Posner Research Symposium 2022

Thursday, August 11
9:00AM-2:00PM

Friday, August 12
9:00AM-2:00PM

Hardin Hall, Evanston, IL

PROGRAM OF EVENTS

Thursday August 11th

9:00am-9:15am: Coffee & Breakfast Service

9:15am-9:30am: Introductions & Opening Remarks

SESSION I: 9:30am-10:30am

1. **Natasha Gonzalez**
2. **Chisara Ojiako**
3. **Michelle Jung**
4. **Jesus Serrano**
5. **Manru Huang**
6. **Mary Armoska**

Break 10:30am-10:45am

SESSION II: 10:45am-11:45am

1. **Rosabel Arellano-Razo**
2. **Julie Park**
3. **Johana Ortiz**
4. **Cristian Castrejon**
5. **Audrey Rojo**
6. **Abram Luna**

Lunch 11:45am-1:00pm

SESSION III: 1:00pm-2:00pm

1. **Sereniti Williams**
2. **Randy Truong**
3. **Elijah Nacar**
4. **Annie Chiu**
5. **Judith Adomako**
6. **Vivian Bui**

Friday August 12th

9:00am-9:15am: Coffee & Breakfast Service

9:15am-9:30am: Introductions & Opening Remarks

SESSION I: 9:30am-10:30am

1. **Sara Bouftas**
2. **Sophia Bonfigli**
3. **Lukas Cortes**
4. **Ethan Huang**
5. **David Aguilar**
6. **Helen Delgado**

Break 10:30am-10:45am

SESSION II: 10:45am-11:45am

1. **Jackie Cantu Balmaceda**
2. **Maria Avina**
3. **Irene Martinez**
4. **Nora Bouftas**
5. **Innocent Nkubito**
6. **Alexis Schwartz**

Break 11:45am-12:00pm

SESSION III: 12:00pm-12:45pm

1. **Natalia Masnica**
2. **Skyler Stone**
3. **Nicole Aguilar-Medina**
4. **Rossul Aldhufari**

Closing Remarks and Reception: 12:45pm-2:00pm

Natasha Gonzalez
Mentors: Dr. Amy Paller, Dr. Nichal Kaplan
Faculty Advisor: Dr. Jaime Dominguez

Probing lipid skin barrier impairment in eczema and ichthyosis in a cell culture system

Lipids play an essential role in membrane function, but they are also involved in energy storage and cellular signaling. In the upper layer of skin, there are flat cells called nucleated keratinocytes that are embedded in an organized matrix of lipids, consisting of cholesterol, free fatty acids, and ceramide sphingolipids, essentially cells that make "glue" for skin. Correct composition and orientation is needed for proper barrier function, and issues with this are associated with several inflammatory skin disorders, including the group of scaling genetic disorders called the ichthyoses (IC) and eczema. ELOVL3, an enzyme of a very long chain fatty acid, has been shown to be reduced in both eczema and IC. In order to mimic the changes seen in these diseases in a cell culture (artificial skin environment), we reduced the levels of ELOVL3 in normal keratinocytes by using a small hairpin RNA interference system, a gene silencing method, to measure the effects on epidermal integrity and barrier. Additionally, preliminary data shows that skins of IC patients had an overall reduction in ceramides and an increase in Sphingosine. To investigate the chronic, detrimental effects of increased sphingosine on the skin barrier, we treated discarded abdominoplasty skin explants with Sphingosine, and then sectioned the explants for immunostaining, with the primary purpose of observing the differentiation markers and cell-cell junction proteins. Our preliminary results show that there are morphological changes in the cell-cell interaction in the epidermis of these skin explants after treatment. The results help advance treatment because they shed light into the participation of these ceramide modifications in keratinocytes, with specific regard to the disease activity seen in eczema and IC.

Chisara Ojiako
Mentor: Dr. Sruti Bhagavatula
Faculty Advisor: Dr. Shelby Hatch

Data Leaks from the Internet of Things (IoT)

For our digital devices to work, they need to be connected to the internet. Once connected, they are able to communicate with other devices or simply return information from the cloud. This process is the framework behind IoT, or the internet of things. When communicating with each other, one common protocol devices use is MQTT. This

protocol allows for every message sent between devices to be stored in a virtual entity known as a broker. Unauthorized access to these brokers can occur via public network scans, thus revealing sensitive information about the device and potentially the user. The goal of this project was to analyze and quantify the privacy of devices that are part of the IoT as well as the information that they hold. By doing so, we hope to educate others on the severity of data leakage and encourage and possibly aid future cyber security development. To measure our data, we used Python's PAHO client to code a program that would connect to a broker's IP address (a series of numbers used for digital identification) and reveal its content. Once the data was collected, we coded several other smaller scale programs to parse. filter, and store the messages sent between connected devices. To determine message sensitivity, we generated a list of key words and analyzed their frequency within each message. We found that the appearance of these key words was highly dependent on the type of device being viewed, meaning certain devices can leave us more vulnerable than others. Our results show that the sensitive information leaked by our devices can be processed to return specific data based off the objectives of a hacker, further compromising our digital, and as a result, physical safety.

Michelle Jung
Mentors: Dr. Carole LaBonne, Dr. Paul Huber
Faculty Advisor: Dr. Christine McCary

Brd2 Gain of Function & Loss of Function Phenotypes

A gene called Brd2 (bromodomain protein 2) plays a role in regulation of pluripotency at blastula stages and neural crest formation at neurula stages. Notably, research into neural crests have shown to have great importance in vertebrates, giving rise to different types of cells imperative for the nervous system and other critical parts of the body. The BET (Bromodomain and Extra Terminal) family is vital for neural crest stages; Brd2, Brd3, and Brd4 are all a part of that family. When embryos are injected with BET inhibitors, they lose their pluripotency, meaning that the embryos cannot develop various types of cells necessary for life. In this study, we micro-injected Brd2 into two and four cell frog embryos and allowed them to grow into more mature stages in order to examine them. We observed Brd2 gain of function and loss of function phenotypes by examining gene markers for pluripotency (sox3, ap2) and neural crest cells (foxd3). So far, we have found that the overexpression of Brd2 decreased the expression of several genes, such as ap2, sox3, foxd3, and slug. However, myc has shown no change in expression. Moreover, we have done CRISPR Cas-9 to observe loss of function phenotypes, but we are planning to look more into the effects of that.

Jesus Serrano
Mentor: Dr. Thom McDade
Faculty Advisor: Dr. Shelby Hatch

Inflammation as a Predictor of Disease Incidence in Different Races and Ethnicities

Acute inflammation is an innate immune response that protects the human body from damage caused by pathogens, stressors and injuries, and typically subsides once the biological threat has been managed. Chronic, low-grade inflammation is non-resolving and can increase an individual's susceptibility for cardiovascular disease (CVD) and/or diabetes. Quantifying inflammation is done through the use of the biomarker C-reactive protein (CRP), with higher CRP levels associated with a high risk for developing CVD. However, this association is based on data collected from European and European-American populations, and has not been established among other race/ethnic demographic groups. Additionally, CRP has not been evaluated as a predictor of diabetes across demographic groups. As such, I sought out to investigate CRP as a predictor of disease incidence across different race/ethnic groups. Based on a literature review of how CRP levels vary across racial and ethnic demographics, I hypothesized that CRP would be a stronger predictor of disease in Hispanics and African-Americans than in Whites and Asian-Americans. Using data from a large, nationally representative sample of adults in the US (AddHealth), I evaluated statistical models using baseline CRP as a predictor of disease 8 to 10 years later for all races/ethnicities, and then stratified by race/ethnicity. I found that within the AddHealth dataset, log-transformed CRP values are a stronger predictor of CVD among Asian-Americans and log-transformed CRP values are a stronger predictor of diabetes among Whites and Hispanics. Results from this analysis could promote a more nuanced understanding of why disease incidence varies between racial and ethnic groups and with more support could be used to identify high risk populations at earlier stages of disease progression.

Manru Huang
Mentor: Dr. Atique Ahmed
Faculty Advisor: Dr. Shelby Hatch

Glioblastoma: The Relationship Between SHMT2 and TMZ

Serine hydroxymethyltransferase 2 (SHMT2) is an enzyme that converts serine to glycine, driving one-carbon metabolism. One-carbon metabolism is important as it provides the necessary proteins, nucleic acids, lipids, and other macromolecules to support tumor growth. Based on published literature, patients with cancer express high

levels of SHMT2. Therefore, I decided to explore the relationship between SHMT2 and glioblastoma, a type of brain cancer that currently has no cure. For my project, I treated GBM43 and U251 cells in minutes and hours with DMSO (control) and TMZ (chemotherapy). I then did a western blot to see SHMT2 protein expression. From the data, the SHMT2 expression level increased after TMZ treatments. To learn why SHMT2 is upregulated, I knocked down SHMT2 using shRNA and integrated it into U251 cells through viral transfection. This is to answer my big question: "Does the knockdown of SHMT2 affect cell viability after TMZ treatment?" By checking the cell viability, I can determine whether SHMT2 plays a role in therapeutic resistance, a major challenge in glioblastoma treatment. Many glioblastoma patients die from recurrent tumors that have become resistant to therapy. Through the knockdown, I can verify whether SHMT2 causes cancer cells to be resistant to chemotherapy, and this finding can perhaps help improve current glioblastoma treatment.

Mary Armoska
Mentor: Dr. Daniel Molden
Faculty Advisor: Dr. Jaime Dominguez

Reexamination of Relationship Well-being in Gay and Straight Couples Post Gay-Marriage Legalization

Relationship research lacks representation of gay couples. Many of the existing findings come from before gay marriage was legalized. My study reexamines this question, directly comparing relationship well-being between both unmarried and married gay and straight couples. Based on past research, a survey was constructed that assessed broad measures of relationship well-being. Replicating previous research, no differences were found between gay and straight couples in several measures of well-being such as closeness, faithfulness, and perception of desirable alternatives outside of the relationship. Parallel to past findings, gay couples on average perceive their partners as more responsive and supportive, and reported being more satisfied and invested in their relationships. In addition, we found some interactions between sexual orientation and relationship status, such that some declines in reported well-being between straight dating and straight married couples were not observed among gay couples. Because of the broad implications marriage has been found to have for health and well-being, a greater understanding of marriage's impacts is needed. The recent expansion of the opportunity of marriage to a new population allows for an examination of whether marriage has the same benefits for gay relationships as it does for straight relationships. Such research could also potentially reduce any stigma attached to gay relationships that questions whether they are associated with less well-being than straight relationships. Therefore,

the present findings suggest that future research comparing gay and straight couples should account for marital status.

Rosabel Arellano-Razo
Mentor: Dr. Sue Hespos
Faculty Advisor: Dr. Jaime Dominguez

The Link Between Language and Cognition in Infancy

The link between language and cognition is argued to be at the core of what it means to be human. Prior studies have examined this link among infants using a linguistic categorization task using face-to-face methodologies (Fulkerson & Waxman, 2007; Ferry et al., 2013, 2010). Yet, few studies have examined the influence of multilingualism on categorization in infancy over the first year of life. Before investigating the effect of multilingualism, and considering the constraints posed by the COVID-19 pandemic, we set out to conceptually replicate this study using an online platform. Specifically, in this study, we focus on ten-to-12.5-month-old infants to examine whether infants could categorize objects when provided with a novel label (a made-up word) on Zoom? We hypothesized that providing infants with labels for objects would facilitate categorization when compared to a control condition where those labels were played in reverse. Across eight familiarization trials, we presented infants with eight images of a single object category (e.g., dinosaurs) and accompanied that with a novel label (e.g., "*Look at the Toma! Do you see the Toma?*"). After the familiarization trials, infants saw a test trial which consisted of a new image from the familiar category (e.g., dinosaurs) and an image from the novel category (e.g., a fish). The proportion of time that infants look at the novel image reveals an object category preference. We found that 10-to-12.5-month-old infants displayed a preference for the novel category when presented with language labels, but the same label played in reverse did not facilitate object categorization. These results demonstrate that the link between language and cognition can be demonstrated through an online task, which will enable us to examine the influence of multilingualism on category formation in infancy.

Julie Park
Mentor: Dr. Marcelo Worsley
Faculty Advisor: Dr. Christine McCary

Bridging the gap between sports and technology

As technology becomes more integrated into modern society, the importance of computer science education becomes increasingly evident. Moreover, computer science education is correlated with numerous benefits among youth including better problem-solving skills and higher rates of college enrollment. To support broader integration of computer science in K-12 education, this study explores sports/physical education as a means to increase youth engagement with computer science. We chose to look at sports because a large proportion of American youth participate in athletics. We partnered with local summer camp organizations to design and implement a learning space that integrates sports with technology. Surveys were combined with ethnographic research methodologies to analyze the ways in which our curriculum changed the participants' perceptions of computer science and/or themselves. The data we collected from the surveys suggest that sports do have the potential to be an effective means to get youth more interested in computer science education. We also observed that the competitive aspect of sports was especially effective in getting participants engaged with the learning material. Future research will continue to explore the effectiveness and design principles of this learning environment.

Johana Ortiz
Mentors: Dr. Heather Mahoney, Dr. Tiffany Schmidt
Faculty Advisor: Dr. Christine McCary

The role of intrinsically photosensitive retinal ganglion cells (ipRGCs) on nicotine's behavioral antidepressant effects

Nicotine is an addictive drug that contributes to today's public health crisis of substance abuse. Surprisingly, it has been found that light input from the eye likely impacts some aspects of drug addiction through a subtype of light-sensitive neurons in the retina called intrinsically photosensitive retinal ganglion cells (ipRGCs), but the extent of this is unknown. ipRGCs project to areas of the brain that intersect with the reward pathways activated in drug addiction. The potential connection between nicotine's properties as an addictive drug and light signaling via ipRGCs is a new research area that has the potential to benefit patients suffering from nicotine addiction by leading to more extensive research and treatments. Our preliminary studies have shown that genetically altered mice

with dysfunctional ipRGCs may have reduced sensitivity to nicotine. With this study, we seek to determine whether the behavioral antidepressant effects of nicotine are mediated through ipRGCs. We hypothesized that these effects of nicotine will be lessened or absent in mice with dysfunctional ipRGCs compared to mice with functional ipRGCs. The forced swim test was used to evaluate the behavioral antidepressant effects of nicotine. Mice with either normal or dysfunctional ipRGCs were injected with nicotine or saline and placed into a water bath to have their immobility tracked, which relates to depression-like behavior. The general effects of nicotine were also tracked via open field experiments that can impact the interpretations of the forced swim test. Our preliminary data shows that ipRGCs may have a potential effect on the antidepressant activity of nicotine in females. Additionally, mice with dysfunctional ipRGCs may be more susceptible to nicotine-induced anxiety. In future work, we will develop a machine learning program to refine the accuracy of our results for further interpretations.

Cristian Castrejon
Mentor: Dr. Wen-Fai Fong, Anya Nugent
Faculty Advisor: Dr. Shelby Hatch

Short Gamma Ray Bursts and Environments

Short gamma ray bursts are the most luminous and biggest explosions in the universe since the Big Bang. These explosions are caused by merging neutron stars in a binary star system. This is significant because this improves our understanding of the short gamma ray bursts' environmental properties and whether it occurs more often in galaxy clusters or field galaxies. This impacts our understanding of how star mergers produce the heaviest elements in the universe such as gold and platinum. We know that these short gamma ray bursts are diverse; they mostly originate from star-forming galaxies and some originate from old, low star-forming galaxies, or quiescent galaxies. Some short gamma ray bursts are located in galaxy clusters, which are groups of galaxies of more than ten that are gravitationally held together. These galaxy clusters are dense and most are quiescent. Most short gamma ray bursts occur in field galaxies since they are star-forming galaxies. In this research, we investigated the rate of short gamma ray bursts in galaxy clusters and if they occur more often in field galaxies using data from the BRIGHT host galaxy survey and other public galaxy surveys. We used python coding to find the separations of these short gamma ray burst host galaxies with nearby galaxy clusters. We determined a galaxy cluster is close with the following criteria: similar redshifts with the short gamma ray burst host galaxy and within a typical cluster radius. Also, we used different color filters with the field galaxies and cluster galaxy redshifts to

determine if the short gamma ray bursts have similar colors with the galaxy clusters to confirm its association. We found that 15%of short gamma ray burst hosts from BRIGHT have similar colors with galaxy cluster members, concluding that short gamma ray bursts do not prefer galaxy clusters so far.

Audrey Rojo
Mentor: Dr. Marcelo Worsley
Faculty Advisor: Dr. Christine McCary

Sports Technology: Shaping the Path of Computer Science Among Children

The future of Computer Science is set to rise at a 22% employment growth from 2020 to 2030, faster than all average jobs combined in the USA. Among its booming popularity, it is essential to implement an effective approach when introducing computer science to children. The present research examines the different technological devices that serve as means to engage computer learning through the lens of sports. Alongside the Sportsense team from the TIILT lab, we developed several tech devices that are interactive games and help improve an athlete's skills. We tested these technologies throughout three different camps with children from 3rd-12th grade. Throughout the camp, we implemented a set of activities in which the kids could interact and replicate similar tools by utilizing a micro:bit, and programming websites such as Scratch.mit and Makecode.com. We gathered our data based on a set of surveys that would measure their understanding of the devices' practicality and functionality as well as their overall experience. In addition, the observations we made throughout the camp enabled us to recognize factors out of our control that would affect the data. Our results demonstrate the introductory approach and structure of the activity are extremely relevant to the computer learning experience of a child. The introduction of computer science through the lens of sports facilitated the participation of campers with athletic experience. Moreover, some tech devices captivated the campers' attention mainly for play purposes, while other technologies engaged their programming skills and challenged their understanding of the devices inner workings. The participants' time, cs/athletic experience, and economic/cultural background affected the peaceful learning environment we strived to create. As the computer science field grows, everyone should have the opportunity to be exposed to it early on. This examination will lead to designing a curriculum that will foster a creative outlook in CS among the minds of the future.

Abram Luna
Mentor: Dr. Sidonia McKenzie
Faculty Advisor: Dr. Shelby Hatch

Ethnic vs General Food Stores: An Analysis of Nominal Prices in Evanston, IL

According to the US Department of Agriculture, Americans' average grocery spending is just over $400 a month, which is expected to increase given the current surge in inflation. Within the greater Evanston and Chicago area, there are a variety of general and ethnic grocery stores focused on providing groceries at affordable prices. This research focuses on tracking nominal price differences across ethnic and grocery stores to help Northwestern students and the Evanston community optimize savings at the grocery store. This research aims to understand whether the average prices for goods are higher or lower at ethnic grocery stores and the underlying reasons for the price differences. While ethnic grocery stores specialize in certain products, price comparisons were made for goods available in both ethnic and general grocery stores. The prices of 13 different goods were tracked across various grocery chains, emphasizing the average prices of these products at general grocery stores compared to ethnic grocery stores. The results show that, on average, Walmart has the lowest prices on the selected basket of goods, with ethnic grocery stores offering better prices for a couple of goods such as fruits (oranges and cantaloupes) and dairy products (eggs). Walmart's price advantage in Evanston may be due to its input cost control strategies, which are beyond the scope of this research. Nonetheless, the findings prove helpful for planning the next grocery trip.

Sereniti Williams
Mentor: Dr. David Uttal
Faculty Advisor: Dr. Christine McCary

Children & Computers: Using new technology for developmental cognitive psychology research

Looking at children's mental processes is an integral aspect of cognitive psychology. However, because of the time commitment required from both the child and the parent as well as the fact that studying cognitive functions historically requires an in-person study format, the participant pool has historically been limited to families in the surrounding area. This has resulted in a very limited participant pool that lacks much diversity. Covid has only heightened this issue, as many families are wary of participating in in-person studies. This summer, I have been working on implementing the use of a recent software

called Lookit that allows researchers to publish studies online that families can then participate in virtually to increase our lab's reach. To do so, I have used Lookit to code a study that is entirely online and is therefore accessible to any family that has access to a computer with a webcam and internet connection. This has eliminated the need for parents and children to travel to the physical location of the lab, cuts down on the total time required to participate, and significantly increases the number of eligible participants that have access to the study as a result. Assuming the study's continued success, our lab will likely begin offering more virtual studies, allowing us to continue increasing our reach. This means a more diverse participant pool that will ultimately allow our results to be applicable to a larger population.

Randy Truong
Mentor: Dr. Domietta Torlasco
Faculty Advisor: Dr. Jaime Dominguez

Genere, Gender, Giallo: Shifting Cultural Attitudes in Italian Exploitation Cinema

The *giallo* is a tradition of violent, low-budget slasher films that dominated the Italian film industry between the 1960s and 1980s. Amidst the social and political unrest in Italy's "years of lead" (1968-1988) , the *giallo* films indicate Italy's changing cultural attitudes towards family and gender. As a result of Italy's economic miracle of the late 50s, traditionally conservative Italian values were challenged by more liberal and inclusive intellectual movements. I investigate numerous *giallo* films in this project and explicate their portrayals of gender and sexuality in order to assess these cultural transformations towards a more modern, inclusive Italian society. I also explore how exploitative, low-budget "popular" films can also effectively communicate socio-political changes alongside highly renowned, big-studio "arthouse" films. From this, I demonstrate both how socio-economic prosperity inevitably leads to paradigmatic changes in culture as well as how intellectual ideas are not just confined to "art films." I apply multiple psychoanalytic film theories to *giallo* films and explore their possibilities in relation to post-1968 Italian society as well as post-1968 Italian intellectual movements, such as the Italian feminist movement. Themes of both modernity and misanthropy emerge in the *giallo* as a result of this. One of the most successful *giallo* films, Dario Argento's *Profondo Rosso* (1975), best demonstrates this excruciatingly dim portrayal of the world. Despite the backdrops of crime, vice, and sin, the *giallo* exposes watchers to a new face of Italy: one that is shockingly pessimistic and taboo—yet modern.

Elijah Nacar
Mentor: Dr. Scott Ogawa
Faculty Advisor: Dr. Jaime Dominguez

What is Rationality?

For many, the most rational choice is broadly understood as the choice that makes the most "sense," but what does that truly mean? How do different academic disciplines qualify whether a thought or action makes "sense," and how are these definitions of rationality similar or different?

This study presents a comprehensive literature review in which interpretations of rationality from Northwestern Professors, conceptual theories, and formal models are compiled, synthesized, and compared in order to analyze the most notable similarities and differences between field-specific definitions of rational behavior. As a result, this study finds that, while definitions of rationality differ greatly between fields, rationality is intrinsically connected to the concept of maintaining a decision-maker's consistency. In other words, all fields relevant to this study agree that one's most rational choice is their most consistent choice, only differing in their perspective of how that consistency is evaluated. To further explore this conclusion, the study presents categorical differences that divide views of rationality based upon the way they define one's most consistent course of action. As the first division, the study will present how views of rationality differ based on the scope of their consistency evaluation, either against an internal standard or an external standard. While the second division will explore how views of rationality are either evaluated within the context of what is most consistent provided the limits of one's knowledge or against an ideal of what is most consistent provided all relevant information. While the study does not present one, universal process for defining rational behavior, its conclusions better illustrate different perspectives of how we, as decision-makers, can define the actions that make the most "sense" to us.

Annie Chiu
Mentors: Dr. Katherine Amato, Dr. Maria Luisa Savo Sardaro
Faculty Advisor: Dr. Christine McCary

Evolution of the Gut Microbiota: Relationship Between Primate Microbiome and Blood Parameters

The gut microbiota, the community of microbes living in the gut, plays an essential role in influencing and interacting with the immune system, contributing to the overall well-

being of hosts and the diverse functions that are vital for development throughout life. Yet, much remains undiscovered regarding how the properties and functions of gut microbes are affected directly by blood cells across different host species. Understanding the interaction between gut microbes and their host can provide valuable information on the evolution of the gut microbial community. The current study aims to explore how primate microbiome diversity and composition vary in relation to differences in primate blood parameters. DNA was extracted from collected primate fecal samples and the 16s rRNA gene was sequenced to identify different microbial taxa. I extracted average blood values for different primate species from published literature, and investigated the relationship between these values and the relative abundances of different microbial taxa. Using R, I found positive correlations at both the phylum and genus level between microbial relative abundances and hemoglobin values across different primates. However, there are fewer patterns between the microbial relative abundances and white blood cell counts due to limited data on blood parameters of the diverse community of primates. The results can help to explain why certain microbes inhabit certain hosts and how microbial evolution is linked to host environment. The results can also serve as a starting point for further investigation and consideration on the interactions between microbes and the different types of white blood cells, effects on microbes from alterations to the hemoglobin protein, and other environmental factors causing outliers on the relative abundances of specific primates. Results can then ultimately be used for medical health purposes where microbiomes can be altered by regulating blood cell parameters that correspond to specific gut microbes and their functional pathways since a great number of diseases can be linked to changes in gut microbiota. Investigating the gut microbiota can thus allow medicine to focus on targeting microbiomes as an alternative to targeting human genomes.

Judith Adomako
Mentor: Dr. Sarah Rodriguez
Faculty Advisor: Dr. Christine McCary

Too Many Numbers: A Closer Look at the Safe Motherhood Initiative

In September 2017, Serena Williams almost died giving birth to her daughter. Many pregnant women around the world share the chilling experience, but unfortunately, some don't survive to tell the story. A recognized global problem for decades, the first global initiative to address maternal mortality between 1987 and 2000, called the Safe Motherhood Initiative (SMI), worked to reduce maternal mortality. This initiative arose out of concern from a report that an estimated 500,000 women, principally in developing countries, died annually from giving birth –a number that was based on guesstimates,

which are numbers compiled by gathering data from the community rather than vital registration records. SMI similarly based its work using maternal mortality guesstimates. How did the use of these guesstimates direct this initiative? What were the challenges of using imprecise data with an expectation of achieving measurable results? Based on a literature review, I performed a historical analysis of the SMI by evaluating medical journals published between the years 1987 and 2000. I concluded that in so-called developing countries, these guesstimates were created by an unreliable methodology that excluded deaths and caused contradiction within countries and between organizations. Guesstimates do not provide a clear picture of the severity of maternal mortality in developing countries. Additionally, SMI's legitimacy relied on the implementation of interventions to reduce maternal mortality to facilitate the collection of quantitative proof. Furthermore, the reporting of guesstimates to the public by SMI created the false narrative of maternal mortality being an issue isolated to developing countries. Maternal mortality remains a significant global issue, one still based on guesstimates. The material mortality guesstimates, however, are powerful as they influence how much and the kind of attention the issue receives. Such control is a result of the imbalance of qualitative and quantitative proof, interfering with maternal mortality progress.

Vivian Bui
Mentor: Dr. Kalyan Nadiminti
Faculty Advisor: Dr. Jaime Dominguez

Asian American Aliens

In this project, I researched the legal term alien, hoping to redefine it specifically for Asian Americans during and around the Cold War era. There are several harmful presumptions that come with this term; it implies that Asian Americans come from inferior races and are uncivilized. The Cold War era served as a transitional period for Asian America because the United States was attempting to market itself as a liberal and inclusive nation against Soviet propaganda that highlighted the United States' domestic racism. However, this comes after Japanese internment during WWII and before refugee crises as a result of U.S. intervention in Southeast Asia during the Vietnam War. With these time periods, I approached the issue from both a legal and literary perspective using legislation, New York Times articles, and Asian American literature. My work revealed that the language used by the federal government not only reflects but also legalizes the pro-exclusionist sentiment held by a predominantly White country. The Asian American Alien, during the 1940's to 1960's, experienced the following evolution: enemy alien to friendly alien to refugee alien. Through this project, I redefined the term alien to be more specific as to which Asian origin group served as the "face" of the alien and why they

did. It is crucial to be specific in the language that is used to describe people because it can further marginalize minority groups. Moreover, language carries across different forms of literature. Terms used by the federal government are understood as acceptable and are then reproduced in media and fiction. By better understanding the term and its implications, the federal government can use more inclusive language that will help it shift away from the exclusionist sentiment it has historically and currently holds.

Sara Bouftas
Mentors: Dr. Lizabeth Jordan, Dr. Priscilla Duong
Faculty Advisor: Dr. Christine McCary

Comparison of Parent Reported Emotional Functioning in Medical Populations Seeking Neuropsychological Evaluations

Depression, anxiety, somatization, and withdrawal all play a part in a child's development and transition to adulthood. However, these disorders can delay a child's development, create immense stress, and eventually cause them to develop further disorders throughout their lifetime (Pop-Jordanova, 2019). Children with epilepsy, congenital heart disease, and concussions are at higher risk for developing anxiety and depression (Plevin & Smith, 2019; Ilardi et al., 2020; Macartney et al., 2021). Previous research has shown that anxiety and depression rates exist within these populations, but none have compared these medical conditions between the groups and why these results may differ between the three populations. Three groups of children will be evaluated - epilepsy patients, concussion patients, and congenital heart disease patients. The neuropsychological examinations of approximately fifty children from each group will be used in this study. The goal of the study is to determine how depression and anxiety rates differ within these pediatric populations, and why some disorders may be higher in certain populations. Participants include patients who received a neuropsychological examination at Lurie Children's Hospital of Chicago. Data is extracted from a large clinical database. The study will focus on the depression, anxiety, somatization, and withdrawal scores provided by the BASC-3 Parent Rating Scale. The study will use an ANCOVA, a statistical analysis that examines differences between groups while also controlling for any covariants. While all three groups are at-risk for mental health problems, we hypothesize that concussion patients may have greater emotional difficulties than other groups. Results from this study will help clinicians better understand how mental health influences each medical population, how mental illnesses differ across the three groups, and how to improve overall mental health conditions for epilepsy patients, concussion patients, and congenital heart disease patients.

Sophia Bonfigli
Mentor: Dr. Federico Lancia, Dr. Liam Palmer
Faculty Advisor: Dr. Shelby Hatch

Dynamic Peptides

Capturing the complex dynamic of living tissues in fully artificial biomaterials is paramount to the development of therapies for the regeneration of permanent or otherwise long-term injuries. From embryonic development to growth and healing processes, controlled delivery and trafficking of growth factors is essential to the healthy development of the human body. In my research, I designed dynamic peptide-based materials that mimic the extracellular matrix in its architecture. These peptide-based materials comprise nanotracks, nano-size fibers that form a network of paths, on which small peptide growth factors mimetic can walk to explore the chemical space and find cells to promote signaling. I characterized the materials and their dynamics by means of Fluorescence Recovery after Photobleaching (FRAP) and addressed the morphology (shape) of the nanofibers by atomic force microscopy (AFM) and cryo transmission electron microscopy (cryo-TEM). I found that the growth factors mimetic binds and move along the nanotracks in a walking fashion and does not destabilize the nanofiber's architecture. Moreover, these materials have been tested on human fibroblasts and promote activation of the integrin receptor they were designed to bind. These findings pave the way toward a general strategy for the development of dynamic materials for cell therapy, and we are currently exploring the impact of these materials on human microglia, a type of brain cell.

Lukas Cortes
Mentor: Dr. Andrew Roberts
Faculty Advisor: Dr. Jaime Dominguez

Billionaire Perceptions on Changing Tax Structures in Latin America

Billionaires now play an increasingly dominant role in the global economy, and the developing countries of Latin America are no exception. Decades of failed economic development policies such as lower corporate taxes and minimal trade barriers under the Washington Consensus has produced some of the world’s richest individuals. Over the last twenty years, leftist politicians have won important elections and proposed the first steps towards a progressive tax structure, one that pushes higher corporate taxes to reverse the consequences of the Washington Consensus. But what do these Latin American tycoons think of these proposals, and how does their source of wealth influence

their opinion on social debt, the idea that through progressive taxation, billionaires are indebted to the impoverished masses of their countries? This research project qualitatively uncovers public statements made by billionaires in various Latin American countries. Using web scraping to find newspapers and articles online, these billionaires have expressed many varying opinions on these reforms. In Mexico and Brazil, most billionaires are not worried that their businesses will be manipulated by the government given historical business influence in politics. In Chile and Argentina, billionaires are much less prevalent, and they are much less involved in public opinion. Across the board, Latin American billionaires are significantly more vocal than American billionaires, and those who found their wealth in retail, mining, and finance are more prone oppose such tax legislation. Those who find their wealth in political connections or agriculture tend to support such resolutions to adhere to government favors in these industries. This research sheds light on the importance of reaching a middle ground in economic development in Latin America. Years of failed development have shown that government action that seeks to radically reduce the role of business in the economy will result in only more lost trust between the public and private sector inhibiting development even more. Billionaires in Latin America may be vocal, but what historical analysis shows us is their lack of commitment to ensure that tax reform effectively tackles income inequality.

Ethan Huang
Mentor: Dr. Mark Witte
Faculty Advisor: Dr. Jaime Dominguez

Factors that cause soaring gasoline prices

In the modern age with people having busy lives, traveling everywhere: from home to work or country to country, gasoline has practically become a necessity for us. From that aspect, people need an understanding of why gasoline prices are what they are. With my research, I intend to answer the question: What are the different factors that affect gasoline prices? The motivation for this research came from the abnormally high gasoline prices that were seen in the past month. I designed my research to investigate this question locally and nationally, analyzing why gasoline prices have huge fluctuations and if prices differ between regions. In terms of national investigation, I plan on using the Federal Reserve Economic Data to see if there's a correlation between the different economical factors and oil/gasoline prices. Locally, I will conduct case studies and field research on certain gas stations in the Evanston and Chicago area. From my research, I have learned that the location at which the gas stations are located does affect the price of gasoline. Gasoline prices in less well off neighborhoods are higher than those in wealthy neighborhoods because of competition and the necessity of

gasoline. In certain cases, gasoline companies have a monopolistic control on the gasoline market caused by the lack of competition. This control would put financial pressure on the people living in those communities, people that can use that money elsewhere. This research sheds light on the problem that gasoline prices are absurdly high in low income areas. Knowing the different factors and results can help us formulate a solution on how to lower the soaring gasoline price.

David Aguilar
Mentor: Dr. Jason Seawright
Faculty Advisor: Dr. Jaime Dominguez

How Does Distributing Political Power By Socio-Economic Position Affect Participation in Civil Society

With income inequality rising around the world, it is important to know how income inequality in political power distribution affects participation in civil society. Research surrounding the topic implies many other variables affect participation, but none attempt to include multiple variables in a single model. The research is also restricted to certain parts of the globe. My research includes 15 variables on a global scale. I used lagged multivariate regressions to find the relationship between socio-economic inequalities in government, our independent variable, and participation in civil society, the dependent variable, while controlling for the other variables. I then connect my findings to current literature and create theories to explain my findings. My results find that without any other variables, as governments become more equal in terms of socio-economic position, then participation in civil society increases. When considering all the variables in the model, the relation is the same but weakened. I also create the" Circumstantial" Theory based on my findings. Different combination of variables lead to a variation of the relation of our independent variable. My research confirms and contradicts other research on my topic. It also suggests, broadly, that findings in certain parts of the world can be applied globally. Further research is needed to include more variables, explore the contradictions, confirm my "Circumstantial" Theory, and whether local trends can be applied globally to create a grand model.

Helen Delgado
Mentor: Dr. Joanna Grisinger
Faculty Advisor: Dr. Jaime Dominguez

The media response to the effects of IIRAIRA on Mexican immigrant communities

The status of immigrants in the United States has long been debated and rewritten. The Illegal Immigration Reform and Immigration Responsibility Act (IIRAIRA) was a redefining moment for immigrants in the United States. The statute made deportation and removal procedures more jarring as its main goal was to decrease the number of illegal immigrants. The act aimed to do this by increasing the punishments that an undocumented immigrant would face. The crimes that were deportable expanded, crimes from years ago would be monitored, and a barring rule that would stop immigrants from immediate re-entry was created. This research focuses on the media response to the effects of IIRAIRA on Mexican immigrant communities by looking at newspaper articles between 1996-1998. Mexican immigrants, the highest immigrant population by over fifty percent in the 1990s, were among the most affected communities. The significance in numbers adds to the impact that the statute still has on immigrant lives today as the barring effects of the act are still implemented in law today. The newspaper findings have shown that there were different approaches to how the statute was talked about. Four themes were able to be curated from the newspapers: being for or against the statute, personal anecdotes, and summary's of the act. While there were mixed reactions, the significance of the statute was undeniable as it altered the course of the way the U.S. looked at immigration and future policies that would be put in place.

Jackie Cantu Balmaceda
Mentor: Dr. Sandy Waxman
Faculty Advisor: Dr. Shelby Hatch

Thinking of the Unseen: Investigating the Referential link between Language and Mental Representations in Infancy

Language is a powerful communicative tool that permits us to call to mind things we cannot perceptually see. This crucial cognitive ability is known as verbal reference and emerges in infancy. Verbal reference establishes a 3-way referential link between words, their referents, and mental representations. Dr. Elena Luchkina's research suggests that between 15-16 months, infants can successfully establish a representation of a novel object, link it to a novel word, and identify that object when it becomes visible. This tells us infants can understand what a word means without having to see the object it

represents at the time of naming. The capacity of verbal reference becomes more robust as we grow older and facilitates language-mediated learning which is also pivotal for cognitive development. It is how we begin to comprehend historical and scientific knowledge and concepts in formal and informal instruction, for example. This set the precedent for investigating: *Does acquiring verbal reference enable learning from verbal testimony?* The aim of the new study, which I'm working on, is to determine the relation between mastery of verbal reference at 15 months and learning from language at 24 months. Adopting a longitudinal approach, we will assess performance on tasks that will test their mastery. Infants will be recruited via Lookit, an online platform for remote studies in partnership with MIT. Left and right looking preferences will be coded frame-by-frame to assess performance on these tasks, a common method used to measure infant language comprehension. We expect that performance on verbal reference at 15 months will be a significant predictor of performance on verbal testimony at 24 months. This study will provide insight into understanding the mechanisms that support learning. Findings could help inform language interventions as evidence for the trajectory and developmental course of learning in its early stages.

Maria Avina
Mentor: Dr. Jennifer Tackett, Cheyenne Bates
Faculty Advisor: Dr. Shelby Hatch

Examining Personality Traits and Leadership Qualities In College Students

Leadership development is often a goal of higher education institutions as they harness efforts to produce leaders in their respective fields and workforce. With high merit held in leadership development, there is a compelling necessity to understand the implications of individual differences on leadership development. Previous literature suggests certain personality traits and socioeconomic status (SES) may be important predictors of leadership outcomes. However, the relationship between leadership qualities and these predictors remain scarcely examined in college students. The aim of this study is to investigate how students' personality traits relate to their leadership motivations and aspirations. As well as, examine if low SES students' harness unique personality traits that render their leadership outcomes. Participants were 34 college-aged students (Age mean 20.23, White 59% Asian 23%Black 9% and Other 9%) participating in Northwestern's leadership development program, The Garage. Students who received sessions of leadership tests and training, completed self-report measures on their personality traits, leadership motivation, and entrepreneurial aspirations on Qualtrics. Results indicated a significant, negative relationship between personality and leadership, such that students lower in sociability reported greater levels of leadership motivations.

Additionally, students who scored higher in interpersonal sensitivity, in other words considerateness/empathy, reported higher levels of career aspirations. Furthermore, students who scored higher on learning approach, a trait alike to openness and curiosity, were positively indicative of entrepreneurial aspirations. These results highlight that ultimately backgrounds and individual differences matter in predicting who becomes a leader. Implications of this study suggest that unpacking personality traits in college students may be beneficial for understanding how to support students' leadership development and related career outcomes.

Irene Martinez
Mentor: Dr. Bethany Perez White
Faculty Advisor: Dr. Shelby Hatch

The effect of silencing EPHA2 on the expression of the proteins of the cornified envelope.

The epidermis, the outermost layer of the skin, protects the interior of the human body from influences of the outside world. This function is due to the outermost layer of skin, the stratum corneum, and the cornified envelope proteins that allow it to act as a physical barrier. These proteins are filaggrin, loricrin, and involucrin. The goal of our study is to further understand how these proteins are regulated. Signaling proteins, such as receptor tyrosine kinases (RTKs), play a role in regulating terminal epidermal differentiation. The RTK ephrin type-A receptor 2 (EPHA2) has shown to be key in orchestrating cellular signaling that is important for epidermal barrier function. However, the role of EPHA2 in the formation of the cornified envelope proteins is unknown. Our laboratory has found that when protein expression of EPHA2 is silenced , there is significantly decreased barrier function and filaggrin and loricrin are not expressed. However, messenger RNA for involucrin in EPHA2-silenced samples is not changed, suggesting that protein expression will not be affected. The purpose of my experiments is to determine the effect of EPHA2 silencing on the expression of involucrin. EPHA2 was silenced in primary keratinocytes that were used to build 3D human skin organoids. Tissue cross sections of these samples were immunostained to detect involucrin and analyzed by fluorescence microscopy. The EPHA2-silenced sample showed a slight decrease in involucrin as compared to the control 3D skin organoids. These results support our hypothesis that, unlike filaggrin and loricrin, silencing of EPHA2 has no effect on the protein expression of involucrin. Furthermore, the, asinvolucrin is regulated differently than filaggrin and loricrin.

Nora Bouftas
Mentors: Dr. Greg Miller, Zach Anderson
Faculty Advisor: Dr. Shelby Hatch

The Neuroimmune Model

Low socioeconomic status and racial discrimination are associated with elevated peripheral inflammation measured in the blood stream. Chronically elevated inflammation is thought to target specific brain regions. These brain regions are hypothesized to signal further changes in the body, which may intensify immune signaling throughout the body. This bidirectional signaling is part of a neuroimmune model of stress that suggests stress may get under the skin to sensitize the bidirectional neural pathways that process rewards and threats. Chronic activation of this pathway is associated with increased risk of engaging with maladaptive activities including high-fat and high-sugar diets as well as smoking and drug addiction. Nearly 600 participants from a community in rural Georgia who range in age from early to late adolescence were recruited to partake in this study. Functional MRI (fMRI) scans were used to assess brain activity during resting state scanning and reward processing. Blood draws were collected to measure peripheral inflammation in the bloodstream. The fMRI images were standardized for comparison through Brain Imaging Data Structure (BIDS) formatting. Quality assessments were performed on the BIDS formatted data to deface the images for anonymization and to remove unusable images through preprocessing. This study will follow up with the young adolescent participants to collect fMRI images throughout development from early adolescence through early adulthood– future work will examine whether certain regions in the brain are preferentially impacted by immune signaling, consistent with the neuroimmune model. Additional factors will measure the presence of early adversity and protective factors, such as racial identity, that seem to correlate with changes in the brain and body.

Innocent Nkubito Manzi
Mentor: Dr. Ian Hurd
Faculty Advisor: Dr. Jaime Dominguez

What does FIFA do and how is it put together?

FIFA is a non-governmental organization based in Switzerland that oversees the World Cup football (soccer) competition, as well as other international competitions and football-related issues. The agency has long been accused of corruption, and in recent years, observers and stakeholders have increasingly chastised it for a lack of transparency

and accountability. The goal of this research is to explain FIFA and how it works. To better understand the organization and the environment in which it operates, this study uses data from existing sources such as primary and secondary sources, newspaper accounts, book chapters, and articles. We'd like to learn more about FIFA's organizational structure and how it interacts with its members (national football associations) and other stakeholders. We identified the organization's main components, as well as its relationships with regional conferences and national associations. We found examples and stories that help explain the organization. This investigation will result in op-eds, essays, and a chapter for Ian Hurd's fifth edition of International Organizations: Politics, Law, and Process. Sports have existed almost as long as human civilization. Despite the fact that many aspects of sports have evolved over time, the enthusiasm for dynamism and physical capability has not changed. The 2015 FIFA corruption scandal jeopardized sport's positive social effects while also harming the reputation of sport, its federations, and its representatives. FIFA, its confederations, national federations, and clubs from all over the world must work to improve their integrity. Failure to do so constitutes a breach of trust.

Alexis Schwartz
Mentor: Dr. Lane Fenrich
Faculty Advisor: Dr. Christine McCary

The Mississippi Lesbian and Gay Community in the 1970s

In the '70s, a massive gay movement swept the nation. In response, the '80s saw an anti-gay movement driven by the moral majority and the Christian right. Much work has been done to investigate the situation of various LGBT+ groups throughout the country during this time, but there is a strange void surrounding the American south. This study aims to uncover the history of Mississippi's LGBT+ movement in the 1970s to determine its position within the national movement and contextualize the massive counter-movement that has been sustained until now. Qualitative research was conducted by reading primary sources, such as newspaper articles from the time period and papers written by prominent activists, and secondary sources that provide the national context, historical reasoning, and language needed to synthesize the primary sources. The findings indicate a robust movement in Mississippi involving the Mississippi Gay Alliance, monthly newsletters, and conventions throughout the '70s. This movement even further explains the severity of the counter-movement that emerged and took its roots throughout the south. The information on the strong origins of Mississippi gay activists, how their oppositions stifled them, and the rhetoric they used to do it is crucial to understand as it can be key to the comprehension of current anti-LGBT policies within southern states.

Natalia Masnica
Mentor: Dr. Almaz Mesghina
Faculty Advisor: Dr. Christine McCary

Statistics Anxiety & Belongingness

Statistics anxiety has been shown to negatively impact students' achievement in the classroom. Yet, factors that can further enhance or decrease statistics anxiety, like belongingness, have not been considered in depth in statistics anxiety research. This study specifically examines two factors: how students' prior knowledge and students' sense of belongingness in the classroom predicts their statistics anxiety in Introductory Statistics courses that use highly interactive cooperative learning teaching approaches. We hypothesized that feeling a sense of belonging can reduce statistics anxiety and improve student achievement in the course. 104 Northwestern undergraduate students enrolled in Introductory Psych Statistics at the beginning of Spring 2022 were recruited to complete surveys that measured their statistics anxiety and attitudes, statistics knowledge, and their felt belongingness to the psychology department. At the end of the quarter, they completed the same measures and were also asked about their sense of belonging to their cooperative learning group. Preliminary analyses show that in a highly interactive cooperative learning class, anxiety and attitudes improved over time. Additionally, statistics knowledge also increased throughout the term and their sense of belongingness. Our next step is to analyze whether belongingness to the group might predict these changes. If so, this suggests educators can implement high-quality group interactions as one way to improve student anxiety and achievement, which is also a low-effort, low-cost pedagogical intervention.

Skyler Stone
Mentor: Professor Erik Andersen
Faculty Advisor: Dr. Christine McCary

The effect of the deletion of tbb-6 in wild-type C. elegans on Benzimidazole resistance

Parasitic nematode worm infections impose a huge burden on the health of both humans and livestock, ultimately affecting billions of people worldwide. These infections are treated with anthelmintic drugs, which are often overprescribed. Because of this, resistance in parasitic nematodes is spreading, meaning that the drugs are at risk of becoming less effective. To combat this resistance, it is first important to understand the mechanism from a genetics perspective. Alleles, or variations, of the ben-1 gene have been previously correlated with resistance to Benzimidazole, a type of anthelmintic drug.

ben-1 encodes beta-tubulin, which is a structural component of the cell and is the target for many Benzimidazoles. There are six genes identified as potential beta-tubulin genes: ben-1, tbb-1, tbb-2, tbb-4, tbb-6, and mec-7. The only gene with the confirmed function of coding for beta-tubulin is ben-1. In this study, CRISPR-Cas9 was utilized to create a strain of the model organism C. elegans with a wild-type background and a deleted tbb-6 gene to test the function of tbb-6 with regards to Benzimidazole resistance. CRISPR-Cas9 is a molecular system that edits genomes by removing, adding, or altering parts of the DNA sequence by creating precise double-stranded breaks in the DNA that are repaired by natural mechanisms. The nematodes with the deleted gene will be exposed to various concentrations of Benzimidazoles, with the null hypothesis that tbb-6 will not have an effect on Benzimidazole resistance. This study will further drug development for parasitic nematode infections by helping to identify how anthelmintic drugs can be most efficient against spreading resistance.

Nicole Aguilar-Medina
Mentor: Dr. John Marquez
Faculty Advisor: Dr. Jaime Dominguez

Brownness

Although research has developed fields of study that seek to understand the Latino population, academic settings falter in the interpretation of brownness as it is vague and under-theorized. Due to this, I occupied a theoretical operation of the term “brownness.” I used qualitative approaches as I read, annotated, synthesized, and reviewed literature, instead of data sets. I found that experts within the Latino Studies field viewed brownness as fluid, a social construct, and a potential ethno-racial category, but they did not evaluate the state of geographic composition in the States. In a world where a white supremacist can identify a location for the “Brown problem” raises the point that the Brown person is geographically identifiable. Whereas experts such as Gloria Anzaldua and Richard Rodriguez claim that brownness is fluid, I ask: “If brownness is fluid and transcending, then how can a white person enter a predominantly Brown community in an attempt to solve the “Brown problem” within the States?" Thus, I conclude that the definition of “Brown” is limited. The actions led by white supremacists in a predominately Brown neighborhood demonstrates the expendability of brownness. In general, all experts reveal an experience attributed to brownness that intersects the ethno-racial category with a lower income class or working class background status. However, the intersectionality of brownness definition does not solve the conundrum of inducing invisibility and abjectivity in a theoretical framework. As has been made evident in historical

scholarship, by Reginald Horseman and Arnoldo De León, whiteness juxtaposes the construction of brownness. Ultimately, the State's failure to recognize brownness as a race minimizes the presence of such groups, further perpetuating the regeneration through violence that Brown people experience.

Rossul Aldhufari
Mentor: Dr. Christian Malapit
Faculty advisor: Dr. Shelby Hatch

Carbon-SF5 Bond Formation

Organofluorine compounds are organic compounds that contain the carbon-fluorine bond and carry diverse applications. Fluoropharmaceuticals are small organic pharmaceutical drugs that have at least one fluorine atom and makeup 20% of marketed drugs. The reason fluoro-organic compounds are common in pharmaceuticals is fluorine is the second smallest atom after hydrogen meaning substituting hydrogen with fluorine doesn't change parent structures drastically. Additionally, the C-F bond is the strongest bond that carbon can form increasing metabolic stability since C-F is harder to break than C-H bonds that are in drugs. Our lab's challenge is to take this information and apply it to pentafluorosulfanyl molecules because of their ability to allow drug molecules to easily enter the cell membrane based on initial pharmaceutical studies that showed the positivity of the installation of the pentafluorosulfanyl. The distribution of fluoro-pharmaceuticals contains aryl-fluorine, alkyl-CRF, and aryl-CF3 as the most frequent molecules. However, there is no practical method to form a C-SF5 bond. We hypothesize that transition metals could mediate a challenging and unknown C-SF5 bond-forming step. Our goal is to develop a reaction that forms C-SF5 bonds through the use of gold through experiments. Gold has high thiophilicity meaning it has a high affinity to bind to sulfur making it ideal for attaching to SF5. I am currently working on attaching sp-carbon and sp3-carbon to gold and eventually using SF5 containing reagents to see if a C-SF5 bond can be made.