 85-90% of food is imported, many diabetic patients are left to survive on their own. However, through a strict diet, this disease can be managed. The goal of this project is to utilize permaculture design to directly educate diabetics on controlling their diet and health through community supported agriculture. This design includes hurricane resilient crops which provide more physical, political, and economic food sovereignty to reduce the impact of colonialism. To determine which plants are diabetic friendly, the model of less calories and carbohydrates but more fiber per serving is used. Macronutrients and the agronomy of each plant is considered to assess environmental resilience and diabetic benefits. These crops will help create diabetic friendly recipes and teach sustainable access to proper foods. Data from this project will add to the *Plenitud PR* permaculture farm grant proposal for funding to positively impact diabetics in Las Marias, Puerto Rico. This model starts in this town but can be applied to other larger regions.

HANNAH KIM

Pennoni Honors College
Custom-Designed Major

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

SCIENCE COMMUNICATION AND PUBLIC ENGAGEMENT: RUTH PATRICK'S PRIVATE AND PUBLIC LECTURES IN NONSCIENTIFIC DOMAINS, 1981–1994

Communicating scientific knowledge to diverse audiences can be measured in terms of effectiveness. Evaluating this communication is based on opposing goals that are still debated among natural and social scientists, as well as the nonscientific audiences. Differences lead to a communicative frustration that requires a medium: lectures that remain dissectible and engaging, while containing the knowledge that scientists hope to deliver.

In the 1980s-1990s, environmentalist Ruth Patrick (1907-2013) presented her scientific findings to various audiences, ranging from waste industries to garden clubs. Her lectures thus provide a valuable case study for investigating the design of effective science communications. Here I examine how Patrick — well-known to be an effective communicator — tailored her rhetoric and style of communication for her different audiences. This analysis of Patrick's methods of communication reveals that her approach at times conformed to general rules of effective practices, yet at other times diverted from them. These categories arguably align with broader issues: women in science communication, environmental advocacy, and the tension between science and policy. Addressing these challenges defined Patrick's approach to science communication and help us to better understand her research.

MEGAN PENG

College of Arts & Sciences
Biological Sciences

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

GENDER ROLES AND ITS EXPRESSION IN SCIENCE: NAVIGATING THE RISE OF RUTH PATRICK'S CAREER, 1945–1975

Gender has continued to be a contentious topic throughout the history of science. One method to better understand its impact is to look through the lens of the biographies of prolific scientists. Ruth Patrick (1907-2013) exemplifies one such life to examine the intersections of gender and science, as a revolutionary ecologist whose career coincided with the rise of gender discrimination in the workplace and an ensuing feminist movement within the 1960s and '70s. A better understanding can be achieved by looking at her interactions with her colleagues, autobiography, and interviews, as well as supplemental social theories to provide a gender-oriented context. Patrick helped to shape the role of a female scientist by rejecting many gender norms and expectations, instead choosing to forge her own path that embraced who she was. Combining these ideas with broader social and feminist trends, today's scientists can learn how to navigate parallel problems in modern society. While there is still a long road to overcome bias and discrimination within science, the life and career of Ruth Patrick demonstrate that change is possible.

SHIVANI PATEL

Bennett S. LeBow College of Business
Finance, Economics

Faculty Mentor: **DR. SCOTT G. KNOWLES**
History

COVIDCALLS: SCIENCE COMMUNICATION THROUGH A REAL-TIME HISTORICAL ARCHIVE

Amid the chaos of a pandemic & ever-changing world, how can expert knowledge be communicated in order to reduce the severity of disasters? To capture the real-time development of COVID-19, Dr. Scott Knowles & his team built the COVIDCalls series to engage in daily conversations with a collection of experts and explore the pandemic through multiple disciplinary lenses. The project is a science communication tool, and involves the formation of a historical archive, aggregating through recordings and transcripts (over 1.25 million words).

My work engaged with learning the intricacies of producing a podcast & historical archive. I spent the first weeks reviewing each episode in order to compose descriptive metadata, compelling descriptions and titles, while also editing the transcripts so that the collected data could eventually be used by the media, researchers, & students. I investigated the latest publications online in order to identify distinctive themes for each episode while also composing invitations for guest speakers and preparing materials for broadcasting episodes. I developed one week's worth of programming & co-hosted an episode of my own design.

COVIDCalls continues to be a platform for experts to share their knowledge.

Summer 2020

DANIEL P. SIN

College of Computing & Informatics
Computer Science, Mathematics

Faculty Mentor: **DR. GEORGI S. MEDVEDEV**
Mathematics

Co-Mentor: Luke Brown

NEURONAL FIRING ON A FRACTAL

Dynamical systems on fractals is a new area of nonlinear science with many exciting applications. In my research, I studied a coupled network of the quadratic integrate and fire neurons on the Sierpinski Gasket. I developed an algorithm in MATLAB that can generate an adjacency matrix for the Sierpinski Gasket and then utilized the Euler-Maruyama (EM) method to numerically solve for the system of stochastic ordinary differential equations in MATLAB. After thoroughly testing the MATLAB code and conducting numerical trials, I have found that increasing the value of the coupling strength decreases the overall firing rate. This agrees well with previous studies of related models on graphs (Medvedev, Zhuravytska, J. None. Sci., 2012) that observe the effect of the coupling strength.

NICHOLAS LIVOLSI

College of Arts & Sciences
Mathematics

Faculty Mentor: **DR. GIDEON SIMPSON**
Mathematics

PARAMETER STUDY OF A SPRING-MASS SYSTEM USING DATA DRIVEN FORCES

The purpose of the research is to determine how the error of synthetic data integrated using data driven forces would be impacted by the variance and sample size of the data. The synthetic data, which is the force of a spring at a certain displacement, is the exact force being substituted for the one known from data. Newmark's Method is used to integrate a spring system, which takes the form mx''(t) + cx'(t) + f(x(t)) = g(t), and in this research, f(x(t)) is the synthetic data. The code would first generate the synthetic data, using a given variance and sample size. It would then integrate the data using Newmark's Method. Lastly, it would calculate the error from the integration and the known solution. The error is calculated for different sets of variances and sample sizes. It's concluded that the combination of the smallest variance and the largest the sample size resulted in the smallest error, which means that smaller variances and larger sample sizes produce more accurate results. This parameter study is significant because it can determine when generating synthetic data if either the variance or sample size is too large or small and it confirms that exact data can be used rather a constitutive relation to integrate a model.

CHRISTINA LUDWIG

College of Arts & Sciences
Physics

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

Co-Mentor: Joseph Fabritius III

CONSTRUCTING DENSITY MAP OF ABELL 2744

Gravitational lensing analyzes the ways in which light bends and is distorted around massive objects. By studying this warping of light, astrophysicists can infer these objects' properties and model their overall structures and substructures in even more detail than from an optical telescope. New programs such as Lenser (developed in the Drexel Physics Department) allow us to obtain information about these individual, massive objects that constitute a galaxy cluster and examine the relationships among its different properties. The current research conducts data analysis on galaxy cluster Abell 2744. With the programming language Python, I developed a code that produces a density map of the cluster, taking into account its various properties, such as its location in the sky and its flexion, or shape. When scaled to and superimposed over optical images of Abell 2744, the density map's legitimacy is proven: the cluster's brightest objects are found within its most dense regions, as expected, since more light will be bent and distorted around those massive areas. Hence, this map reasonably demonstrates the correlation between a galaxy cluster's density and magnitude, and accurately depicts Abell 2477's surface area density.

Summer 2020 **Velay Fellow**

DMITRI LABELLE

College of Arts & Sciences
Physics

Faculty Mentor: **DR. JÖRN VENDERBOS**
Physics

Co-Mentor: Jeremy Strockoz

GINZBURG–LANDAU THEORY OF MULTI–Q MAGNETISM

Crystalline magnetic materials form geometric lattices at the atomic level. The electrons within said atoms have spins which arrange themselves in an ordered pattern below a certain temperature, referred to as a ground state. While most conventional magnets have spins which all point in the same direction, there is a plethora of other ordered spin configurations these magnetic materials can have. Determining the magnetic ground state in these unconventional magnetic systems is generally a hard problem, and solutions have only been obtained in a limited number of cases; which notably doesn't include most interesting magnetic materials. The author, alongside a group of the primary investigator, is working out a method to systematically derive potential ground states, exploiting the lattice symmetries of the magnetic materials. Such a method would greatly simplify the work needed to understand these materials, and a better understanding of such materials can also aid in the progress of using strongly correlated materials such as unconventional magnets in device technology. The method has shown promising results with regularly ordered lattices and has risen more potential questions within the field of condensed matter physics.

KEJSI RUKA

College of Arts & Sciences
Global Studies

Faculty Mentor: **DR. DIANE SICOTTE**
Sociology

UNDERSTANDING LABOR UNION VIEWS ON ENERGY FUTURES

In the age of climate change, the reliance on and continuing use of fossil fuels as a primary energy source is at the center of political discourse. As complex interest groups, labor unions can stand on both sides of this environmental issue. However, labor unions have dwindled in size and power over the decades; with so many energy related jobs at stake, unions are seeking the influence to shape the conversation. This project focuses on analyzing interviews from union members in the PA/NJ/NY region where five have taken public positions in favor of fossil fuels, and the other five anti-natural gas positions. Using qualitative research methods and a focus on an individual level of analysis, I reviewed interview transcripts and coded themes using NVivo software. Research findings indicated that a complex set of concerns motivated union members' opinions regarding energy choices. The findings ultimately demonstrate the importance of listening to the lived experiences of union members in a rapidly evolving energy industry.

RYAN MCSHANE

College of Computing & Informatics
Computer Science

Faculty Mentor: **DR. MARK BOADY**
Computer Science

CLASSICAL TO QUANTUM LOGIC

A Google search for quantum computing results in a large number of varying articles and papers which the average person may or may not understand. Even for the experienced programmer or computer scientist, the field of quantum computing can seem broad and complicated. The goal of this research is to create a library so that someone with little to no programming background can learn about the algorithms quantum computers run on. Everyone working with computers learns the foundations of boolean logic. The classic patterns of logic are still found in quantum computers, but the differences in approach are substantial. By creating these utilities, we hope to decrease the learning curve required to accurately design quantum computer algorithms. Quantum computing is in the very early stages which leaves much to be explored. At the same time, there are a limited amount of resources that assist newcomers and computer scientist veterans to the quantum field in learning about the algorithms that quantum computers run on. Taking into account the current knowledge of classical logic, a library was created containing modules that represent a basic starting point for anyone interested in learning how to program a quantum computer.

SALAMATA BAH

College of Computing & Informatics
Computer Science

Faculty Mentor: **DR. EDWARD KIM**
Computer Science

MACHINE LEARNING MODELS TO PREDICT BREAST CANCER

In the United States, Breast Cancer is the second leading cause of cancer among women. The best ways to prevent Breast Cancer deaths are early identification and accurate diagnosis. Having robust prognosis models can help doctors treat Breast Cancer patients rapidly and efficiently.Thus, developing techniques that give minimum errors can increase accuracy and reduce the death rate among women. In the medical field, classification and data mining methods are efficient in making decisions, and in Computer Science, Machine Learning is very known for training machines to learn from data or past mistakes. Hence, this research aims to find out how accurate a Machine Learning Model can be trained to predict the outcome of a patient having Breast Cancer and whether the tumor is Malignant or Benign. Three algorithms – Logistic Regression, Naive Bayes, KNN (K-Nearest Neighbor)- were executed using Python and conducted in Jupyter Notebook. These three algorithms were applied to the Wisconsin Breast Cancer Dataset, and each algorithm showed different accuracy scores. Experimental results demonstrated that Logistic Regression gives the highest accuracy score (97.36%) with the lowest error rate.

Summer 2020 **Velay Fellow**

MUNEERA B CADERSA

College of Computing & Informatics
Data Science

Faculty Mentor: **DR. EDWARD KIM**
Computer Science

PREDICTING BREAST CANCER USING MACHINE LEARNING

About 1 in 8 U.S women (about 12%) will develop invasive breast cancer throughout her lifetime. In 2020, an estimated 276,480 new cases are expected to be diagnosed in women in the U.S. About 42,170 women in the U.S are expected to die in 2020 from breast cancer. Overall, the death rate from breast cancer is higher in women than in other types of cancer. The recent decades have witnessed the development of several data mining and machine learning techniques for breast cancer detection and classification. Over the course of this research, a model was created based on breast cancer data set to predict whether a patient has a positive breast cancer diagnosis based on several tumor characteristics. An exploratory data analysis is performed to allow us to see what kind of data we are dealing with. The model is then built, first by splitting the data into a train set and a test set. The model is then trained and the prediction takes place. The model is then evaluated generating a classification report which checks the model's precision. The test set had a total of 171 input data. Out of 105 women predicted to not have breast cancer, 7 women were classified as not having breast cancer when they did (Type 1 error). Out of the 66 women predicted to have breast cancer, 10 were classified as having breast cancer when they did not (Type II error). The model, therefore, has an accuracy rate of more than 90% in predicting whether a tumor is malignant or benign.

Velay Fellow **Summer 2020**

ZACHARY NGUYEN

College of Computing & Informatics
Computer Science

Faculty Mentor: **DR. EDWARD KIM**
Computer Science

VOCAL STYLE TRANSLATION USING PIX2PIX GENERATIVE ADVERSARIAL NETWORKS

Voice synthesis has been a popular topic in the machine learning community, due to its growing adoption in modern technology. In the past few years, there has been monumental progress with popular implementations such as Tacotron or Wavenet dominating the field of voice synthesis. However, much of the vocal reproduction research has been focused on pure synthesis, while voice translation on the other hand is a relatively untapped research topic. As opposed to voice synthesis, which generates a completely new voice, voice translation transposes the audio and features of an input onto a target voice. This process mimics the characteristics and audio style of the input voice while maintaining the semantics of the target audio. Using a Pix2Pix generative adversarial network (GAN), audio samples in the form of spectrograms can be paired together to train a neural network that can generate translated audio. Once applied to audio samples, the Pix2Pix network was able to generate audio that mimicked style and semantics to some degree of success albeit with significant noise. However, the results are promising and hopefully will serve as a baseline for future work on vocal translation using a Pix2Pix GAN.

JACQUELINE Y. GUAN

College of Computing & Informatics
Computer Science

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

HUMAN BEHAVIOR AND ANALYSIS IN EYE TRACKING

Eye tracking is a sensor technology that measures the motion of an individual's eye in order to detect the location of where the individual is looking. Tracking eye movements is commonly used for assessing human behavior, especially as it relates to marketing or graphic design. As a web developer or interface designer, these behaviors can be crucial to analyzing and improving the usability, attractiveness, and flow of the graphical user interface. For this project, we used an open-source eye tracking software written in JavaScript that displays in a browser and added four simple, yet interesting images. The simulation was sent to twelve different users who tested the eye tracking software and finished with four files containing data of each point they looked at on the screen. The files then went through a Python program I created to determine the region of interest each point fell into for each individual image. Regions of interest are specific areas of the image that have a key feature like the face of a baby. The results showed that people do not look over images in the same way. Eye tracking provides a better understanding of how people view images and demonstrates an interesting window into a person's cognitive processes.

Velay Fellow **Summer 2020**

COLLEGE OF COMPUTING & INFORMATICS

KENN CHONG

College of Computing & Informatics
CCI - Undeclared

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

REVISITING ENIAC PROJECTILE TRAJECTORIES

The ENIAC is a computer that is capable of performing basic arithmetic such as addition, subtraction, multiplication, division, and finally, square rooting. However, in today's world, there is less people that know about the ENIAC and even less people that knows how to program one. This project's purpose is to understand the programming techniques that was used to program the ENIAC. The specific program that this project is interested in is the ballistic trajectory calculations program that will calculate the positions of the ballistics motion. As the schematic for such calculations is being translated into the simulator code, an unexpected discovery soon rendered such efforts as futile. It is discovered that the high-speed-multipliers between the schematic for the program and the ENIAC's multiplier configuration widely differs from each other. This discrepancy resulted from the fact that as the schematic was designed, the ENIAC's design is still not final. Hence, in order to proceed with implementing the schematic, either to find another version of the schematic is needed (whereas the multiplier is the right order), or to redesign the high-speed-multiplier's design so that it would roughly fit the original intent of the program.

AZRA GALLANO

College of Computing & Informatics
Computer Science

Faculty Mentor: **DR. DENISE AGOSTO**
Information Science

TEACHING DESIGN THINKING IN INFORMATION SCIENCE EDUCATION WITH COMMUNITY PARTNERSHIPS

Readily available and accessible information systems are essential in community spaces. Libraries, for example, hold a variety of resources for both research and recreational needs. However, there are often inefficiencies within library spaces or large-scale information systems that make them confusing and frustrating to use. Design thinking- a problem solving process focused on user need and iterative prototyping- has been popularized to help mitigate these problems. The aim of this project was to investigate the current use of the design thinking model within libraries across the globe, evaluate relevant research literature, and create a detailed curriculum for Drexel's "Design Thinking for Digital Community Service'' graduate course for Master's in Information Science students. This is one of three new community-based learning courses funded by the "Integrating Community-Based Learning with LIS Education" grant received by the College of Computing and Informatics from the Institute for Library & Museum Services, grant #RE-17-19-0006-19. These educational materials will not only prepare graduate students to employ design thinking methods, but also create a meaningful impact on future community information services.

ANSH CHANDNANI

College of Computing & Informatics
Computing & Security Technology

Faculty Mentor: **DR. THOMAS HEVERIN**
Information Science

SECURING INDUSTRIAL CONTROL SYSTEMS USING ONTOLOGIES

Industrial Control Systems (ICS) are systems that control physical infrastructures like nuclear power plants, water treatment facilities, and various automation systems. ICS holds different software, functions, and custom operating systems and have increasingly become a target of cyber-attacks due to its ability to control physical infrastructure. This allows hackers to cause serious damage eg: financial impact, business operations, and loss of life. By attacking systems, it is possible to preemptively detect and patch vulnerabilities. Due to the wide variety of devices and systems part of ICS networks, most security professionals are not familiar with them. This prompts the need to effectively organize and model knowledge about the ethical hacking of ICS. Using ontology modeling, an approach of knowledge representation through graphs and semantic relations, we concisely model data pertaining to ICS hacking. Data is gathered from public databases such as Shodan, National Vulnerability Database, and ExploitDB, etc. Through ontologies, we can thread various entities like vulnerabilities, exploits, and the systems impacted. The ontology modeling of ICS ethical hacking reduces the complexity in pursuit of their security.

CATHERINE LOPEZ

College of Computing & Informatics
Computer Science

Faculty Mentor: **DR. THOMAS HEVERIN**
Information Science

INDUSTRIAL CONTROL SYSTEM ONTOLOGIES

Ethical hackers are tasked finding and reporting vulnerabilities, weaknesses, and exploits in systems including industrial control systems (ICS). ICS control essential functions in systems such as electric grids, nuclear power plants, security systems and building automation systems. Ethical hackers need to find and decide which vulnerabilities to exploit based on a variety of factors such as vulnerability severity, attack vectors, and attack complexity. To find this information ethical hackers must manually search across multiple data sources and then make decisions. Ethical hackers may have to sort through thousands of vulnerabilities to determine which ones to exploit first. Our goal was to automate this searching and decision-making process. We modeled ICS software, vulnerability data, exploit data, and attack data in an ontology to link all this data together. From there, SPARQL queries were developed by the researchers to automatically retrieve, reason, and sort vulnerability data on ICS to show which vulnerabilities were the most severe, that could be exploited over the Internet, and which were the easiest to exploit.

MANNA HAILE

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

Faculty Mentor: **DR. ALEKSANDRA SARCEVIC**
Information Science

Co-Mentor: Swathi Jagannath

PERCEPTION AND COMMUNICATION OF ACTIVITY DELAYS DURING TRAUMA RESUSCITATIONS

Trauma resuscitation is a time-critical medical process that addresses severely injured patients. Trauma teams follow the standardized Advanced Trauma Life Support protocol to efficiently stabilize the patients. However, process deviations and delays are still common. The goal of this research is to design a decision-support system to alert teams about activity delays by using multiple modalities, including computer vision and speech. In this project, we focused on understanding the speech characteristics associated with four life-saving interventions (LSIs) – intubation, cardiopulmonary resuscitation, chest tube insertion, and blood transfusion. Medical experts on our team identified delays while reviewing 55 videos of trauma cases with LSIs. We then analyzed those videos and delays to understand team members' communication behaviors by making narratives and speech transcripts. We identified delay-related speech patterns to determine optimal timing for providing alerts. We can send proactive alerts to prevent the delay or reactive alerts to improve the team's situational awareness. In the future, we will use the duration and impact of delays on patient care to determine the timing of alerts to support team's decision making.

HANNAH H. DOWNEY

College of Engineering
Chemical Engineering

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

Co-Mentor: Mr. Amir Azimi

DRAG ON A FLUIDIZED FIBER AS A FUNCTION OF ASPECT RATIO

3-D manufacturing is gaining attention as a method of producing custom parts. However, parts made from thermoset resins are often too weak for use. The Alvarez Research Group has developed techniques for introducing fiber reinforcements into thermosetting resins to strengthen small parts through 3-D composite manufacturing. A recently developed Fiber Flying Machine uses air flow to separate bundles of fibers into single fibers for deposition in a resin vat. We use computational fluid dynamics, via COMSOL®, to simulate the drag of a single fiber in parallel and perpendicular configurations. The aim of the simulations is to understand the relationship between the fiber's preferred orientation as a function of diameter and aspect ratio. We have determined the drag coefficient and force on the surface of a cylindrical object as a function of aspect ratio. The equivalent spherical diameter is calculated, normalized by the cylindrical diameter, and plotted as a function of aspect ratio. When compared to experimental data, we find the results overpredict the experimental data, suggesting the fibers take on an angled orientation in the flow field. This angle is important to understanding how to control the orientation of the fiber.

Velay Fellow **Summer 2020**

ELIZABETH CLARKSON

College of Engineering
Environmental Engineering

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

Co-Mentor: Mr. Sherif Khalifa

MATERIAL FLOW ANALYSIS TOWARD A MORE CIRCULAR ECONOMY FOR WIND TURBINE BLADES

As our energy production begins to move toward independence from fossil fuels, wind energy has grown to the second largest renewable energy source and is responsible for generating 300 million MWh in 2019, 7.3% of total electricity demand. Wind is an abundant sustainable resource caused by air circulation of different atmospheric pressures. However, the current production method is resource intensive, with substantial amounts of virgin materials employed in turbine blade production. Experts predict 8.17 million tons of turbine blades will be disposed in US landfills by 2050. Currently, blades are made from composites that are expensive and logistically challenging to recycle, limiting the potential circularity of materials. In this project, we built an interactive python model to track the materials used for blade construction. The model is built from wind energy generation projections; users can vary recycling, reuse, and remanufacturing parameters to evaluate the impact on extracted raw materials and overall cumulative waste in different scenarios.

ISABELLA SNYDER

College of Engineering
Mechanical Engineering

Faculty Mentor: **DR. RICHARD CAIRNCROSS**
Chemical & Biological Engineering

Co-Mentor:

DEVELOPING AERODYNAMIC MODELS FOR KITE DESIGN ANALYSIS

Kites are effective platforms for meteorological and atmospheric studies because of their low cost, light weight, and ability to withstand high wind speeds. This research focuses on developing aerodynamic models to evaluate and improve kite designs. The models calculate forces and torques acting on a kite using published experimental values for aerodynamic coefficients. Two models were developed, a pitch equilibrium model in Excel and a dynamic 2D model in Wolfram SystemModeler. The pitch equilibrium model calculates the wind speed at equilibrium for a given angle of attack and identifies regions that are unstable or physically unrealistic. The dynamic model allows for a changing wind speed and displays transient motion of the kite when not at equilibrium. In the dynamic model, when exposed to a perturbation in wind speed, the kite exhibits decaying oscillations that approach a stable equilibrium point. Within the stable region, both models agree and show that tuning the kite bridle farther forward enables flying at lower wind speeds. Future research will extend the model to multiple wing surfaces and lateral motion of the kite.

HANNAH ABRAMS

College of Engineering
Chemical Engineering

Faculty Mentor: **DR. JOSHUA LEQUIEU**
Chemical & Biological Engineering

EXAMINING THE INTERSECTION OF DNA SEQUENCE, NUCLEOSOME MOTION AND POLYMERASES ON CHROMATIN STRUCTURE

A nucleosome is a structural unit of chromatin, formed when eukaryotic DNA is coiled around histone proteins. Prior work has demonstrated that nucleosome positioning directly effects chromatin accessibility, providing the opportunity for further research. The movement of nucleosomes along a strand of chromatin is a process that happens slowly and can be challenging to observe experimentally. Biological activity which naturally takes a long time to occur is observed in reduced time by implementing computer simulations which accelerate these activities. In addition to quicker results, computer simulations also can be used to identify the fundamental interactions that are responsible for nucleosome positioning while providing more detailed information. In this project, a Kinetic Monte Carlo (KMC) model was developed in Python. The KMC model demonstrates the movement and dynamic evolution of processes with very long timesteps by using randomly generated numbers to update the positions and time. It was demonstrated that a baseline KMC model can reproduce experimentally observed nucleosome densities. The future of this project looks to use this baseline KMC model to observe patterns within different species' nucleosome density profiles.

I. C. COSMO RANDAZZO

College of Engineering
Chemical Engineering

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

MICROBIAL ELECTROLYSIS CELLS FOR SUSTAINABLE AMMONIA PRODUCTION

Based on sustainability, cost-efficiency, and design flexibility, a novel nitrogen-fixing microbial electrolysis cell (NfMEC) could offer our in-demand agricultural sector a locally implemented, green ammonia source. However, after an extensive review of MECs, related technologies, and the current outlook on N-fixation in nature, factories, and other bioelectrochemical systems, we were only able to create conceptual designs for possible NfMECs. Limitations, remote setting aside, include microbe viability, system scalability , and significant ammonia production as compared to modern fertilizing practices. Here, we utilize literature to develop diagrams, mathematical break-even models, and future research questions, which could ultimately provide insight into NfMEC feasibility. With experimentation directed towards the refinement and optimization of various NfMEC operational units, we plan to define the practicality of a biocatalytic anode coupled with a biocatalytic N-fixation mechanism on the cathodic side. While marrying a bio-active system with an electrochemical system presents many challenges, related studies would delimit and possibly set forth NfMECs as a green alternative to existing ammonia production.

GRACE B KNAUSS

College of Engineering
Environmental Engineering

Faculty Mentor: **DR. EUGENIA VICTORIA ELLIS**
Civil, Architectural, & Environmental Engineering

THE FUTURE OF FOOD

The researcher of this project was tasked with gathering a broad understanding of the viability of hydroponic indoor growing within the Philadelphia region and its potential impact, as well as researching the other beneficial by-products of hydroponic agriculture. The goal of this project was to compose a database of information to aide in the process of writing various grant proposals. The major topics that were researched: traditional vs indoor agriculture pay scales, conventional vs urban farming, Philadelphia's communities, impacts on nutrition. Research was also dedicated to learning about how hydroponics impacts sustainability, climate change, and health equity. The information gathered centered around the social justice potential within urban farming, and the creation of a workforce program to create jobs within the Philadelphia region. The final product was the compilation of research to create a small database of information to be used in future grant proposals. Dedicated research and monetary investment towards indoor agriculture has the potential to resolve many issues within society. The future of food would not be bound to rural farmland anymore but integrated within cities throughout the whole United States.

ADRIENNE MEI-YI CHEUNG

College of Computing & Informatics
Computer Science

Faculty Mentor: **DR. PATRICK GURIAN**
Civil, Architectural, & Environmental Engineering

Co-Mentor: Mahsa Safari, Hugh Johnson

CALCULATOR FOR ADDRESSING ENERGY COST BURDEN

Affordably financing energy infrastructure is relevant to reducing greenhouse gas emissions. The goal of this research is to create a tool which allows providers to minimize cost burden while earning a customarily allowed profit. To develop an optimization program in the form of a website, I used JavaScript to define fifteen household categories (showing the overlap of income quintiles with low, medium, and high electricity or gas use in New York City). I took pricing information from sample charges from Con Edison – the major utility provider for NYC – and repeatedly entered alternate rate structures into the website. Across and within income quintiles, a relative demand factor separates household categories' average usage. Demand factors obtained through testing yielded consumption values that align well with known values for aggregate expenditure and total usage. Drastically reducing fixed and slightly increasing variable charges, applying charges to the highest usage categories, and increasing benefits can mitigate utility cost burden without creating great impact on higher-income categories or insufficient profit for providers.

ANNE E. HANLON

College of Engineering
Architectural Engineering

Faculty Mentor: **DR. SIMI HOQUE**
Civil, Architectural, & Environmental Engineering

"EMBODIED CULTURE"

Historic buildings typically have a high embodied energy even if they are not protected under the National Register of Historic Places. This can lead to the demolition of many historical buildings, which negatively impacts the environment as well as community patterns and traditions. To study this issue, we developed a framework to value the "Embodied Culture" of historic buildings. The methodology for developing the framework involved a close analysis of various building rating systems as well as the Historic Registry. It is comprised of categories, subcategories, and degrees used to score a building and quantify its historical, functional, social, and architectural place in a community. We tested the framework through a case study of the Chestnut Hill Library, a Carnegie Library built in 1907 in Philadelphia. We analyzed the library's embodied energy as well as the functional/social, historical, architectural, and organizational elements of the building. The goal of this research is to create a more holistic view of a historic building, to preserve more of these structures, and to value the integral role they play in the various communities in which they are located.

ELIZABETH LE

College of Engineering
Environmental Engineering

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

Co-Mentor: Ms. Korin Tangtrakul

EVALUATING EVAPOTRANSPIRATION RATE OF POPLAR TREES IN URBAN GREEN STORMWATER INFRASTRUCTURE

Due to climate change, heavy rain and increased flooding causes urban run-off to overwhelm Philadelphia's historic combined sewage system. Excess run-off deposits into the ocean, which increases pollution; also known as a combined sewage overflow (CSO). Through an agreement with the EPA, the city of Philadelphia plans to implement Green Stormwater Infrastructure (GSI) systems, such as rain gardens and green roofs, to prevent CSO's. In GSI, evapotranspiration (ET) rate presumably plays a large role in water storage turnover; evaluating ET in different situations helps develop improved systems and decreasestormwater runoff. This study evaluates the ET of poplar trees compared to other vegetation in a rain garden. The U.S. Forest Service believes that poplar trees have a higher ET rate compared to other vegetation and when placed in GSI systems, may increase water storage turnover and decrease flooding. Although the rain garden site did not record proper lysimeter weight data to evaluate ET, poplar trees may increase the rate of ET in urban GSI with evidence based on prior literature, allowing for increased water storage and decreased CSO effects.

SAMANTHA SEIDEN

College of Engineering
Environmental Engineering

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

Co-Mentor: Korin Tangtrakul Lab Manager, Aspasia Zerva Assistant Professor

HUNTING PARK HEAT MITIGATION RISK STUDY

As climate change continues to develop and extreme heat becomes a normality for the summer months, certain areas-especially within cities-are being negatively impacted. Scientists have identified a phenomenon called Urban Heat Islands where urban areas experience hotter temperatures than surrounding rural areas due to a lack of vegetation in conjunction with the materials that are more commonly present in urban areas. It has been recognized that this increasing temperature is a serious problem for vulnerable urban communities, however the effect of this extreme heat on public health is worse this summer due to the shutdown of cooling centers because of COVID-19 physical distancing guidelines. This study develops, implements, and monitors different resolutions to reduce the effects of extreme heat in Hunting Park, one of the most heat vulnerable communities within Philadelphia. Several solutions were explored such as shading structures, pavement wetting, greenery, and a combination of them. This project aims to give community members relief from the heat while giving them a way to participate in the experimentation process by being involved in the design and monitoring of each solution.

Summer 2020 **Velay Fellow**

NICHOLAS COLE

College of Engineering
Electrical Engineering

Faculty Mentor: **DR. MIRA OLSON**
Civil, Architectural, & Environmental Engineering

STELLA MODEL FOR JORDAN RIVER BASIN WATER ALLOCATION

This project's aim is to update a pre-existing STELLA optimization model. The model is designed to calculate allocation of water resources in the Jordan River Basin. The model considers water resources, both natural and engineered, existing demands across multiple sectors, and negotiated allocations codified by treaties among Israel, Jordan and the Palestinian West Bank to calculate water levels in existing surface- and ground-water reservoirs.

It enables users to consider future scenarios of water allocation, their associated costs, their ability to meet projected water use demands, and their impact on natural water resources, which provides drinking and irrigation water to Jordan, Israel, Syria, the Palestinian territories in the West Bank and Lebanon through both surface and groundwater resources. Precise water allocation from the Sea of Galilee, the Dead Sea, Red Sea, and aquifers could help maintain a sustainable water level in the region, and for the countries that share the water.

SNEH PATEL

College of Engineering
Computer Engineering

Faculty Mentor: **DR. ANUP DAS**
Electrical & Computer Engineering

OPTICAL FLOW ESTIMATION

Optical flow is a sequence of time-ordered images that are projected onto the two-dimensional image motion as instantaneous image velocities. It can be used to perform motion detection, object segmentation, and much more. Moreover, it is one of the building blocks in a self-driving car as the car uses it to detect motion around it. In this project, FlowNet implementation of Optical Flow was used. FlowNet demonstrated that optical flow estimation can be cast as a learning problem. FlowNetCorr runs with the average endpoint error of 1.76 at the learning rate of 1e-4. Computation of the optical flow is a fundamental problem in processing sequences of images. However, improvements in the processing speed can be made by reducing the size of the network or reducing the size of the dataset in the input. The efficiency of the network is crucial for Optical Flow applications.

ABIGAIL HOWELL

College of Engineering
Mechanical Engineering

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

Co-Mentor: Dr. Pablo Huang, Dhruv Shah

DESIGN AND MANUFACTURING INNOVATION THROUGH THE DEVELOPMENT OF A DRONE COMPETITION

There is a need for educational opportunities that develop innovative thinking outside of the classroom. This project, in collaboration with the Pi Tau Sigma mechanical engineering honor society and supported in part by Autodesk, looked at developing a design-centric competition from the ground up. The development of the present competition outlined three fundamental tasks: establishing rules and constraints for three technical challenges, developing a rubric for documentation, and designing and manufacturing a prototype drone for each challenge. Over the course of the competition, participants will learn how to design for manufacturing while meeting performance requirements as defined by the Endurance, Performance, and Hybrid Technical Challenges. The drone will act as a tool for innovative thinking, and to encourage unique design paths linking ideation to prototyping supported by computational simulation and optimization analysis techniques. It is expected that participants of the competition will develop a symbiotic understanding of classroom theory with real-world design applications including computer-aided design, simulation, additive manufacturing methodologies, and experimental validation.

JULIA B. FLEMING

College of Engineering
Electrical Engineering

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

CUBESAT AUTONOMOUS DOCKING TECHNIQUES

CubeSats are compact 10cm, 3lbs square satellites. Their small size and light weight makes them more affordable satellites that are able to catch a ride with other launches and be pushed out into orbit. Since 2016, the European Space Agency and NASA have been looking to students to propose techniques to have multiple CubeSats connect together in space. If successfully docked in space, the CubeSats would work as building blocks to make larger satellites. This surface area increase would increase the power generated by the solar panels and would allow for larger scale missions. Some aspects vital to docking CubeSats include controlling the speed in which the satellites dock, the sensors used to detect each other, and the physical hardware that allows the connection. Throughout the STAR Scholars Program, my partner, Julie McCree, and I created a program for an Arduino Robot Car to detect a target car using an ultrasonic sensor, travel towards the car, and dock together with the lowest required speed. Our two model cars simulate our proposed software and hardware design for CubeSat docking.

JULIA E MCCREE

College of Engineering
Electrical Engineering

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

MANEUVERING THE IDEAL SPEED FOR DOCKING CUBE SATELLITES

CubeSats are 10cm x 10cm x 10cm cube satellites that are less expensive and use up fewer resources to launch into orbit. These small satellites have the potential to dock in orbit to create a larger satellite with a greater range of applications. The docking process involves a "chaser" satellite, which seeks out the "target" satellite to dock. Based on prior Drexel research in the Space Systems Lab, there is an ideal docking speed for the chaser for the satellites to dock successfully in a low-friction environment. This project focuses on finding a way to ensure the chaser is at the ideal speed when the satellites dock by programming communication between the locating system and the propulsion mechanism of the chaser. In the tests we ran for this project, an Arduino car served as the chaser and a wooden car as the target, with the motors of the Arduino car acting as the mechanism of propulsion. The programming was successful in locating the target with the ultrasonic sensors and coming to the correct speed to dock, but was less successful in actually docking with the target due to a lack of a reliable alignment system. A key takeaway regarding docking CubeSats is that alignment is as important as locating the target.

MIKIN PATEL

College of Engineering
Mechanical Engineering

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

Co-Mentor: Sanjog Karki

THERMAL ANALYSIS OF A CUBESAT

Research conducted from space has played a pivotal role in our understanding of complex issues on Earth such as climate change. Through the use of CubeSats, we have also tracked weather patterns and have successfully changed our agricultural systems in areas such as Africa to increase healthy crop growth. Even though CubeSats are relatively small, their low cost and specific purpose have provided us with immense research that continues to shape how we interact with our planet. It is highly crucial to ensure CubeSats and other such satellites remain within certain parameters so they can function properly for the entirety of their entailed mission.

Throughout this project, C&R Technologies Thermal Desktop software was utilized to preform thermal analysis of a 6U CubeSat which is 10x20x30 cm in dimension. The main objective was to understand and apply Finite Element Analysis (FEA) and heat transfer analysis to optimize the correlation between the applied mesh size and the resulting computation time of the simulation. Through multiple iterations of the simulation, the maximum temperature accuracy and optimized computational time of simulation for both a CubeSat and an onboard PCB were produced.

OLIVIA REILLY

College of Engineering
Mechanical Engineering

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

PARACHUTE DROP VEHICLE

The objective of this research on drop vehicles was to construct a 10 cm cubed device that would descend from a High Altitude Balloon platform at 250 ft, transform, and then land on a target. The success of the drop vehicle can be related to CubeSats which are miniature satellites of similar dimensions. The feasibility studied through this research relates to CubeSat missions, where probes would land on planets from kilometers high rather than feet. Because CubeSats are smaller and less costly than a larger satellite, there is room for more risky, questionable experiments.

This was a team project and we decided to use a parachute based device for its controllability, compactibility, and lightweight design. I mainly worked on the parachute aspect while my partner worked on the box mechanics. My duties included equations relating to and the creation of the canopy which involved the use of the software SingleSkin 0.3 for estimated dimensions and flight predictions. There were many redesigns for the parachute and box to make the system more effective. In the end, our finished project unfolded properly once ejected and its flight direction could be controlled remotely.

Velay Fellow **Summer 2020**

LUKE SIMEONE

College of Engineering
Mechanical Engineering

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

TRANSFORMATIVE DROP-VEHICLE DESIGN

The goal of this project is to create a small device that is capable of landing safely and accurately when dropped from a height of about 250 feet. All components must fit within a 10cm cube upon release, after which the vehicle can transform so that it can fulfill these goals. Possible applications of this device include payload carrying and delivery when dropped from a sizable height, as well as dropping these vehicles on other planets with gaseous atmospheres.

Our team of 2 decided to base our drop-vehicle on a parachute for its ability to be compressed and expanded. My responsibilities covered the 10 cm cube and its interior fixtures, while my teammate worked on the mechanics of the parachute itself. I had to select parts that were small and lightweight to design systems such as a parachute release module and a steering module. It was also important to arrange these systems to achieve a desirable center of gravity for the initial launch stages. In the end, a vehicle was created that ejected the parachute correctly and can be steered once gliding.

SEO YEONG PARK

College of Nursing & Health Professions
Nursing

Faculty Mentor: **DR. JOKE BRADT**
Creative Arts Therapies

Co-Mentor: Karolina Bryl, PhD, R-DMT/DMP, CMA, RMST/E

ANALYZING THE SIGNIFICANCE OF VERBAL-BASED PAIN MANAGEMENT SESSIONS FOR PEOPLE WITH ADVANCED CANCER

Chronic pain is a significant problem for people with advanced cancer. As pharmacological treatments often provide insufficient relief and may lead to undesirable side effects, researchers have been investigating non-pharmacological interventions for chronic pain. This project was part of a larger ongoing NIH-funded randomized controlled trial that compares a 6-week music-based and verbal-based support program for chronic pain management in people with advanced cancer.

This qualitative study specifically explored what challenges participants in the verbal-based treatment arm shared during their sessions. We used maximum variation sampling (age, gender) to select 9 participants. Two sessions purposively selected for each participant were transcribed and uploaded to NVivo. Transcripts were coded using thematic analysis. So far, analysis of 11 session transcripts has been completed.

The preliminary results suggest that study participants shared information regarding challenges associated with functioning, cancer, and cancer treatment experience, and needs and hopes. The results highlight the importance of offering psychosocial interventions to cancer patients to enable sharing of emotions and challenges in a supportive environment.

GIAVANNA HUNT

College of Engineering
Chemical Engineering

Faculty Mentor: **DR. DEEPTHA SUKUMAR**
Nutrition Sciences

Co-Mentor: Dr. Stella L. Volpe

MAGNESIUM AND VITAMIN D SUPPLEMENTATION ON EXERCISE PERFORMANCE

Magnesium and vitamin D are two micronutrients that contribute to energy metabolism and the maintenance of muscle function. The increased importance of these processes in athletes advances the idea that athletes require greater nutrient quantities than less active populations due to increased energy expenditure. The purpose of this review was to present research on magnesium, vitamin D, and the combination of magnesium and vitamin D on exercise performance. A systematic, keyword search was conducted during the months of June through August 2020. Inclusion criteria required articles to be a clinical trial, randomized-controlled trial, or longitudinal study, and to involve magnesium, vitamin D, or both micronutrients. After reviewing the 392 resulting articles for applicability, 13 studies were included in our review. The evidence and literature suggest that magnesium may provide ergogenic benefits via contributions to muscle function and recovery while vitamin D may positively impact physical endurance and muscle recovery. The metabolic interactions between magnesium and vitamin D may potentiate the functions of each micronutrient, making the combined effects of magnesium and vitamin D greater than the effects of either one alone.

JENNY TSUI

College of Nursing & Health Professions
Nursing

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

CHRONICLING THE IMPACT OF COVID-19 PANDEMIC ON PHYSICAL AND MENTAL HEALTH: PERSPECTIVE FROM CHRONIC WOUND PATIENTS

The COVID-19 pandemic has forged social distancing guidelines that affect people's lifestyles, especially older adults and those with chronic conditions who are at the highest risk for COVID-19 related morbidity and mortality. The impact of COVID-19 on physical and mental health, loneliness, and access to health care in older adults and chronic wound patients are unknown but critical in improving the quality of life (QOL) for those at-risk. The purpose of this ongoing exploratory study is to describe these changes in a cohort of chronic wounds individuals. We conducted an hour-long telephone interview on 8 patients from our clinical trial on ultrasound therapy for chronic wounds (1R01NR015995 PI: Lewin). While data collection is ongoing, participants to date had a mean age of 58.6 years, were majority male, black, and not working outside the home. Since COVID-19, the majority have taken actions to keep safe from COVID-19 and found no new difficulties in their access to health care. 71% would consider a telehealth appointment and 43% are more likely to use it after COVID-19. The study is ongoing but can be used to improve the QOL of at-risk populations as we move forward in healthcare, specifically in telehealth, during a pandemic.

DORNSIFE SCHOOL OF PUBLIC HEALTH

MOBOLAWA ADIO

Dornsife School of Public Health
Public Health

Faculty Mentor: **DR. AMY CARROLL-SCOTT**
Community Health & Prevention

THE QUALITATIVE STUDY OF WEST PHILADELPHIA RESIDENTS ENGAGED IN DREXEL RESEARCH

The goal of the Qualitative Study of West Philadelphia Residents Engaged in Drexel Research was to design, conduct, and analyze semi-structured interviews with the community resident surveyors that who were employed by the West Philly Promise Neighborhood (WPPN). The WPPN is a 5-year, Drexel-led initiative funded by the U.S. Department of Education designed to gain a better understanding of the people children and families living in Philadelphia's Promise Zone in order to create programs to improve their educational and health outcomes.

The surveyors were recruited for interviews through emails and phone calls. The interviews were conducted and recorded through Zoom, lasting no longer than 30 minutes. Recordings were transcribed and then coded through using NVivo qualitative data analysis software. The research team created a structured coding scheme to identify and analyze emergent themes within the transcripts

It was found that despite initial difficulties that surveyors experienced working for Drexel University and being community members, their experiences were largely positive, and they felt that it was important for Drexel University to hire community residents from West Philadelphia for community-based research.

DORNSIFE SCHOOL OF PUBLIC HEALTH

ARYA S. AMARO

Dornsife School of Public Health
Public Health

Faculty Mentor: **DR. AMY CARROLL-SCOTT**
Community Health & Prevention

A QUALITATIVE STUDY OF WEST PHILADELPHIA RESIDENTS ENGAGED IN DREXEL RESEARCH

Community-based participatory research (CBPR) has become an increasingly prevalent method of data collection due to its unique ability to engage community members in academic studies to improve health and social equity in those communities. However, this literature lacks evaluations of the experiences of community members hired as study personnel–a key component of inclusive study design in CBPR.

Two waves of neighborhood surveys have been conducted by community members in partnership with Drexel University under the West Philadelphia Promise Neighborhood (WPPN) initiative. The involvement of the hired community members is invaluable to the project's future success as the participation by WPPN residents is crucial.

We invited all WPPN community surveyors to partake in an interview, and 48% participated. After analyzation, surveying challenge themes were identified (bad weather, visiting an address multiple times), as well as some surveyor proposed solutions (a shared vehicle, daily overview meetings). Our findings also indicate that most surveyors are motivated out of a civic duty, and that being a member of the communities being surveyed was essential in fostering trust between surveyor and community resident survey participant.

MADELINE ROCKETT

Dornsife School of Public Health
Public Health

Faculty Mentor: **DR. PHILIP MASSEY**
Community Health & Prevention

USING STORYTELLING AND TWITTER TO PROMOTE HPV VACCINATION

Human papillomavirus (HPV) causes about 34,800 cases of HPV-associated cancers each year and affects one in four Americans. The HPV vaccine has proved safe and effective in preventing HPV, yet in 2019, only 54.2% of adolescents had completed the vaccine series, well below the national goal of 80%. Vaccine hesitancy is one of the largest current threats to public health. Recent studies show that narrative-focused messages may be effective in shaping health beliefs and behaviors. Additionally, millions of parents use social media for health information, making it a useful tool to educate about the HPV vaccine. This study aims to understand if narrative messages are more effective than non-narrative ones in promoting HPV vaccination to parents who use Twitter as a health information source.

On this project, I built an understanding of vaccine hesitancy and researched stories of peoples' experiences with the HPV vaccine, HPV, and its associated cancers. I drew from narrative engagement and behavioral change theories to analyze these stories and design different vaccine-hesitant narratives and characters to use in our study, where we will expose participants to narrative or non-narrative messages and compare HPV vaccination rates.

DORNSIFE SCHOOL OF PUBLIC HEALTH

ANDREA ELEAZAR

Dornsife School of Public Health
Public Health

Faculty Mentor: **DR. USAMA BILAL**
Epidemiology & Biostatistics

Co-Mentor: Dr. Mariana Lazo-Elizondo

A COMPREHENSIVE ANALYSIS OF THE UNITED STATES IMMIGRANT POPULATION: CHARACTERIZING HETEROGENEITY FOR HEALTH EQUITY

The US immigrant population is projected to grow, contributing to the socioeconomic advancement of the country. Immigrants are those who leave their home country to settle in another. Such a broad term allows for heterogeneity in demographic, socioeconomic, cultural, biological, situational factors and specific public health challenges. This project characterizes the US immigrant population's heterogeneity to inform future public health interventions. We obtained data from the 2018 American Community Survey representing the entire US and the city of Philadelphia, using R and RStudio to analyze it. We compared the US- and foreign-born population among several socioeconomic characteristics. We later divided the foreign-born population into 10 geopolitical categories based on region of origin. Results indicate disparities both between US-born and immigrants and within the immigrant population itself. Future research is needed to investigate heterogeneity's specific role in immigrant health outcomes. Amidst their diversity, understanding their varying needs may help to ensure equitable resource allocation and healthcare delivery.

LAURA KLOUDA

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. MICHAEL J. BOUCHARD**
Biochemistry & Molecular Biology

Co-Mentor: Dr. Srinivas Somarowthu

IDENTIFICATION OF CHANGES IN EXPRESSION OF LNCRNA IN HCC TRANSCRIPTOMES

The purpose of this study was to identify dysregulated long non-coding RNAs (lncRNAs) in hepatocellular carcinoma (HCC) tumors. To do so, we used bioinformatics tools to analyze publicly available RNA-seq data from patient donor samples. After much bioinformatics training, we searched for RNA-seq data of HCC transcriptomes in the public database GEO, selected an ideal dataset, and downloaded the sequence data using Drexel's computer cluster Proteus. We then set up a series of analyses in a bash script pipeline to align the reads to a human reference genome and compare the resulting lncRNA expression levels between benign adjacent and tumor tissue samples. To test this pipeline, we isolated two sample datasets to compare, both from one HCC patient. The results of the pipeline successfully compared expression levels in the transcriptomes and dysregulated lncRNAs were able to be identified. This showed that as we continue running the remaining data through the pipeline, we will be able to gain a fuller picture of expression patterns within the HCC transcriptome and identify dysregulated lncRNAs to investigate further in a lab setting.

RISHA PATEL

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. MICHAEL J. BOUCHARD**
Biochemistry & Molecular Biology

Co-Mentor: Dr. Srinivas Somarowthu

IDENTIFICATION OF VIRAL SIGNATURES IN HEPATOCELLULAR CARCINOMA TRANSCRIPTOMES

Hepatocellular Carcinoma (HCC) is the most common type of liver cancer and makes up approximately 80% of known cases. HCC is often caused by viral infection, primarily Hepatitis B virus (HBV) and Hepatitis C virus (HCV); however, there is little known about their mechanisms and viral signatures. To address this gap in knowledge, we used bioinformatics tools to create and test a data analysis pipeline that identifies RNA transcripts and quantifies their expression relative to the human genome. In our study, we applied this pipeline to both a non-tumor liver tissue sample and an HCC liver tissue sample to produce a list of genes, including AKT1 and CHORDC1, that are differentially expressed within the two tissues. Previous studies have shown that AKT1 is upregulated in tumor liver tissue samples relative to non-tumor liver tissue samples and CHORDC1 is down-regulated, parallel to the results of our pipeline. This pipeline can be used to identify correlations between the genes expressed in HCC, while also being able to identify the expression of viral signatures. This can be accomplished by comparing the RNA to viral genomes, creating the potential to detect viral signatures of HBV and HCV in other cancers, and even other diseases.

DREXEL UNIVERSITY COLLEGE OF MEDICINE

PATRICK HENDERSON

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. IRWIN CHAIKEN**
Biochemistry & Molecular Biology

Co-Mentor: Mr. Erik Carter

MULTI-IMMUNOGEN DNA VACCINES IN PRIME-BOOST IMMUNIZATION REGIMENS: AN ANALYTICAL LITERATURE REVIEW

Even after 40 years of research and immunogen design, scientists still have not developed an effective vaccine for HIV-1. Problems ranging from poor stability within the human body and vaccine resistance caused by mutations to weak and short-lived immune responses have plagued vaccine trials. Two areas of research seek to address these issues: vaccines encoding multiple antigens which can elicit broadly specific T and B cell responses, and prime-boost regimens which can restimulate potent memory cell populations. Both techniques greatly improve the breadth and specificity of polyfunctional immune responses compared to controls and traditional vaccines. By inducing broad cellular responses alongside a humoral/B cell response, a multi-antigen DNA plasmid vaccine within a prime-boost immunization regimen will elicit a broader range of protective immunity, a possible concern for viruses such as SARS-CoV-2. This literature review synthesizes DNA vaccine research using a multi-antigen and/or prime-boost approach. It covers the benefits and disadvantages of DNA vaccines, how adjuvants optimize their immunogenicity through bioengineering and vaccination strategies, and how their success could aid current efforts against ongoing epidemics.

PETYO MANEV

College of Engineering
Chemical Engineering

Faculty Mentor: **DR. IRWIN CHAIKEN**
Biochemistry & Molecular Biology

Co-Mentor: Dr. Gabriela Canziani, Aakansha Nangarlia

COMPARISON BETWEEN SARS-1, SARS-2, AND HIV-1 AND THE TRANSFERABLE PROPERTIES OF DLIS

Despite nearly 40 years of ongoing research on HIV-1, there is still no antimicrobial available that can irreversibly inactivate the virus. Had not HIV-1 been enough, we are now faced against another major health crisis – the COVID-19 disease.

There have been significant findings in the fight against COVID-19, with multiple pharmaceutical companies entering the clinical stages of developing a vaccine to cease the spread of the virus. The majority of the vaccines target a specific region of the virus called the Receptor Binding Domain, with the goal of neutralizing the virus. However, in our lab, we studied another way of controlling the virus and that is by using the knowledge and experience the group had with HIV irreversible inactivation.

Our research lab designed and engineered a novel molecule called Dual Lytic Inactivator (DLI) which was originally intended to combat HIV, but my work throughout the summer involving comparing HIV and CoV-2 sequences of the surface protein showed that there was enough similarity between the domains of these two viruses domains to hypothesize that the inhibitory effect of the molecule could transfer on to COVID-19.

DREXEL UNIVERSITY COLLEGE OF MEDICINE

AASHA GUPTA

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. POOJA JAIN**
Microbiology & Immunology

NON-CANONICAL WNT SIGNALING PATHWAY IN BONE MARROW DENDRITIC CELLS

Dendritic cells (DC) are antigen-presenting cells that mediates innate and adaptive immune responses in the host. Genes that regulate the differentiation of DC has been a subject of investigation because of its similarity to other myeloid lineages such as monocytes and macrophages. Previously, the Jain lab performed the epigenetic analyses, utilizing next generation sequencing of bone marrow derived CD11c+ DCs (BMDCs). The combined analysis of the DNA methylome by Reduced Representation Bisulfite Sequencing (RRBS) and the transcriptome by RNA-seq identified a hypermethylation and a reduction in gene expression of Wnt5 signaling. The Wnt5 gene family is implicated in cell fate determination and embryogenesis. The aim of my project was to identify Wnt signaling pathway and assess the fold changes in the gene expression from the BMCDs RNA sequencing data. The results show that BMDCs utilize the noncanonical Wnt signaling pathway to regulate the gene transcription. The networks of genes in this pathway collectively regulate cell polarity and migration and have also been implicated in cancer. We will further confirm the transcription regulation via non-canonical Wnt signaling pathways in BMDC by molecular and biochemical assays.

NADIA N. BOURAS

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. WEN-JUN GAO**
Neurobiology & Anatomy

Co-Mentor: Ms. Nancy R. Mack

THE IMPACT OF ADOLESCENT SOCIAL ISOLATION ON SOCIAL AND EMOTIONAL BEHAVIOR IS MEDIATED BY PREFRONTAL PARVALBUMIN AND SOMATOSTATIN-EXPRESSING INTERNEURONS

With continuous efforts to reduce the spread of COVID-19 via public health mandates, the unexpected shift to social distancing may have detrimental effects on our youth that could last much longer than the safety guidelines themselves. Here, based on literature review, we hypothesize that alterations to distinct classes of inhibitory GABAergic interneurons, particularly parvalbumin (PV) and somatostatin (SST) interneurons in the prefrontal cortex (PFC), may contribute to the social and emotional behavioral deficits associated with a lack of social experience adolescence. This project may give insight on the adolescent mind and has the potential to explore neurobiological issues that may arise as a result of the pandemic. We conclude both PV and SST interneurons in the PFC undergo a delayed maturation during adolescence, however, differing developmental stages occur in each cell-type. A lack of social experience during this sensitive period will likely lead to a PV hypofunction, resulting in social deficits seen in psychiatric disorders. However, the specific changes in SST cells after adolescent social isolation has not been well explored despite the recent evidence highlighting the crucial role of SST in emotional regulation.

Velay Fellow **Summer 2020**

INARA PIRANI

Bennett S. LeBow College of Business
Finance

Faculty Mentor: **MR. ADAM ZAHN**
Office of Global Engagement

Co-Mentor: Professor Dana D'Angelo

A VIRTUAL PASSPORT: IDENTIFYING THE SHARED KSA OF VIRTUAL EXCHANGE

Students in higher education have traditionally engaged globally through mobility programs–either through direct exchange, third party organizations, or faculty-led programs. However, reports have ndicated that only 14% of university students actually go abroad. Systemic barriers such as financial stressors, curriculum rigidity, and advising resources often prevent them from participating. In order to expand
opportunities for global engagement, many universities have implemented virtual exchange programs, known at Drexel University (USA) as the Global Classroom (GC). These courses engage students with their peers abroad by using technology. This qualitative study explored the knowledge, skills, and attitudes (KSA) that students gained during their time in the GC. Focus groups of students from business, engineering, and modern language GCs were asked their opinions of the class. After analyzing their responses, it was determined that students across disciplines gained knowledge on teamwork, enhanced their multicultural communication skills, and developed positive outlooks for future global engagement. This study supports the GC pedagogy for global engagement, and will be used to enhance the curriculum of the program.

ALEXA GAMBURG

Bennett S. LeBow College of Business
International Business

Faculty Mentor: **PROF. JENNIFER AYRES**
Academic Programs

SUSTAINABILITY AND ZERO WASTE AS A SOCIAL MOVEMENT

Recycling has been considered an optimal solution for waste management for many years however, it does not eliminate the production of waste or plastic pollution and is not effective when considering environmental conservation. In hopes to solve waste pollution, many academics refer to zero waste as a solution that promotes a circular economy and higher standards of sustainability. For this research, the objective was to analyze how zero waste is spreading as a social movement and to identify current barriers that prevent people from supporting it. Through literature review, content analysis, and 11 open-ended interviews I was able to identify certain characteristics of the movement that make it exclusionary rather than intersectional. 8 out of 11 interviewees showed a relationship between education levels and whether sustainability was thought of as a systemic or individualized problem- lacking higher education corresponded to thinking of sustainability only in terms of lifestyle and consumer choice. The interviewees who had advanced education demonstrated the notion sustainability should be addressed on an industrial level and systemically in order to make large scale change.

LEAH WINKLER

Antoinette Westphal College of Media Arts and Design
Fashion Design

Faculty Mentor: **PROF. JENNIFER AYRES**
Academic Programs

FASHION FOR THE AVERAGE SIZE WOMAN

68% of American women are plus-size, and yet, they are not catered to as a valuable market. In this project, I set out to research this problem and collaborate with my plus size mother in designing garments that flatter her. I also constructed a survey, that received 67 responses, for plus-size women about their experiences getting dressed and what they wanted from clothing.

I discovered that plus-size women just want to be accepted and treated like everyone else. However, this is not the case due to fatphobia. My respondents could not understand why they were ignored as a valuable market. Plus-size women think "it seems odd for an industry that refuses making money from a willing and excited market." Not only is fatphobia cultural, but it's also racial as cultural norms differ for women of color versus white women.

I received very conflicting ideas about what women want. Some just want to be treated like everyone else, while others want to be looked up to. This led to the question of how would our world be restructured if plus-size was considered the norm? What if they weren't just an afterthought, but designed for?

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

HANNAH BROWN

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

Faculty Mentor: **DR. HASAN AYAZ**
Biomedical Engineering

OPTICAL BRAIN IMAGING FOR KIDS WITH AUTISM AND AIBO ROBOTIC DOG INTERACTION

Functional near-infrared spectroscopy (fNIRS) is an emerging technology that uses light to measure hemodynamic changes in the brain. Compared to other neuroimaging devices, it is quiet, mobile and less constraining thus more practical in social and interactive settings. One experiment uses fNIRS in measuring the brain activity of typically developing (TD) and autistic (ASD) children. The project aims to understand neural activity underpinning the social interaction and how this is impacted in ASD compared to TD. My contribution was to implement experimental tasks in Psychopy to produce a sequence of social, non-social, or inanimate image presentation to be viewed by participants as their brain activity is recorded. The second experiment demonstrates the behavioral range of human-robot interaction with Sony's robotic dog, Aibo. Participants' interactions were coded using behavioral measures, including Aibo task success, duration, and participant social behavior. Ideas from both projects show the relationship between humans and technology through physical behavior and hemodynamic response. The fNIRS study shows differences in brain activity between TD and ASD children as they perceive and interact with the world. The Aibo study shows how positive human-robot interaction and Aibo performance can be improved. Together, future studies could demonstrate the neurological advantages of socially-diverse robotic bonding.

Summer 2020

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

IWUEZE WISDOM OLUWATOBI

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

Faculty Mentor: **DR. HASAN AYAZ**
Biomedical Engineering

CLASSIFYING IMAGINED FINGER MOVEMENTS FROM EEG SIGNALS

Locked-in Syndrome refers to a condition characterized by a conscious mind in a body that has lost almost all motor functions, including the ones required to produce speech. As patients with the syndrome require constant care, it is essential to provide them with some means of communication with those around them and interaction with the environment. This project investigates the possibility of decoding finger movement imagery based on EEG signals in order to establish communication with locked-in patients. As EEGs are limited by their low spatial resolution, classification of EEG recordings into five labels, thumb, index, middle, and ring finger imageries, was attempted. Overall decoding accuracy was 47.47%, which was significantly higher than the upper confidence limit, 20.6% ($p<0.05$), with a maximum accuracy of 75.53% recorded. Additionally, mean precision-recall curves of all labels for all classifiers lay above the baseline curves, with thumb and little finger imageries having the largest iAUCs. These results thus indicate that it is possible to capture imagined finger movements and fine-grained mental states using wearable and non-invasive sensors.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

MARC KARAM MOUNZER

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

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

ESTIMATION OF THREE-DIMENSIONAL DIAPHRAGM MORPHOLOGY IN NORMATIVE PEDIATRIC SUBJECTS

INTRODUCTION: The diaphragm is the muscle responsible for respiration, attaching to the ribs and spine. Because there is limited data on diaphragm morphology in normative pediatric subjects, the objective of this study was to derive 3D measurements from segmented diaphragms in this specific population. **METHODS**: CT scans from 95 normative male and female subjects ages 1-18 years were obtained from the Children's Hospital of Philadelphia. The diaphragms were segmented from CT scans using 3D Slicer. Diaphragm height, hemidiaphragm widths, and hemidiaphragm depths were derived using custom MATLAB code. **DISCUSSION**: Diaphragm width can be estimated as a function of age with a high coefficient of determination ($R^2 > 0.77$). Hemidiaphragm height (male and female) cannot be estimated as a function of age with a low coefficient of determination ($R^2 < 0.50$). Body mass index may also affect diaphragm morphology. **SIGNIFICANCE**: Diaphragm segmentation in normative pediatric subjects can be applied to study diaphragm morphology in subjects with early onset scoliosis.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

HANNAH TESON

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

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

Co-Mentor: Ms. Ausilah Alfraihat

3D MORPHOMETRIC DATA OF IMMATURE PIG VERTEBRAE

Spinal disorder research has used computational models to predict the outcomes of experimental trials, but most models are human based, so predictive outcomes for animal trials are limited. This study aims to recreate the 3D geometries and gather morphometric data of immature pig spines. Using MIMICS, the T1-L6 vertebrae and ribs of three immature pigs (6 wks, 9 wks, and 18 wks) were reconstructed and converted to 3D point clouds. These data were input into a MATLAB code to measure each vertebra's vertebral body heights (VBHs), and then into ImageJ to measure the kyphosis and lordosis angles. The average thoracic VBHs for the 6 wks, 9 wks, and 18 wks old pigs were 13.1 mm, 16.6 mm, and 23.3 mm, respectively. The average lumbar VBHs for the 6 wks and 9 wks old pigs were 16 mm and 19.2 mm, respectively. The average growth rates of the thoracic and lumbar vertebrae were 0.14 mm/day and 0.15 mm/day, respectively. The kyphosis angles for the 6 wks and 9 wks old pigs were 31.6° and 40.1°, respectively, while the lordosis angles were 20.8° and 3.4°, respectively. Future research should focus on a broader range of ages.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

PEARLE SHAH

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

Faculty Mentor: **DR. STEVEN M. KURTZ**
Biomedical Engineering

ADDITIVELY MANUFACTURING PATIENT-SPECIFIC POROUS IMPLANTS FOR SHEEP TIBIAE

Of the 6 million fractures that occur annually in the U.S., about 1.9%-15% cause non-union, which is the body's inability to heal a bone defect for several months at a time. Factors such as the bone's size, anatomical location, or the patient's underlying health issues can influence non-union. The development of porous structures can be useful in promoting the healing of such defected bones; however, they can be challenging to incorporate in implants using traditional manufacturing methods due to their complexity and size. In order to achieve such structures in an implant, a sheep DICOM set was used to generate a 3D-model of the tibiae which allowed for a critical-sized defect to be resected from the bone. Then, MathMod and Blender were utilized to generate a diamond triply periodic minimal surface in the shape of the resected bone. This structure was then sliced and 3D-printed to produce a fully porous implant that was patient-specific for the sheep tibia. This workflow will be particularly useful in producing implant structures that closely mimic the properties of a patient's bone while also being patient-specific. Future work will include optimizing the design of this implant before animal trials are conducted.

Velay Fellow **Summer 2020**

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

JULIA TAGLIAFERRO

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

Faculty Mentor: **DR. STEVEN M. KURTZ**
Biomedical Engineering

FEMUR IMPLANT DESIGN FOR USE IN RABBIT MODELS

Femur fractures are one of the most painful injuries humans can endure and they can result in a host of complications. These include improper bone setting, limited mobility, immune problems, and death soon after fracturing. In order to reduce the risk of complications, surgical implants are used to strengthen the bone and help it heal in the correct shape. Implants are tested using animal models to ensure their quality without putting humans at risk; therefore, the implant design in this research is intended for use in a rabbit model. CT scans of a rabbit femur were provided by the mentor and, using the DICOM reader InVesalius, they were read from 2D images into a 3D model. The femur model was rendered in Fusion360 where a fracture was simulated in the bone. The implant design explored in the report R*eamed Locked Intramedullary Nailing For Studying Femur Fracture And Its Complications* published in the journal *European Cells and Materials* was used as a basis for the implant in this research. The implant was successfully modeled to scale in Fusion360 and 3D printed using the Ender 3 Pro printer. Due to the remote nature of the research, the implant could not be tested in live animal models.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

CAROLINE VITKOVITSKY

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

Faculty Mentor: **DR. KAMBIZ POURREZAEI**
Biomedical Engineering

Co-Mentor: Ardy Wong

ARDUINO VIA MATLAB

The objective of my project this summer was to translate an existing Arduino code, which runs an fNIR (functional near-infrared imaging) to track hemodynamic changes in brain tissue, into MATLAB syntax. Within my mentor's lab, this would allow for the combination of the Arduino code with a MATLAB graphical user interface (GUI) that gathers and interprets the resulting data.

I began with the study of codes on MathWorks, the MATLAB website, that are designed to control Arduino devices, and learned commands for connecting the Arduino device to MATLAB software, controlling power to it, and writing to its individual pins. I then wrote simple MATLAB programs for an Arduino Due board, such as blinking an LED for a set number of iterations. Finally, I walked through the Arduino code one section at a time to learn what specific actions it performed, and translated it line by line into MATLAB syntax.

At the end of the ten week period, I had recreated the original Arduino script in MATLAB so it could be combined with the GUI to make the process of data collection/analysis with this program simpler and more streamlined. I also created a spreadsheet of corresponding MATLAB and Arduino commands, which can be used for similar projects in future.

Velay Fellow **Summer 2020**

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

ETHAN JACOB MOYER

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

Faculty Mentor: **DR. AHMET SACAN**
Biomedical Engineering

MEASURING PROTEIN STRUCTURE DEVIATION USING MACHINE LEARNING

Identifying the native 3-D structure of a protein is a common problem in bioinformatics. Previous methods of 3-D structure prediction have focused on energy minimization to find thermodynamically favored structures. However, a more optimal approach is to directly estimate the energy deviation of a decoy structure from its native structure. This work proposes a framework utilizing three metrics to predict the deviation of 3-D structures: the Rosetta score function, the Mean Squared Error (MSE) of a decoy contact map compared to that of the native structure, and the contact map prediction of decoy structures. These approaches are validated using datasets of 5-10 amino acid alpha-helical fragments. 3-D Convolution Neural Network (CNN) models are trained on these datasets to predict the absolute energy of a decoy protein and its deviation from the native structure. Moreover, the contact map of a protein is predicted from its amino acid sequence and the 3-D structure is generated from the predicted contact map; achieving an average Root Mean Squared Deviation (RSMD) of 2.14 Å. The predicted energy and the relative structural deviation values produced from our models can be integrated into molecular simulations of 3-D structures.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

KHANG DUONG

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

Faculty Mentor: **DR. CATHERINE VON REYN**
Biomedical Engineering

NEURAL PATHWAYS RESPONSIBLE FOR SENSORIMOTOR TRANSFORMATION

Sensorimotor transformation is the process by which sensory information is converted by the brain into an appropriate motor response. It is important to understand the neural circuits that underlie this process as animals must be able to detect and react to changes in the environment for survival. We examine these circuits in *Drosophila melanogaster* as its entire brain was recently imaged with electron microscopy (EM) for easy identification of circuit connectivity. We study a population of descending neurons (DN), which receive inputs from sensory neurons and then project down in the spinal cord to activate motor neurons. It is hypothesized that DN are involved in generating behavioral responses, but their interconnectivity in the brain is unknown. Here, we look for novel direct and indirect connections (interneurons) between DN to understand communication within the DN network. Analyzing the EM dataset, we find that DN are heavily connected in the brain via direct and indirect connections through 60 interneurons. These data support DN function as a highly interconnected network to select and coordinate behaviors and reveal biological network structures that may shed light on sensorimotor network connectivity in larger brains.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

CONNOR ZABIELSKI

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

Faculty Mentor: **DR. CATHERINE VON REYN**
Biomedical Engineering

Co-Mentor: David Goodman, Dr. Jessica Ausborn

THE PATTERNED CONNECTIVITY OF LOBULAR COLUMNAR NEURON CELL-TYPES

In the wild, organisms use visual information to react to their environment. This is made possible by neural circuitry in the visual system that provides information about what stimulus they see and where it is located. However, what is the underlying connectivity that encodes the "what" and "where" aspects of visual information? Here, we address this by examining the connectivity of a class of neurons in the model organism Drosophila melanogaster that plays a role in encoding these two salient pieces of visual information: lobular columnar (LC) neurons. We examine their interconnectivity by using an electron microscopy dataset of the Drosophila hemibrain. The connectivity data reveal that LC neurons form stronger connections with neurons of the same type and that these connections are predominantly axo-axonic. This connection modality has been suggested to amplify signals and has been found in LC6 to maintain spatial mapping. The LC4 cell-type was studied closely due to its role in escape circuitry. Here, we present data that show it receives substantial input from other cell-types and that suggest it maintains spatial mapping. These findings elucidate the connectivity underlying the "what" and "where" of visual information.

FALL / WINTER 2020 ABSTRACTS

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

HANNA PISTORIUS

College of Arts & Sciences
Environmental Studies & Sustainability

Faculty Mentor: **DR. ANDREW ZITCER**
Arts Administration, Museum Leadership,
Graduate Urban Study

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ARTISTS AND CREATION IN THE CREATIVE ECONOMY

As artists work to engage in the creative economy, they must attune themselves to necessary business skills, while remaining adaptable and prepared for risk. In assisting in the development of a survey related to how artists thrive in the creative economy and how they may be better supported, I developed an independent project stemming from the same ethos. This project centers how working artists' approach to creating may differ when the work is monetized. Methods of exploring this theme were researching relevant literature and interviewing artists based in and around Philadelphia. Findings were then processed creatively through hand embroidered pieces. The two embroidery pieces that came out of this depict how coalescence of many factors forms the approach to creation and the vitality of presence in one's creative work as artworks transform throughout the process of creation.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

NIA MCCUNE

Antoinette Westphal College of Media
Arts & Design
Entertainment and Art Management Major

Faculty Mentor: **DR. BREA HEIDELBERG**
Entertainment and Arts Management

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THE INTELLECTUAL GREEN BOOK

The arts field is largely unwelcoming to artists and art administrators of color (Serna & Herndon, 2020). Due to the lack of established human resource standards, this industry lacks set systems to protect them. The importance of survival within this field causes Black women and Black non-binary individuals to create self-preservation tactics and coping skills to participate and succeed in this predominantly white field. This project will look at the specific intersectionality of being a Black woman or Black non-binary person in the nonprofit arts. Using survey data, this study will show the connection between race and gendered trauma and the coping mechanisms used to survive and create better spaces for those who come after.

ANTOINETTE WESTPHAL COLLEGE OF MEDIA ARTS & DESIGN

PHOEBE JAY FRY

Antoinette Westphal College of Media
Arts & Design
Film & TV

Faculty Mentor: **PROF. JOCELYN ROSE TARQUINI**
Film and Television

,

DUNES

"Dunes" is a short documentary style film chronicling surfer Mark Warfield's time in Amagansett, New York . He talks about growing up in the dunes, learning to surf, and later passing on the legacy to his children. Footage for this film was shot by me over the course of summer 2020. I then edited and sinked the film with a fitting score. The goal of the project was to get more comfortable with the documentary style and to better my editing craft.

MOHAMMAD ALAVI

Bennett S. LeBow College of Business
Economics

Faculty Mentor: **DR. MARK STEHR**
Economics, Health Management and Policy

,

IMPACT OF TEMPERATURE AND LAGGED TEMPERATURE ON THE TRANSMISSION OF CORONAVIRUS

The Covid-19 pandemic has led to a widespread increase in mortality and economic distress. Policymakers can better respond to the crisis if they are able to predict the evolution of Covid caseloads. This study utilizes data from NOAA and New York Times to estimate the impact of temperature on COVID-19 cases on a daily basis across 2,326 counties in the US from March to December 2020. The results show raising the minimum temperature increases COVID cases. Future work should establish the effect of other predictors and anti-Covid policies on transmission.

Keywords- COVID-19, temperature, transmission, infectious disease, time lags

JACK IVIE

College of Arts & Sciences
Environmental Science

Faculty Mentor: **DR. TED DAESCHLER**
Biodiversity, Earth, and Environmental Science

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NEW FOSSIL MATERIAL OF GROENLANDASPIDIDAE (PLACODERMI, ARTHRODIRA) FROM ANTARCTICA

Over the 2016 and 2018 field seasons, scientists from the Academy of Natural Sciences collected fossil specimens from the Aztec Siltstone of southern Victoria Land, Antarctica. The fossils included a variety of Devonian fish groups including new material of the arthrodire placoderm family, groenlandaspididae. There are two Groenlandaspidid species known from Antarctica, Groenlandaspis antarcticus and Boomeraspis goujeti. Taxonomic relations within the groenlandaspidids are not well resolved and new genera have made the namesake genus, Groenlandaspis, difficult to define. The comparative approach to fossil identification was taken, focused on known Antarctic groenlandaspidids and their diagnostic plates, the median dorsal plate and posterior dorsolateral plate. We found that the two median dorsal specimens ANSP# 24279 and ANSP# 26217 display features that are groenlandaspidid, but not of either known Antarctic genera. The posterior dorsolateral plate impression, ANSP# 26077, shares similar features to G. antarcticus but differs in proportions. The two MD specimens are similar to known undescribed forms from Australia. ANSP# 26077 shares G. antarcticus features but differs in its proportions, suggesting a new species.

ELIZABETH OTRUBA

College of Arts & Sciences
Environmental Science

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

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SEASONALITY AND SUCCESSION OF BIOFOULING COMMUNITIES IN BARNEGAT BAY, NJ

Biofouling communities refer to those aquatic organisms that attach to submerged substrate and form colonies. The organisms can be anything from bacteria and algae to barnacles and mussels. The substrate they attach to can be rocks, shells, dock pilings, boats, or artificial substrate samplers. In Barnegat Bay, New Jersey, these biofouling communities are an essential component of the ecosystem. The assemblages of organisms attached to substrates provide habitats for other aquatic organisms, perform extremely important carbon sequestration, and supply the ecosystem with the biodiversity that aids in resilience and conservation. Through time and with seasonal changes, the structure and composition of biofouling communities change. Because of this, studying the successional patterns and seasonality of biofouling communities is important when looking to conservation efforts in Barnegat Bay. By placing artificial substrate in the bay, samplers called Hester Dendys made of ceramic plates, we will be able to observe how the biofouling communities develop over time (succession) and how they change with the seasons (seasonality).

MIKAYLA E. TRAINI

College of Arts & Sciences
Environmental Science

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

Co-Mentor: Mr. Zachary J. Smith

CARBON SEQUESTRATION OF BIOFOULING COMMUNITIES IN BARNEGAT BAY, NEW JERSEY

Estuarine biofouling communities within Barnegat Bay, NJ have the potential to serve as important factors in carbon sequestration. In this literature review/study plan, we seek to elucidate the temporal and spatial variation within successional patterns of these communities. Based on the literature, we will place 36 Hester Dendy Samplers at each of 3-4 sample locations in the bay for a twelve-month period, return once a month to remove samplers from each site for analysis, and replace them with new samplers to be removed in the last month of our study. So far, we have left 5 Hester Dendy Samplers at the bay for 12-months. Once removed and brought back to the lab, the organisms on the samplers will be identified and scraped off, dried, and weighed initially. The dried samples will then be placed in a muffle furnace to burn off the carbon. These organic material samples will then be weighed again and compared to the original weight to see how much of the mass was carbon. This will give us an idea of how much carbon biofouling organisms can sequester from the water column during peak productivity (summer months). We will also be utilizing data loggers to measure water temperature, salinity, and conductivity.

FELICITY KHOA

College of Arts & Sciences
Biological Sciences

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

Co-Mentor: Ellen Armour

OPTIMIZATION AND QUANTIFICATION OF TIP60 HAT/ HDAC2 SUBCELLULAR LOCALIZATION IN AN IN VIVO DROSOPHILA MODEL OF ALZHEIMER'S DISEASE

Alzheimer's Disease (AD) is one of the most prevalent neurodegenerative diseases in the world. However, there lacks a comprehensive understanding of the disease, resulting in minimal effective treatment options. Previous studies have shown reduced expression of the histone acetyltransferase (HAT) Tip60 in the AD brain. Although Tip60 HAT's role in gene regulation is well characterized, its role in neuroprotection has only recently been explored. Identifying the mechanistic relationship between Tip60 and neurodegenerative diseases such as AD will open up more directions for effective treatment options. The present study investigates the subcellular localization of Tip60 in our well-characterized amyloid precursor protein (APP) Drosophila model of AD using immunohistochemistry. Larval and adult Drosophila brains were dissected in vivo and imaged through confocal microscopy and analyzed on ImageJ. A refined method of antibody staining was developed to accurately discern between cytoplasmic and nuclear Tip60. Results revealed a marginal decrease in Tip60 in our early stage AD model in comparison to the wild-type, suggesting further work on a late staged AD model to confirm a progressive decrease in Tip60.

NEHA CHONGTHAM

College of Arts & Sciences
Biological Sciences

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

Co-Mentor: Ellen Armour

DOPAMINE AGONISTS RESCUE LOCOMOTION DEFICITS INDUCED BY ALZHEIMER'S DISEASE

Alzheimer's Disease (AD) is considerably one of the most menacing diseases as it causes the progressive deterioration of a person's memory, cognitive functions, and locomotion. Presently, there are minimal noninvasive treatment options that can slow down the rate of AD progression and reduce its induced symptoms. Therefore, in order to find more treatment options, SK609 drug compounds previously found to treat symptoms of Parkinson's Disease were tested in AD by specifically looking at their ability to rescue deficits in locomotion in a Drosophila melanogaster model. SK609 is a selective small molecule agonist of the Dopamine D3 receptor (D3R) with atypical signaling properties. Previously, SK609 has been successful in reducing impaired immobility in hemiparkinsonian rats. However, to assess whether this specific drug can rescue mobility deficits induced by AD, locomotion assays were conducted for different concentrations of SK609 agonists, referred to here by C1, C2, and C3. Amazingly, this study shows that SK609 rescues deficits in locomotion induced by AD. Thus, this provides a new outlook on a possible non-invasive treatment that can be implemented for the aging human population suffering from AD.

CASSANDRA L. MIKKELSON

Pennoni Honors College
Custom Designed - Neuroscience

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

Co-Mentor: Ellen Armour

OPTIMIZATION OF A SIMPLE COGNITION ASSAY FOR USE IN NEUROPROTECTIVE DRUG SCREENS

Alzheimer's Disease (AD) is the leading cause of dementia across the world, characterized by the accumulation of neurotoxic amyloid-? peptides in the nervous system. There are many efforts to cure AD, and the search for drug therapies to extend a better quality of life and/or delay the onset of AD are more promising at this time. The learning and memory cognition assay was previously created to identify potential deficits in cognitive function in different Drosophila disease models. By modifying this original protocol, we can better optimize this assay for drug screening. It is found to be more efficient, in time and quality of data, to separate individuals by performance index, and specifically focus on those with high performance (HP) levels. HP have proven to show a significant difference in cognitive function between the wild-type and AD models, revealing cognitive defects in AD that can potentially be restored by neuroprotective drug compounds. Meanwhile, other methods have not proven to show equivalent differences. The next step would be to implement the HP collection method to screen potential drugs for AD therapies.

NAOMI JANE FRIEDMAN

College of Arts & Sciences
Environmental Science

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

Co-Mentor: Ian Nichols

AN ANALYSIS OF THE BIODIVERSITY IN WEST AFRICA

With an ever growing human population, we are constantly expanding and encroaching on wildlife habitats. In conservation biology it's important to understand how we impact different species and how we can learn to mitigate that human-wildlife conflict. In the Gonder Lab, Ian Nichols focuses on the use of camera traps to understand changes to mammal communities across human landscapes and protected areas in Cameroon and Bioko. This project will impact local land owners, small stakeholder agricultural development, and it will help the world of conservation biology better understand the specific impacts of human activity in western Africa. To begin to gain further understanding of biodiversity in Cameroon, analysis started with camera trap footage taken in Mbam Djerem National Park. After information for the initial pilot data was entered using distance sampling methods, the data was passed through a distancing software. During initial analysis, a species guide for western Africa was created as a tool for future education and research. Finally, a coloring book of species seen in Bioko was started as an accessible educational tool for conservation, to be used by both Drexel students and potentially students in Bioko.

DISHA PATEL

College of Arts & Sciences
Chemistry

Faculty Mentor: **DR. ALEISTER SAUNDERS**
Biology

Co-Mentor: Dr. Swathi Swaminathan

UNDERSTANDING THE ROLE OF PRIMARY CILIA IN ALZHEIMER'S DISEASE PATHOGENESIS

Alzheimer's disease (AD), a progressive neurodegenerative disorder, is one of the leading causes of death in the United States. A central event in AD pathogenesis is the accumulation of Amyloid-β (Aβ) plaques on the brain, leading to impaired neuronal function and ultimately, cognitive decline. Aβ plaques are formed from the proteolytic Aβ peptide, a by-product of amyloid precursor protein (APP). Recently, we observed the unique effects of these molecules on primary cilia. Cilia are non-motile, sensory antennae that are essential in regulating fundamental neurophysiological activities. Defects in the primary cilia lead to impaired neurogenesis which is also compromised in AD. We have shown that Aβ can disrupt primary cilia structure and cause APP to co-localize at the primary cilium. Only specific proteins are trafficked to the cilium and they are mediated by the cilia targeting sequences (CTS). We have identified 7 putative CTS in the human APP protein. We utilized site directed mutagenesis to create mutants of these putative motifs to determine if these motifs direct APP to the primary cilia. This will help shed light on the role of cilia in AD pathogenesis.

LUPHI GAO

College of Engineering
Mechanical Engineering

Faculty Mentor: **DR. HAI-FENG JI**
Chemistry

COLLECTIVE BREAKAGE OF HYDROGEN BOND IN HEXAGONAL ICE CRYSTAL

Ice can assume up to eighteenth different crystalline phases. Hexagonal ice crystal, I_h, where the subscript *h* denotes the hexagonal symmetry of its crystal structure, is the most common form of ice. The structure of I_h can be considered as being composed of crinkled interconnected hexagonal planes. Each water molecule makes three hydrogen bonds with its neighboring molecules within the plane and one hydrogen bond with the adjacent plane. In this project, the collective breakage of hydrogen bonds in hexagonal ice crystals is investigated. We observed that when a force is applied to an ice disk, the ice disk break into six pieces from the point of contact in a symmetrical manner, indicating a collective breaking of the hydrogen bonds in the ice crystal. This anisotropic behavior of I_h is relevant as it provides the grounds to understand the flow behavior of ice sheets, the viscosity of ice, etc.

ALI ZAIN KHAN

College of Engineering
Mechanical Engineering

Faculty Mentor: **DR. HAI-FENG JI**
Chemistry

RESEARCH MANUSCRIPT ON THE SYNTHESIS, PROPERTIES, AND APPLICATIONS OF 2D METAL-ORGANIC FRAMEWORKS (MOFS)

This work involved preparing a manuscript regarding research carried out on the properties of a two-dimensional Metal-Organic Framework (MOF). A considerable amount of research papers investigating the semiconductive, electric, and optoelectronic applications of 2D MOFs were reviewed and analyzed to extract relevant information that could be used to draft the manuscript. This work involved actively searching for relevant research papers addressing the research topic, organizing the research papers based on research topic and relevancy, analyzing the abstract and the research paper to gather relevant information about the behavior of 2D MOFs under certain conditions, learning to interpret and compare data from lab experiments and research papers, understanding the content of each research paper and research methodology, and summarizing the relevant information in paragraphs of text supported through figures. This work was important for the submission of a research manuscript for publishing, detailing the investigated properties of 2D MOFs and their behavior which has many applications in the fields of electronics, biology, chemistry, and energy storage.

ANDREW PHILLIPS

College of Arts & Sciences
Physics

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

Co-Mentor: Dr. Pierce Weatherly

ANALYSIS OF PROSPECT NEUTRINO DETECTOR REACTOR-ON ENERGY SPECTRA

The Precision Oscillation and Spectrum experiment, or PROSPECT, is a collaboration that seeks to make a precise measurement of the flux and energy spectrum of antineutrinos ($\bar{\nu}_e$) emitted from nuclear reactors. Utilizing Li-6 doped liquid scintillators and an 11x14 grid of PMTs, PROSPECT seeks to address the reactor flux anomaly: one of the current inconsistencies in particle physics wherein modeled $\bar{\nu}_e$ flux mismatches the spectra of $\bar{\nu}_e$ directly detected via IBD. PROSPECT most recently collected data in 2018 and is now in the process of upgrading their detector. Among the planned upgrades is a proposed alteration in the method of detector calibration. Instead of using deployed radioactive sources within the detector, PROSPECT plans to calibrate its new detector using natural radioactivity on a segment-by-segment basis. I have performed analysis of prompt singles spectra of old PROSPECT-I data. By taking in the aggregated prompt singles spectrum, separating by segment, and applying an error-corrected gaussian fit to energy bumps, I have determined with considerable accuracy the locations and amplitudes of said bumps. Later, PROSPECT will use this data to finely tune the detector's energy scale and improve data collection.

THOMAS RUGGIERO

College of Arts & Sciences
Physics

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

Co-Mentor: Dr. Pierce Weatherly

BACKGROUND ANALYSIS OF IBD ENERGY SPECTRA AT PROSPECT

I have analyzed data from PROSPECT, a reactor neutrino experiment, aiming to identify features in the spectrum of background energy for use in the calibration of future analysis and the second iteration of PROSPECT's detector, P-II. My analysis has been completed using CERN ROOT, an open-source data analysis framework designed for high energy physics. To the calibrated by-segment background spectrum, I have applied both a standard gaussian fit as well as a special gaussian fit with an error function correction to two distinct features of the background spectrum. These features occur at ? 2.05 MeV and ? 2.45 MeV, with PROSPECT calibration and liquid scintillator quenching offsetting these peaks from their true values by ? -0.15 MeV. Additionally, I have identified the sources of background located at these peaks, which result from Bismuth-214 and Thallium-208 respectively. P-II will not have interior radioactive sources deployed for calibration, thus the simulation of these sources in the future will be used to calibrate P-II's energy scale on a segment-by-segment basis.

RENAE K. TINGLING

College of Engineering
Chemical Engineering

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

ANALYSIS OF CURRENT ORGANIC ELECTROSYNTHESIS RESEARCH AND ITS FEASIBILITY FOR INDUSTRIAL APPLICATION

Modern society is shifting towards sustainable synthesis methods. Organic electrosynthesis may be a suitable alternative to existing production methods. Organic products can be generated with low emissions by replacing toxic reagents with a "clean" electric current. There are, however, limitations which dispute the environmental compatibility of electrosynthesis and hinder its large-scale commercial application. These include a high level of CO_2 production, low conversion of reactant, low selectivity of desired products and high cost due to high energy consumption depending on the involved reactants and products. This research examines the current state of electrosynthesis research in order to identify conditions and products that reduce the impact of these limitations. This objective was achieved through analysis of the scientific literature on propene and cyclohexane oxidation. This analysis considered economic viability and environmental impact of varying propene oxidation products and cyclohexane oxidation catalysts. It was found that acrylic acid from propene oxidation is most likely to combine economic desirability and environmental friendliness, and N-doped carbon is the best current catalyst for cyclohexane oxidation.

LAURA DOUGLAS

College of Engineering
Computer Engineering

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

Co-Mentors: Vasil Pano, Alex Lackpour, Marko Jacovic

DREXEL WIRELESS RADIO SYSTEM.

The Drexel Wireless Systems Laboratory (DWSL) is focused on prototyping new technologies for a range of applications. In this project, we focused on the development of new wireless channel models for the Dragon Radio wireless system. The goal of this project was to develop code for translating results from an electromagnetic ray tracing system to a format that can be used for hardware testing. We started off the project by converting code provided from MATLAB to Python, to compare the frequency response of the wireless channel. We then moved to MATLAB and generated Orthogonal Frequency Division Multiplexing (OFDM) simulations to get a visual understanding of the OFDM transmitter and receiver and were also able to view two proposed channel impulse response (CIR) paths and compare them using an error graph which was also generated using MATLAB. After this was done, we shared the final code on GitHub and walked through the process of setting up the Dragon Radio for hardware testing. This deployment involved working with a Linux Container (LXC) based system that manages multiple radio software images. The results from the simulations will eventually be deployed for real hardware testing.

SAMUEL TOSEAFA

College of Engineering
Computer Engineering

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

Co-Mentors: Dr. Vasil Pano, Marko Jacovic, Alex Lackpour

MACHINE LEARNING IN WIRELESS SYSTEMS

This research is centered around the fact that new technology in wireless architecture needs to be constantly tested to meet broadcasting standards. Hardware experiments are challenged by radio frequency licensing constraints and the challenges of testing real hardware in the field. This motivates the use of large-scale wireless channel emulation to evaluate radio technologies in a controllable and repeatable manner that cannot disrupt real systems.

To solve this problem, we are developing software to process and import wireless channels from simulations to a large-scale wireless Channel Emulator that can be used to expose real radios to simulated channels. With the Channel Impulse Response data obtained from these simulations as input, Python and/or MATLAB is used to process and format this data for use in a Channel Emulator. Then, field devices such as jammers are connected to the emulator and from there more complex scenarios can be tested.

Once results are obtained from these scenarios using software defined radios such as the Drexel-developed open-sourced DragonRadio, the next step would be to obtain the necessary permissions needed to validate this emulation experiment with measurements taken in the field.

JANAKI NAIR

College of Computing & Informatics
Computer Science

Faculty Mentor: **DR. ANUP KUMAR DAS**
Electrical and Computer Engineering

Co-Mentors: Adarsha Balaji

GAIT ANALYSIS WITH ECHO STATE NETWORKS

Gait analysis is an investigation of human locomotion or more precisely, the distinctive nature of an individual's stride. This study of movement patterns has applications in the medical field to identify and diagnose biomechanical dysfunction for therapeutic purposes. The aim of my research project is to improve the analysis of gait parameters by utilizing a simple variant of recurrent neural networks, the Echo State Network. My project utilizes an existing dataset of step events modeled with a Long Short Term Memory network as a starting point. While both ESNs and LSTMs handle time series data effectively, an ESN is simpler in structure. ESNs are generally composed of an input layer, a sparsely connected reservoir and an output layer, with only the output layer being trainable. This makes it more efficient from the perspective of computational resources. Using the dataset of step events, my project aims to show that an ESN can produce comparable classification results when compared to an LSTM, while reducing computational complexity through reduction in training time. Subsequently, we will use this ESN as to model a Spiking Neural Network to handle real time data, which is particularly useful in the field of gait analysis.

SARA BRESSLER

College of Engineering
Materials Science and Engineering

Faculty Mentor: **DR. YURY GOGOSTI**
Materials Science and Engineering

Co-Mentor: Eliot Precetti

MXENE FILTRATION OF DIALYSATE

Over 2 million people worldwide are currently on kidney dialysis, with that number increasing every day due to COVID-19. Kidney dialysis is the process of removing toxins from the blood in order to clean it for patients whose kidneys are not functioning properly. Unfortunately, the normal wait time for a kidney transplant is 3-5 years, meaning patients must spend multiple hours a week hooked into a dialysis machine. This project focuses on creating the filter in a wearable artificial kidney device. MXene film acted as a filter to adsorb toxins which was tested by pumping both simulated dialysate and human dialysate at 37° C through the filter. The absorbance of the MXene was tested through a series of bioassays which showed that the MXene adsorbed the toxins exceptionally well in the simulated dialysate; the human dialysate clogged as the plasma proteins present in human dialysate fouled the filter. Simultaneously, the reusability of the filters were tested by running water, a current, or a mix of the 2 through the filter and taking a bioassay to assess if the toxins were released. Neither the water nor the current were effective in releasing the toxins.

MARLEY DOWNES

College of Engineering
Materials Science and Engineering

Faculty Mentor: **DR. YURY GOGOTSI**
Materials Science and Engineering

Co-Mentor: Geetha Valurouthu

QUANTITATIVE INVESTIGATION ON LITHIUM POLYSULFIDE ADSORPTION OF MXENE COMPOSITIONS FOR HIGH PERFORMANCE LI–S BATTERIES

Lithium-Sulfur batteries have attracted a lot of attention because of their high theoretical energy density, low cost, and relative abundance of their host materials. However, the practical utility is hindered by poor cycle stability and cell efficiency due to loss of active material by the dissolution of intermediate lithium polysulfides (host material) in the electrolyte and the incomplete utilization of sulfur due to its insulating nature. In this study, MXenes, a new family of two-dimensional transition metal carbides and nitrides with rich surface functionalities and high conductivity are used to tackle the challenges associated with rapid capacity decay by physically confining the soluble polysulfides to conductive MXene. Here, we quantitatively compared the lithium polysulfide (LiPS) adsorption capacities of Ti-based MXenes - $Ti_3C_2T_x$ and Ti_2CT_x. Interestingly, large-flake Ti_2CT_x has the highest polysulfide adsorption capacity of ~226 mg over large-flake $Ti_3C_2T_x$ (68 mg) per gram of MXene. In the future, by expanding the quantitative investigation to other MXene compositions, it is possible to select a suitable MXene composition for use as a cathode material in Li-S batteries.

PRIYA KANERIA

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. LI-HSIN (LEO) HAN**
Mechanical Engineering and Mechanics

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REVIEW OF PROMISING STRATEGIES FOR SUCCESSFUL IN VITRO TO IN VIVO ENGINEERED CARTILAGE TISSUE INTEGRATION

Articular cartilage can be damaged by injury or normal wear and tear. Because cartilage does not heal itself well, doctors and engineers have developed surgical techniques and tissue engineering strategies to stimulate the growth of new cartilage. Restoring articular cartilage can relieve pain, allow better function, and improve a patient's quality of life. Successful repair of knee cartilage relies on an ideal integration of surgical technique and supportive scaffolds promoting cartilage formation. In a preliminary study, the creation of FiberGel demonstrated a new advantage of treating knee cartilage defects because of its unique properties. While FiberGel has promising *in vitro* data, successful cartilage repair, associated with the formation of hyaline cartilage, to translate in an *in vivo* setting remains a difficult task. In this project I will provide a review of current *in vitro* testing strategies to better *in vivo* outcomes, as well explore *in vitro* to *in vivo* extrapolation using computational modeling in terms of cartilage repair.

LASHWINTH SURESH

College of Engineering
Mechanical Engineering

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

Co-Mentor: Emine Tekerek

EFFECT OF PARAMETERS ON MECHANICAL BEHAVIOR OF ADDITIVELY MANUFACTURED ALSI10MG?

Additive manufacturing (AM) is a net-shaped production technology that builds a 3D solid object using computer-aided design (CAD) data. The capability of these manufacturing techniques, along with innovations in advanced materials, have enabled novel approaches for producing complex geometries with high dimensional accuracy and surface integrity, within a short time frame. This enables AM processes to be a desirable choice for industrial applications. Although traditional manufacturing techniques limit the design freedom, metallurgical differences such as grain structures and defects between conventionally manufactured and additive manufactured samples, cause changes in their mechanical responses. Specifically, AM components show unique defects, residual stresses, and strong anisotropy. Therefore, X-Ray tomography was used to observe volumetric porosity measurements and a Scanning Electron Microscope (SEM) was used to investigate the manufacturing induced defects, and their effect on the mechanical behavior of the material. Acoustic Emission (AE) and Digital Image Correlation (DIC) systems capable of observing in-situ local kinetics and kinematics and relating these to the overall mechanical behavior of material are also searched.

JANVI PATEL

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. ROSE ANN DIMARIA-GHALILI**
Doctor of Nursing

AN EXPLORATION OF SYMPTOM CLUSTERS IN YOUNGER AND OLDER ADULTS WITH CHRONIC WOUNDS: PRELIMINARY ANALYSIS

Individuals with chronic leg wounds (venous ulcers and diabetic foot ulcers) experience unpleasant physical and psychological symptoms that lead to a diminished quality of life. Chronic wounds are associated with local inflammation, however, the relationship between systemic inflammation and symptoms is not clearly understood. We analyzed serum biomarkers associated with inflammation and examined the relationship with self-reported physical and psychological symptoms in patients enrolled in a randomized control clinical trial with ultrasound therapy to treat chronic wounds. The sample consisted of a subset of patients (N=15) who completed 12-month follow-up. Several strong significant correlations were observed between baseline and 16-week biomarkers (serum albumin, TNFa, CRP) and physical and mental symptoms at baseline and 12-month. This preliminary data suggests that some individuals with chronic wounds also experience systemic inflammation which are related to physical and mental symptoms. Further research will help elucidate the physiological mechanism responsible for producing physical and mental symptoms associated with chronic wounds.

SARAH WETZEL

Dornsife School of Public Health
Public Health

Faculty Mentor: **DR. ROSE ANN DIMARIA-GHALILI**
Doctor of Nursing

Co-Mentor: Ms. Martha Coates, Mr. Zachary Hathaway

PATTERNS OF TELEHEALTH & TECHNOLOGY USE IN OLDER ADULTS DURING THE COVID-19 PANDEMIC

The COVID-19 pandemic has been a barrier to health care for older adults during the past year. Older adults face greater morbidity and mortality risk as a result of COVID-19. Telehealth is one way to bring safe care to this population. More research is needed to understand current telehealth readiness among older adults, specifically across different age groups. This is a secondary analysis of a larger study describing the impact of COVID-19 on the health and social interaction of community-dwelling older adults (n = 150). We conducted telephone interviews and online surveys, and descriptive and inferential statistics were used to analyze research with respect to age. The mean age was 76.6 years; the majority were female, white, and college-educated. The oldest old (80+) are less likely to use technology and have confidence in their abilities compared with younger participants. Older age groups are also less likely to consider telehealth services. This study can be used to improve access to technology and confidence in telehealth services for older adults. Particular attention should be paid to those over age 80 implementing telehealth care.

ANTHONY PAUL LISI

College of Arts & Sciences
Chemistry

Faculty Mentor: **DR. IRWIN CHAIKEN**
Biochemistry and Molecular Biology

Co-Mentor: Ms. Aicha Bendia

DESIGNING ANTAGONISTS OF HIV-1 ENVELOPE AND SARS-COV-2 SPIKE FOR DISEASE THERAPY AND PREVENTION

With 38 million individuals worldwide infected by HIV-1 and no cure for the disease, new options for prevention and therapy are needed in the global effort to end AIDS as a public health crisis. There is hope, cyclic peptides have arisen as a promising new class of therapeutics to target the gp120 envelope glycoprotein of HIV-1, causing irreversible inactivation of the virus and inhibiting host cell infection. The goal of our project is to synthesize different configurations of an existing cyclic peptide in order to identify those with optimized gp120 binding and infection inhibition potencies. These new configurations help us learn about the mechanisms involved in the binding and inhibition by our cyclic peptides with HIV-1 Envelope. Understanding the mechanism enhances synthetic design, leading to the synthesis of better-performing cyclic peptides for viral envelope inactivation. Our work also consists of investigating the structural similarities between HIV-1 and SARS-CoV-2. Our understanding of the makeup of the glycoprotein for HIV-1 and how to target this virus entry complex has been instrumental in our fight against the novel coronavirus, which contains a similar surface glycoprotein region for its cell entry and infection.

ANJANI GUDA

College of Arts & Sciences
Biological Sciences

Faculty Mentor: **DR. RAMESH RAGHUPATHI**
Neurobiology and Anatomy

Co-Mentor: Zoe Romm

REPETITIVE MILD TBI MODEL IN JUVENILE MICE

Traumatic brain injury (TBI) inflicted individuals typically suffer from long term behavioral problems such as affective behaviors (depression, anxiety, fear, and PTSD). Current models of repetitive mild TBI in rats and mice use an impactor on the intact skull. In order to extend the model to juveniles, our initial studies were to determine which impactor tip would demonstrate visible signs of brain injury. Three mice were subjected to repeated impact using a silicone-tipped impactor and three mice were injured using a metal-tipped impactor. Brains were histologically evaluated at 24 hours following the last impact. Observations indicate that repeated impacts with the metal tip led to axonal injury using immunohistochemistry (IHC) for amyloid precursor protein (APP) and silver staining, accompanied by increased reactivity for astrocytes using glial fibrillary acidic protein (GFAP) IHC. Nissl stained sections did not show any qualitative differences. GFAP and APP IHC show that the metal impactor tip induced pathology in the white matter and cortex of the mouse brains, which is not observed in those injured with the silicone impactor tip. Ongoing work will focus on behavioral alterations using the metal-tipped impactor.

JACOB M. BORNYASZ

College of Arts & Sciences
Environmental Science

Faculty Mentor: **MARIANGELES ARCE H.**
Ichthyology

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CRANIAL OSTEOLOGY OF LOPHIOSILURUS ALEXANDRI

Lophiosilurus alexandri is catfish endemic to the São Fransisco river in northeastern Brazil. It belongs to the family Pseudopimelodidae, which is distributed throughout South America. Lophiosilurus alexandri has seen significant population reduction from overfishing, forest degradation, and hydroelectric plants. Understanding the phylogeny of the species is critical for the implementation of conservation efforts.

We analyzed the cranial osteology of Lophiosilirus alexandri searching for evidence of its phylogenetic placement within the family. When compared with other members of the family, we see main differences in the size and shape of the mesethmoid, supraoccipital, posterior process of the supraoccipital and the anterior and posterior fontanelles. The completion of our study will provide morphological evidence to place the genus within the Pseuopimelodidae. This information in addition to ongoing molecular studies will provide a robust hypothesis for the phylogenetic placement of L. alexandri.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

RAMYA ASHISH

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

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

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QUANTIFYING PELVIC MORPHOLOGY IN NORMATIVE PEDIATRIC SUBJECTS

There is a limited amount of pediatric bone data available which limits the work that can be done surrounding pediatric bone fractures and treatments. The goal of this work is to quantify pediatric pelvic morphology for normative subjects ages 1 to 19 years. CT reconstructions of pediatric pelvic images from the Children's Hospital of Philadelphia were used in a custom MATLAB code to plot specific landmark points on an anatomical pelvis. 26 measurements were made from the 15 various landmark points that were plotted using the MATLAB code. Five new parameters were added to the code, and measurements for all parameters were plotted as a function of age and sex and fitted with a linear regression line. The findings from the work has shown a significant variation in trends in the growth rates in 14 relevant pelvic parameters. There is a moderate to strong correlation of growth in almost all measured parameters, and little to no change in the measured angles across ages 1 to 19 years. These data can help in understanding pelvic deformations in pediatric subjects, as well as aid in the further development of age-specific shape models of the pelvis and patient-specific models for pre-operative planning and surgical simulation.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

VICKY LI

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

Faculty Mentor: **DR. LIN HAN**
Biomedical Engineering

Co-Mentor: Thomas Li

QUANTIFICATION OF CARTILAGE NEO-MATRIX FORMATION

Osteoarthritis is a degenerative disease that causes progressive damage to articular cartilage. Aggrecan, the major proteoglycan in articular cartilage, is mainly responsible for the load bearing and energy dissipation biomechanical functions of cartilage. The NanoBiomechanics Lab has recently made important findings, specifically with their study on the role that decorin, a small leucine-rich proteoglycan, has in cartilage extracellular matrix. It was initially believed that decorin influences the assembly of collagen fibrils, but previous literature from this lab found that decorin functions in the retention of aggrecan in the neo-matrix of chondrocytes. This study focuses on providing support for the literature by using click labeling to quantify the amount of proteoglycan that is released from decorin-null murine cartilage explant compared to wild-type control. The femoral heads of age-matched decorin-null and wild-type mice were harvested and cultured to establish click labeling of proteoglycans. The released proteoglycan was collected and found that more proteoglycan was released from the decorin-null explant than the wild-type control, which supports that decorin facilitates the retention of aggrecan in cartilage matrix.

SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE, & HEALTH SYSTEMS

COOPER MOLLOY

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

Faculty Mentor: **DR. KURTULUS IZZETOGLU**
Biomedical Engineering

Co-Mentor: Ms. Pratusha Reddy

INDIVIDUAL DIFFERENCES IN COGNITIVE WORKLOAD DURING A UAS MISSION

Unmanned aerial system (UAS) sensor operators (SOs) experience high workload due to increasingly complex systems, yet few studies have investigated realistic transitional workload conditions. SOs experience challenges during missions (e.g., visibility changes, object prevalence, sustained alertness), often becoming disengaged and hindering performance. Many research studies examine group-wise changes during training but exploring subject-dependent changes helps to personalize human operator training and improve engagement. Hence, this study examined individual differences in SOs' task performance observed via behavioral and neurophysiological measures during various workload conditions. These measures are used to detect changes in mental workload by a non-invasive functional neuroimaging technique, functional near infrared spectroscopy (fNIRS). This study captured data from thirteen novice SOs who completed realistic tasks implemented using a high-fidelity simulator, with varying workload conditions resulting from time-of-day changes. Participants' behavioral performance and prefrontal cortex activation indicated that participants with similar performance trends exhibited different oxygenation trends between conditions.

FRANCIS VELAY FELLOWS

The 2020 STAR Scholars cohort includes our fifth cohort of Frances Velay fellows, thanks t the generous support of the Panaphil and Uphill Foundations. This year's cohort of 13 women in STEM included 10 Fellows who participated in remote research this summer and 3 Fellows who will participate in part-time research over Fall and Winter Terms. These students are participating in the fullest extent of the STAR Scholars Program available to the 2020 STAR Cohort, while also having the opportunity to engage with each other in virtual biweekly meetings throughout the summer. Through this program, we are able to provide these exceptional young women with the structure and time to reflect on what it means to be a woman in STEM, to help them build their identities as women in research, and to introduce them to others at Drexel who support and encourage them in their future goals.

The Frances Velay Fellowships have been created in the memory of Frances Velay, a remarkable scientist, artist, musician, and citizen, to assist undergraduate women in the Greater Philadelphia area ncrease their opportunities to pursue science careers. This opportunity is provided to support individual research efforts in the hpe that the Fellowship recipients will embody the spirit and determination France Velay brought to her work and life.

This program is jointly managed by the Center for Advancement of STEM Teaching and Learning Excellence (CASTLE) and Undergraduate Research & Enrichment Programs. We would like to thank the Panaphil and Uphill Foundations for their generous support of undergraduate research and women in STEM, as well as the faculty mentors, graduate students, and industry professionals who come together to support these exceptional women.

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Undergraduate Research
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Pennoni Honors College

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SPECIAL THANKS

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