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**Posner Research  
Symposium  
2021**



**Thursday August 12th  
1:00pm-4:00pm (CST)**

**Friday August 13th  
10:00am-1:00pm (CST)**

# PROGRAM OF EVENTS



**Thursday August 12<sup>th</sup>**

**1:00pm Opening Remarks:  
Brian and Lauri Posner  
Dean Adrian Randolph**

**SESSION I: 1:20-2:20pm**

- 1. Abby Burt**
- 2. Melissa Barraza**
- 3. Winnie Chui**
- 4. Ruba Memon**
- 5. Bryan Enriquez**
- 6. Taylor Bird**

**Break 2:20-2:35pm**

**SESSION II: 2:35-4:00pm**

- 1. Elijah Hansen**
- 2. Chantel McCrea**
- 3. Jesus Hernandez**
- 4. Amelia Vasquez**
- 5. Erica Chavez**
- 6. Ashanti Hatchett**
- 7. Rakin Hussain**



**Friday August 13<sup>th</sup>**

**10:00am Opening Remarks: Dean Mary Finn**

**SESSION III: 10:10-11:20am**

- 1. Guadalupe Bravo**
- 2. Julia Filimowicz**
- 3. Wilma Tay**
- 4. Marc Montgomery**
- 5. Danielle Moreno**
- 6. Brandon Ozobu**
- 7. Janie Xu**

**Break 11:20-11:35am**

**SESSION IV: 11:35am-12:50pm**

- 1. Leslye Molina**
- 2. Leandra Hawkins**
- 3. Melissa Yasunaka**
- 4. Kevin Foley**
- 5. Devyn Coar**
- 6. Pedro Guzman**
- 7. Missy Trigos**

**Closing Remarks: 12:50-1:00pm**





## **The 2021 Posner Summer Fellowship Program**

As the 2021 Posner Summer Research Fellowship Program draws to a close, we would like to acknowledge the hard work that everyone has devoted to the program this summer. And, in particular, the mentors and fellows. As we have balanced continued on-line activities with in-person ones, we are thankful that the fellows have experienced more normalcy than they have since their college careers began. We wholeheartedly thank all of the faculty members, “day-to-day” mentors, and all others who made this possible, particularly Ilene Tokarz.

Professors Dominguez, Hatch, and McCary  
Co-Directors  
Posner Summer Research Fellowship Program



**Abby Burt**

**Mentors: Professor Sandy Waxman and Dr. Lauren Mondesir**

***Developing a Measurement of Bias for the Racial Disparity in Preschool Disciplinary Actions***

Preschool disciplinary actions, such as suspension and expulsion, demonstrate an extreme racial disparity in the US. Black preschool students are disproportionately expelled from preschool in comparison to white preschool students. This creates a problem: not all children will have equal opportunity to benefit from early childhood education. Although there has been a great deal of interest in how teachers and preschool students express racial biases in the classroom, there is no standardized way of measuring this bias. In order to fix this issue, it is imperative to address and understand it, which is why this measurement tool is necessary. The current study aims to build tablet-based platforms that measure teachers' implicit biases, children's perception of classroom dynamics, and children's ethnic-racial identity. We are currently developing several tools, including CHAT-E (the CHildhood Assessment Tool-Electronic), the Self-categorization task, the Me/Not Me task, and the Ethnic-Racial Identification Puppet Task. These tools will be adapted to an online format so that they may be used without the need for a researcher to be present in-person. This will make the tools widely accessible to many different schools. Evanston and Chicago preschools will be recruited at launch. It is anticipated that this platform will result in establishing a standardized measurement of racial bias in the classroom. The measures may then be expanded to a broader range of schools. Knowing the root causes will contribute to the development of interventions and resources which can serve as a solution to this problem.

**Melissa Barraza**

**Mentors: Professor Anis Contractor, Dr. John Armstrong, and Dr. Charlotte Castillon**

***Role of Adult Born Dentate Granule Cells in Pattern Separation***

Neurons differentiate and are added to the dentate gyrus of the hippocampus throughout adulthood in most mammals; a process called adult neurogenesis. These adult born dentate granule cells (abDGCs) take weeks to mature but eventually integrate into the hippocampal network. The hippocampus plays a critical role in how episodic and semantic declarative information is stored and how the temporal sequence of experiences is maintained. abDGCs have been shown to be critical to hippocampal dependent tasks

including pattern separation. This is the ability to differentiate between separate events that are very similar. As a first step to understanding how abDGCs contribute to pattern separation, we devised an automated touch screen pattern separation paradigm for mice. Over four weeks, two groups of mice were trained in an operant chamber to touch one of two lit panels in the correct order to receive a water reward. The initial task involved sessions in which there was a large separation between the lit panels making it easier for the mice to complete the task. Once the mice reached 70% correct responses on two consecutive days, a more difficult separation task was presented where they were required to differentiate between panels of large separation (15 trials) and panels of small separation (15 trials). The average successful trials for large separation were 65.6% compared to 56% for small separation trials. The acquisition of the two tasks increased steadily throughout the 19-day study demonstrating that the mice learned both large and small separation trials. In the next phase of this project, we propose to measure the expression of a marker of the activity of neurons to determine whether abDGCs are active when animals are engaged in this task. Eventually, these studies will clarify the role of abDGCs in tasks that require an animal to discriminate between similar contexts.

**Winnie Chui**

**Mentor: Professor Dave Uttal**

### ***Investigating the Impact of Praise Types on Children's Performance on Spatial Tasks***

Spatial performance has been a strong indicator of spatial thinking and reasoning, along with involvement in STEM-related careers. When investigating children's spatial performance and abilities, it is important to consider the influence of parents' perception on the learning environment and their behavior toward their children. Parental attitudes towards boys' and girls' spatial abilities are often influenced by gender stereotypes, which children can internalize, affecting their perception of their own spatial abilities. The current proposed study aims to investigate the factors that contribute to a child's learning environment, and a child's perception of their own spatial abilities in order to investigate the gender bias in spatial tasks. One of the factors that contributes to how children perceive their abilities is the type of praise they receive: process-directed, where praise is directed at how a child behaves or person-directed, where praise is directed at the qualities of a child. In this proposed study, parents will be directed to use different types of praise with their children after they have completed an initial spatial task and received a score. The children will then take a second test and rate themselves before receiving their score to determine how parental influence impacts performance in spatial tasks regardless of actual achievement. The predicted results are that children who hear person-directed praise will perform worse. This is likely because they develop negative

spatial attitudes and low confidence in their spatial abilities from exposure to person-directed praise. These predicted results will reflect how parents' behavior and attitude influence the learning environment and how children view their spatial abilities. Future research can focus on investigating the praise type differences parents use with girls or boys, providing data that could lead to potential intervention methods to help reduce gender bias in different environments.

**Ruba Memon**

**Mentor: Professor Sarah Rodriguez**

### *Historical Trends in Maternal Mortality*

Abortion, pre-eclampsia, puerperal sepsis, and peritonitis are all major causes of maternal mortality, known as such for well over a century. In the late 1960s to the early 1970s, however, there was a dramatic increase in the number of medical journal articles concerning these four causes of maternal mortality. This study sought to understand why this increase in medical journal articles occurred during this time by doing the following. First, I undertook a quantitative data analysis to see how many articles were published each year and where there were peaks, spikes, and a lack of articles. I took note of peaks if the number of medical journal articles did not generally increase and noted spikes if the number of medical journal articles significantly increased within one year. Second, I performed a qualitative analysis by reading all the articles to determine if the reasoning behind the rise in articles was apparent within the articles themselves. I found the authors of these articles made connections with the increased legality and accessibility of abortions. Additional research is needed in order to further historically understand the connections between a reduction in maternal mortality and abortion being legal and accessible. Maternal mortality remains a huge issue today and in order to make progress on this issue, we need to know much more about the history of the causes of maternal mortality and interventions to reduce maternal mortality, including how, historically, causes and interventions have been understood.

**Bryan Enriquez**

**Mentors: Professor Amy Paller and Dr. Nihal Kaplan**

***The Role of Cutaneous Nerves in Wound Healing with Regard to a Better Understanding of Diabetic Skin Ulcers***

Individuals with type 2 diabetes (T2D) are more likely to develop wounds that do not heal properly and can lead to non-healing skin ulcers. Normal wound healing follows the steps of homeostasis, inflammation, proliferation, and remodeling. However, T2D wounds have a prolonged inflammation phase that interferes with proper wound healing. Cutaneous sensory nerves communicate with keratinocytes to promote wound healing after injury to the skin. Diabetic skin has fewer cutaneous sensory neurons and nerve degeneration. Nerves expressing the sodium channel Nav1.8 encompass 70% of all cutaneous afferent fibers. To understand the role of cutaneous nerves in diabetic wounds, we sought to determine if Nav1.8+ sensory nerve subsets contribute to normal wound healing. To recapitulate reduced cutaneous nerve fibers of diabetic skin, Nav1.8+ sensory nerves were targeted in mice with a diphtheria toxin receptor (DTr) followed by a toxin (DTx) to ablate Nav1.8+ neurons. There was a 90% reduction in Nav1.8+ neurons after DTx treatment, and a reduction in wound healing 3 days after wounding. However, 7 days after wounding the difference was not apparent due to variability between samples. Real-time quantitative polymerase chain reaction (qRT-PCR) analysis showed an increase in leucine-rich G-protein-coupled-receptors (Lgr5) expression in the wound bed and a decrease in Lgr6 levels suggesting a loss of the neuron-regulated Lgr6+ stem cell population in wounds with ablated nerves and compensation by Lgr5+ stem cells. Lgr5 stem cells have a delayed response to injury, but when Lgr6 is inhibited, Lgr5 stem cells re-epithelialize the wound. The qRT-PCR analysis also revealed a diminished induction of interleukin (Il6), encoding the proinflammatory cytokine IL-6, in wounds after nerve ablation suggesting a reduction in inflammatory cell infiltration. Our preliminary results show a link between cutaneous nerves and wound healing with implications for diabetic skin ulcers.

**Taylor Bird**

**Mentor: Professor Erin Waxenbaum**

***The Truth in Bones***

The TV show *Bones* brought public attention and interest to the field of forensic anthropology. However, TV does not always reflect reality. In an attempt to better appreciate the reality of forensic anthropology in the Chicago area, this project is a result



of a literature review and case analysis of a total of 118 forensic anthropology cases from the Cook County Medical Examiner's Office performed by Dr. Erin Waxenbaum, from 2012 until the present. Through an examination of all case report material, examined here are the months in which remains are discovered, the depositional environment, the condition of the remains at point of discovery, and the type of anthropological analysis requested. The results of this analysis demonstrate peaks in discovery during the months of September (19 cases; 16.7%) and June (18 cases; 15.8%) and lows in January (4 cases; 3.5%) and December (5 cases; 4.4%). The majority of remains were discovered in outdoor, surface environments (47 total; 41.2%) followed by indoor environments (25 total; 21.9%). Fully skeletonized remains comprise the majority of consults (49 cases; 41.5%), followed by bodies with severe decomposition/partial skeletonization (30 cases; 25.4%) (as the condition of the remains involved subjective analysis, there was no observable means of distinguishing between the categories). The least consults dealt with bodies mostly skeletonized (6 cases; 5%) and those involving thermal damage (7 cases; 5.9%). The primary, majority analysis requested was biological profiling of remains (86 cases; 72.9%). These results provide a representation of the realities of medicolegal casework of forensic anthropology in Chicago, distinguishing fact from fiction. These results can, in the future, be compared to the data of other forensic anthropologists to broadly demonstrate forensic anthropology's medicolegal role.

**Elijah Hansen**

**Mentor: Dr. Jens Koch**

### ***Systemization of Truncation Process in Superconducting Qubits***

The purpose of the project being presented is to contribute to the ongoing work towards the completion of a quantum computer that is vastly more powerful than the classical computers known today. Specific to the project, the primary issue being solved is the possibility of error when users perform calculations. To simulate quantum processes, approximations must be made due to the infinite nature of fundamental quantum energies in the form of a matrix. Therefore, the work done during this investigation aids in systemization of that approximation process via additions to the scqubits library, which is a python library that simulates superconducting qubits, the essential components of a theoretical quantum computer. The goal of this research is to provide solutions to approximations made within the library and allow experts to ensure accuracy of these more easily. The method taken during this project is simply pure problem solving via python coding which allows for creative thinking and unique solutions for these problems within the library. The preliminary major findings of this short project show trends between important properties of the transmon qubit, specifically the matrix size required for a given

accuracy as a function of the Josephson energy (one of several defining parameters of this superconducting qubit). A solution within python was created to return the matrix size required to reach accurate approximations, for the energies of a specified number of quantum states. These results will lead to progress within the quantum computing community by enhancing and simplifying the use of the scqubits library, which has become a widespread tool used in research on superconducting qubits.

**Chantel McCrea**

**Mentor: Professor Justin Mann**

### *Oriented Towards the Unhappy*

For this project, I worked under Professor Justin Mann to assist him with his book, “Pessimistic Futurism” which looks into the potentiality within the disciplines of Black feminism, queer studies, women’s studies, and Black studies where afropessimism and afrofuturism overlap. This is done through the lens of black female subjectivity, specifically that shown through the works of Octavia E. Butler and the author herself. Octavia E. Butler was the first black woman science fiction author whose work includes, “Parable of the Sower”, “Kindred”, and most notably her Xenogenesis trilogy. To do this work, I read the aforementioned trilogy and I have done archival work looking through every work done by and about Butler. This work has included cataloguing, organizing, summarizing and completing my own analysis of each document while paying specific attention to mentions of black female subjectivity, racism, nuclear warfare, former president Ronald Reagan, and gender. Through this work I seek to answer questions relating to affect theory and marginalized futurity. What doors are opened by viewing happiness as an orientation rather than as an ideal that should be sought out? Who is happiness accessible to? What are the potentials for resistance in orienting oneself towards unhappiness? How can contact between Afrofuturism and Afro-pessimism named by Butler be used to create radical new futures through the rejection of violent systems rather than a rejection of those harmed by these systems? Ultimately, with Butler’s diverse collection of ephemera, correspondences, manuscripts, and journal entries I have explored ways to improve marginalized futures through an orientation to unhappiness and a merging of Afrofuturism and Afro-pessimism that is open to coalition.

**Jesus Hernandez**

**Mentor: Professor Shelby Hatch**

***Determination of Lead Levels in Viaduct Paint Coating Near Ashburn Community Through ICP-AES Analysis***

High levels of lead have been shown to have various detrimental effects on the adolescent brain ranging from attentional deficits to an increased risk of committing violent crimes. Decades ago, 5 viaducts located from 63rd through Marquette Street were coated with paint containing high levels of Lead- as was thought to be acceptable before further research had been done. Unfortunately, over time, the paint on each respective viaduct has begun to chip, causing the paint strips to hang off the structure and be exposed to the community. What makes this dangerous is not only that the lead-contaminated paint remains present, but the amount of foot-traffic and the fact that the paint is severely chipping and lands on the ground, exposing young children and adolescents to its presence. Paint samples from each of the five viaducts were collected, digested with concentrated nitric and hypochlorous acid, and analyzed using ICP-AES analysis to determine the range of lead in these samples. ICP-AES works by exciting atoms in a given sample with an Argon lamp, causing the atoms' electrons to emit a characteristic wavelength of light that is then detected. The intensity is correlated with the concentration of the element and quantified. Furthermore, the general location- such as north or south of each viaduct- was documented in the analysis. It was found that, on average, there was found to be 1,000 ppm of lead in each sample of paint. Not only is this much higher than the legal limit for paint chips, but this also demonstrates the hazardous conditions the younger generation of the Ashburn community is exposed to on a daily basis. We plan on sharing this data with the alderwoman and requesting that these viaducts be remedied and murals be painted with new, lead-free paint for the safety of the community.

**Amelia Vasquez**

**Mentor: Professor Diane Schanzenbach**

***The Issue of Public-School Expenditures and their Racial Inequalities: An Observational Study***

School funding is an important driver of education quality; increased school spending improves test scores, a range of soft skills (eg. emotional intelligence, attendance rates), as well as future income. On average, Black, Hispanic and Indigenous students attend school districts that spend less than those attended by white students (2.5%, >3.5%, and >6% less spent on these groups respectively than white students across the nation). It is

important to understand to what extent these differences in spending arise due to between-state or within-state differences, as the policy solutions which close spending gaps differ by the level of inequality.

To address this question, I use nationally representative data on instructional spending from 2017-18 and calculate Oaxaca decompositions to compare spending on Indigenous, Hispanic, and Black students with spending on white students. I find that within states, instructional spending tends to be higher on Indigenous, Hispanic, and Black students in comparison to white students. There are, however, large differences across states in spending, reflecting the fact that a higher share of Indigenous, Hispanic, and Black students live in low-spending states. As a result, I conclude that increasing school spending in low-spending states with large Indigenous, Hispanic and Black populations can reduce racial and ethnic gaps in school spending.

Finally, I created a policy simulation to determine how much the national disparities in spending on different racial categories could be reduced if various states increased their average school spending. By increasing expenditures on instruction in the following states by the noted percentage, I was able to decrease national disparities for Black, Hispanic and Indigenous students to just 0.8%, <0.2%, and 3.5% respectively: Texas (18%), Arizona (35%), Mississippi (30%), Alabama (18%), Florida (15%), New Mexico (35%), Oklahoma (55%), and South Dakota (20%).

**Erica Chavez**

**Mentor: Professor Reza Vafabakhsh**

### ***Determining the functional impact of mGluR2 phosphorylation via fluorometric calcium imaging***

G protein-coupled receptors (GPCRs) are a family of cell surface receptors that interpret extracellular signals to trigger a cellular response, most prominently in the central nervous system. Patterns of phosphorylation - a biochemical process involving the addition of phosphates to an organic compound - in GPCRs are one of their significant characteristics to regulate receptor function. Mapping of the total number and exact location of phosphorylation modifications on GPCRs has been difficult due to their unique complexity in patterns of phosphorylation. The purpose of this study is to determine the first ever intact phosphorylation state of the intracellular tail of a GPCR

and its relation to functionality, specifically for metabotropic glutamate receptor 2 (mGluR2). Three target areas of high phosphorylation on the tail were determined. Then, two types of mutant mGluR2 constructs, phosphomimetic and phospho-silencing, were created and cloned. The mutant mGluR2's were expressed in a human cell line, and to compare the affected receptor activity of each mutant, their corresponding samples were individually tested. Each sample underwent fluorometric calcium imaging to quantify the mGluR2 signaling in the mutants and compare it to the signaling of the wild type when exposed to glutamate. It was determined that the wild type receptors had the highest sensitivity to glutamate, followed closely by the phosphomimetic mutants, and finally the phospho-silencing mutants being the least sensitive to glutamate. If a statistically significant difference is found, these findings can indicate the specific areas in the mGluR2 tail where loss of phosphorylation leads to a decrease in receptor function. Thus, narrowing down the exact sites of necessary phosphorylation on the mGluR2 tail for effective receptor function. Future work can use the determined phosphorylation state to study mGluR2's interaction with other proteins for prominent neurological drug advancements, and also generalize the methods used to other GPCRs of interest.

**Ashanti Hatchett**

**Mentor: Professor Wendy Espeland**

### ***Quantification and Automation in the Workplace***

This research examines how Amazon uses metrics and computer systems to monitor its workers, and the impact on employees. Amazon is the largest online retailer in the world and employs almost 1.3 million people worldwide. So, understanding their employee relations is important due to their influence on other companies. Through archival work, reading scholarly articles and viewing news media, I investigated how being monitored by metrics is different from being monitored by people, and whether Amazon's extensive automation has had a negative impact on its employees. I found 85 articles about Amazon's metrics and treatment of workers from November 2000 to June 2021 in the New York Times, Washington Post and Wall Street Journal.

Amazon workers are introduced to the company's computerization before starting their jobs; the applications are online and most are reviewed by computers with little to no human intervention. Candidates are accepted without any indication that Amazon is the right fit for them, contributing to Amazon's high turnover rate of 150%. Amazon's high expectations for productivity has led them to constantly monitor their employees with metrics that keep track of how much time they spend "off task," or not handling items. Managers use these numbers to reprimand or fire employees, regardless of their reasons

for “time off task.” Also, there are so few human resource representatives, workers often spend all of their limited breaks waiting in line to speak to them.

This further encourages the use of online reporting as an alternative, which expands automation at Amazon. Employees say that extensive monitoring and lofty productivity demands as reasons for striking and attempting to unionize. My work so far shows that using numbers to measure employees’ performance with minimal human involvement has a negative impact on employees.

**Rakin Hussain**

**Mentor: Professor Mark Witte**

### *The Environmental Kuznets Curve*

For my research under the guidance of Professor Mark Witte, I am investigating the Environmental Kuznets Curve (EKC), a hypothetical economic model that suggests that over time with a country’s economic development, pollution output rises within the first stage of development but then decreases within the second stage of development. To determine whether real-world countries were exhibiting polluting behavior consistent with the model, I constructed curves for 37 countries and territories mapping their Particulate Matter 2.5 (PM 2.5, a toxic air pollutant) exposure in micrograms per cubic meter against their GDP per capita since 1990. Data was collected through a database provided by the Organization for Economic Cooperation and Development (OECD). Second-order linear regressions found that all countries but one had statistically significant curves (the outlier was found to have a p-value of .05448), but only 4 countries had statistically significant curves that conformed to the shape hypothesized by the model. Although 25 curves were found to have negative linear relationships between PM 2.5 output and GDP per capita, one limitation of the study is that more pollutant data before 1990 might be necessary to provide a complete picture of a country’s historical polluting behavior, thus the study is inconclusive. However, there is a global trend of decreasing PM 2.5 exposure with increased economic development, indicating that most countries in this analysis have already entered their second stage of development. This can lead toward potential avenues of research investigating the role of various factors that facilitate pollution abatement efforts of countries in this stage such as environmental policy, regulation, and changes in national economic structure.

**Guadalupe Bravo**

**Mentor: Professor Chad Achenbach**

***DASH: A New Method for Diagnosis of SARS-CoV-2 Infection***

Throughout the COVID-19 pandemic, prompt and accurate diagnosis of SARS-CoV-2 infection has been essential to understanding epidemiology, transmission, and prevention. Current modalities for diagnosis of SARS-CoV-2 infection are slow, require extensive laboratory infrastructure, or are inaccurate. Minute Molecular Diagnostics has created DASH (Diagnostic Analyzer for Selective Hybridization), a point-of-care test using highly sensitive PCR technology that is able to diagnose SARS-CoV-2 infection in under 15 minutes. In this pilot study of DASH, our aim was to test the validity of this new technology on different specimen types (saliva and nasal swab). We performed a cross-sectional study of adults (over 18 years old) who were hospitalized with COVID-19 as determined by standard clinical molecular testing (non-PCR and PCR). Saliva samples were collected from 22 participants and nasal swab samples were collected from 19 participants. These samples were processed using DASH and participant data including demographics, date of symptom onset, clinical symptoms, their DASH test results, as well as their SARS-CoV-2 molecular test results were collected. Our study consisted of N (46%) female and N (54%) male participants at a median age 57 years with N (22%), N (16%), and N (3%) identifying as White, Black/African American, or Asian race groups, respectively. We found that DASH was able to provide valid results for 32 participants (78%). Additionally, DASH was 82% sensitive from saliva samples and 74% sensitive from nasal swabs. There were no participant or clinical factors identified that significantly impacted the ability of DASH to detect SARS-CoV-2. Our pilot study found that DASH was able to process and obtain valid results on both saliva and nasal swab samples from sick hospitalized participants with COVID-19. Additional technical and clinical research is required to improve DASH sensitivity and determine test characteristics of DASH using a uniform standard clinical PCR assay.

**Julia Filimowicz**

**Mentor: Professor Joanna Grisinger**

***Dissecting Perpetual Allegiance through Afroyim v Rusk***

Citizenship is the relationship between an individual and a state to which the individual owes allegiance in return for protection. This definition envisions total allegiance to one state, but what happens when one owes allegiance to two? My research project answers

this question by analyzing the legal history of dual citizenship in the United States. Furthermore, this research intends to enlarge the notion that the perpetual allegiance is still embedded within American immigration law despite the Founding Fathers yearning to stray away from the 17th century doctrine. The 1967 Supreme Court case *Afroyim v Rusk* established that immigrants should not be forcibly deprived of their United States citizenship for embracing dual citizenship. In particular, the Nationality Act of 1940 and the Immigration and Nationality Act of 1952 are the prime statutes in involuntarily renouncing the citizenship of millions. The investigation of congressional statutes and court cases reveal that throughout the twentieth century, the United States went from having the most grounds for loss of citizenship to one of the least. However, the *Rusk* decision stripped Congress of the power to deprive an American of their citizenship, enabling dual citizenship. Since *Rusk*, dual citizenship has gone from a prohibited status to a widely accepted one.

**Wilma Tay**

**Mentor: Professor Jim Hornsten**

### ***Female Corporate Leaders and the Impacts on Women***

In recent years, there has been increased attention to women's empowerment, and many studies show that female leaders create better social and economic outcomes for other women. Governments and organizations have employed various measures and affirmative actions to empower women. Notably, gender quotas for boards of directors, especially in some European, South Asian, and Middle-Eastern countries, have led to a gradual increase in female directors. Researchers have studied the effects of these quotas: the impact of female directors on firm performance, decision-making, and behavioral differences across genders.

My research focuses on the impact of the presence of female board members on the welfare of other females within major U.S. companies. Using numerous sources, I gathered and analyzed data on 82 Fortune 500 companies for 2021; the Fortune 500 is an annual list of the 500 largest U.S. companies ranked by total revenues for their respective fiscal years. The results show that firms with a female CEO are likely have more female directors and vice versa, and this result is statistically significant. The results also suggest that female-run companies offer longer and more weeks of paid maternity leave, employ more females, and are more committed to environmental protection, and better leadership; however, these results are not statistically significant. This result might be because of my dataset, as Fortune 500 companies are more established and face more pressure than younger firms to comply with set standards.



Acknowledging the positive impacts female leaders have on other women will encourage more significant investment in women's advancement by females themselves and other stakeholders. This investment will further bridge the U.S. corporate world's gender gaps since women—especially women with power—are probably the best advocates for the wants of their fellow women.

**Marc Montgomery**

**Mentor: Professor Scott Ogawa**

### *The United States Housing Market During the COVID-19 Pandemic*

In the early stages of the COVID-19 outbreak, the United States housing market shifted unexpectedly as housing prices soared due to the pandemic shock. The current narrative is that safety concerns of the pandemic and the prospect of working at home led to mass exodus out of costly metropolitan areas into more affordable neighboring suburbs and rural areas. Therefore, as demand for housing in these environments increased, housing prices rose accordingly. This story is true for coastal elite cities like Boston, LA, New York, SF, and Seattle, but remained untrue for most of the U.S.. My research focuses on relative changes of housing prices at the zip code level and for specific metropolitan areas. This research environment is interesting because it differs from most current studies on the housing market. Other studies research housing prices at the city level and measure them against income distribution levels as well as focus on the total movement in and out of metropolitan areas. Conversely, my research analyzes price changes based on zip-code population density. Analysing the housing market at the zip-code level allows for more accurate determinations of who exactly are benefiting or suffering more because of the pandemic. The goal of this research project is to analyze zip code data across the United States and create statistical models which answer the question: Did suburban and rural areas truly experience a greater increase of housing prices compared to metropolitan areas? The research approach was a combination of quantitative and qualitative analysis. I gathered data from housing databases and government resources and with this data I plotted statistical models which begin to tell the true story of the housing market during the pandemic. The results of my research are the following: 1) There is no clear trend between metropolitan areas; meaning that most metropolitan areas faced similar changes in prices 2) My analysis disproves many notable articles that state suburban and rural areas experienced more of an increase of housing prices than metropolitan areas.

**Danielle Moreno**

**Mentor: Professor Mark Beeman**

***Effect of Waking Daytime versus Sleeping Nighttime Incubation Periods on Ability to Solve Complex Problems***

The Creative Cognition lab is a cognitive neuroscience and psychology lab working on insight and incubation. Insight is also known as the eureka factor which is the act of suddenly achieving a solution to a difficult problem. Sometimes people stuck on a problem can solve it better after an incubation period, during which they are not consciously working on the problem.

This research project examines whether people solve complex problems better when the incubation period includes sleep or when the incubation period occurs during the day. This research is significant because it brings us closer to understanding how cognitive processes work, including how sleep or daytime activities affect these processes over time. In addition, it allows us to take a closer look at the abstract concept of creativity, through creative problem solving. Our project gives participants brain teasers and puzzles of various sorts. For problems they cannot solve in their first attempt, they will incubate on them either overnight, including sleep, or throughout the day. They will be instructed to not consciously work on the problems during incubation. The participants are given a set amount of time to complete these problems and all their answers are recorded qualitatively with timestamps. Although the data is still being collected, the importance of the results include knowing more about the effect of sleep on creative problem solving and insight.

**Brandon Ozobu**

**Mentors: Professor Mark Bevan and Dr. Jeremy Atherton**

***Stereological Analysis for Huntington's Disease***

Huntington's disease (HD) is a progressive neurodegenerative brain disorder that is caused by an expansion of the specific nucleotide repeats (CAG) in exon 1, or the first group of genetic information, of the Huntingtin gene (HTT). Symptoms include involuntary movement, compulsive behavior, paranoia, irritability, and aggression. The subthalamic nucleus (STN) is a component of the basal ganglia, a group of subcortical brain structures important for movement, reward processing, motivation, and memory. Through its powerful regulation of basal ganglia output, the STN is critical for action suppression. In HD mouse models and in HD itself, approximately 30% of STN neurons

are lost. However, the identity of these neurons is unknown. The aim of my research project was to determine which types of neurons in the subthalamic nucleus (STN) degenerate in the Q175 KI mouse model of Huntington's disease (HD). Mice were perfused fixed with 4% paraformaldehyde. The STN was then sectioned at 70 microns using a vibratome, an instrument using a vibrating blade to cut thin slices. Sections containing the STN were then processed for the immunohistochemical detection, or the fluorescent marking, of two calcium binding proteins calretinin and parvalbumin, which are expressed by distinct subsets of neurons in the STN and a NeuN fluorescent marker for all neurons. The optical fractionator, an estimation method, was then used to estimate the number of calretinin marked neurons in the STN of 18-month-old wild-type and HD mice. The optical fractionator was applied using a computer-controlled and encoded epifluorescent microscope. Mice 1 and 4 were the wildtype mice with an unaltered genome or 2 copies of the normal gene. In mice 1, 9161 NeuN neurons and 3150 calretinin neurons using 10 sections. In mice 4, 10291 NeuN neurons and 2260 calretinin neurons using 9 sections. Mice 2 and 3 were the Q175 mice with an altered genome or 1 copy of the normal gene and 1 copy of the HD gene. In mice 2, 11344 NeuN neurons and 2093 calretinin neurons using 8 sections. In mice 3, 12396 NeuN neurons and 3388 calretinin neurons using 8 sections. Based on previous data, the Q175 mice in this research project can be assumed to be outliers based on excessively high estimates of NeuN neurons, especially in the Q175 mice. In addition, no degeneration of calretinin neurons can be proven based on the limited data available. Therefore, it cannot be proven that calretinin neurons are the type of neurons in the STN that degenerate due to Huntington's disease, so further research is needed to discover these types of neurons in order to find better treatments or a cure.

**Janie Xu**

**Mentor: Professor William Leonard**

### ***COVID-19's Impact on Chicago's Underrepresented Communities***

The United States tends to focus on the economic and physical impact of COVID-19. However, it is crucial to consider the pandemic's effects on underrepresented communities to see the disparities in a cosmopolitan but racially divided city. It is also essential to examine the gap in privilege during a vulnerable time to prevent these effects from occurring again. This study hypothesized there would be disproportionate impacts of COVID-19 on Chicago's racial minorities and low-income residents. This study used a combination of qualitative and quantitative approaches through data provided in news articles, papers, and a local database. The groups to be compared to were white and high-income Chicago residents. Low-income residents felt highest levels of food insecurity.

The zip codes with the highest level of death rates were Latino and Black communities due to underlying conditions and higher risk of exposure. This study has concluded that low-income and communities of color have felt the brunt of the pandemic the most due to pre-existing social fault lines. The results of this study add to previous research on the social aspect of COVID-19. This data addresses the inequalities in Chicago and will hopefully lead to preventative approaches.

**Leslye Molina**

**Mentors: Professor Jennifer Dunn and Dr. Sabyasachi Das**

### ***The Difficulties of Quantifying the Adverse Environmental Effects of Microplastics in Life Cycle Assessment***

Microplastics (MPs) are plastic particles that are less than 5 mm in size and can be found in oceans, freshwater, soil, atmosphere, and inside organisms. There is very little research on methods used to quantify adverse environmental effects of MPs in the context of life cycle assessment (LCA) due to the fact that MPs are a recent area of interest for scientists. This literature review was conducted to provide insight on the complexity of quantifying adverse environmental effects of MPs, and to suggest new directions of research to be able to incorporate MPs into the LCAs of plastic products. The incorporation of MPs into the LCAs of plastic products is important because MPs can have negative effects on the environment as well as the health of organisms that come in contact with these particles. A literature review of scientific papers concerning the end of life options of plastics was first conducted to understand where most of these studies were putting their focus. It was found that the most common end of life options chosen for plastics were landfills, mechanical recycling, and incineration. A literature review concerning the collection of MPs was then conducted to understand the methods used for the sampling and quantification of MPs in a multitude of environments. It was found that the vast majority of studies used different methods with many not having replicable results. This further demonstrates the need to standardize sampling and quantification methods to help quantify and standardize the toxicity of these micropollutants being released into different environments which have not yet been quantified well. It was also found that more research is needed for the collection of MPs from terrestrial and atmospheric environments as well as the extraction of MPs from organisms before new methods can be suggested to quantify adverse environmental effects of MPs in the context of LCA.

**Leandra Hawkins**

**Mentor: Professor Francesca Tataranni**

***Ancient Rome Meets the Native Americans of the Midwest in Chicago***

Architecture has the power to shape a city's look, reputation, and identity. It connects us to the past and represents our legacy. As a quintessentially American metropolis, Chicago has always relied on architecture to convey its values and ambitions. This study aims to correctly interpret and determine why on Chicago's Art Deco styled buildings there exists a unique combination of classical and Indigenous motifs. To answer this question, a case study of two Art Deco styled buildings in Chicago were analyzed: the Chicago Board of Trade building and One North LaSalle. The meaning of each Indigenous and classical motif on both buildings was determined by a thorough review of Chicago's history, its tense relations with its Indigenous people, and each building's history. This study revealed that both motifs appear on Art Deco styled buildings as a celebration of Chicago's history centered around the centennial of its incorporation as a city into the United States. The classical motifs reinforce the American concept of Manifest Destiny while the Indigenous motifs romanticize interactions between early settlers and Native Americans. The classical motifs were used to draw parallels between Chicago and ancient Rome, showcasing Chicago's culture and America's need for expansion. The Indigenous motifs serve as a form of appropriation and manipulation of Native American culture and history. This retold version of history is something so ingrained in American culture that it is considered the "correct" version of history, which needs to be rectified.

**Melissa S. M. Yasunaka**

**Mentor: Professor Christopher Udry**

***Ghana Panel: A Qualitative Analysis***

The Ghana Socio-Economic Panel Survey is an extensive dataset led by Professor Christopher Udry at the Global Poverty Research Lab along with collaborators in Ghana. The Panel follows around 5000 households in Ghana throughout the years and contains a wide range of information on topics including education, health, employment, financial assets, and social conditions. This project focuses on the analysis of four open-ended questions given to participants regarding their feelings, worries, and expectations for their communities and themselves. The data consists of transcripts with the individual responses translated to English. Responses were coded to pave the way for analysis. Patterns highlighted by the codes were identified to determine common tendencies and circumstances. A notable trend is that many interviewees report being hopeful towards

their future finances, which raises multiple questions: What is the source of such optimism? Does it relate to their present financial situation? Does the religious context influence this hopeful state? Can this optimism predict a better financial outcome when compared to respondents who give more pessimistic responses? These research questions are addressed to identify factors that can predict the level of optimism. The understanding of such correlations aims to shed light on the relationship between positive mindset and mental health on one hand and behaviors and socioeconomic outcomes on the other.

**Kevin Foley**

**Mentor: Professor Matthieu Dupas**

### *An Analysis of Dustan Guillaume's Construction of Sexuality*

My research explores a trio of short autofictions written by gay author Guillaume Dustan in the late 1990's during the HIV/AIDS crisis. These texts center around the narrator's sexual relationships, nightlife antics, and HIV diagnosis. Given the controversial behavior exhibited in his stories, my study aimed to determine whether his work has anything to teach a modern audience. For that purpose, I propose a close-reading of Dustan's writing, which I contextualize through a sample of contemporary texts and period films, as well as scholarly articles engaged in the content and form of Dustan's autofictions. My reading highlights how the author's straightforward writing style and heavy focus on sex suggests his detachment from traditional aspects of life that have harmed him in the past. After enduring familial trauma as a child, Dustan becomes hyper-focused on sex and nightlife as a means of escape. His HIV status, however, complicates his efforts at distraction. Each sexual encounter offers a connection to the body he will soon lose, yet it also reminds him of his infection and his impending death. Instead of trying to be virtuous, Dustan presents his audience with the difficult reality of a gay man living in France during the AIDS epidemic. My study can hopefully incite new research into depictions of HIV in the media and the psychosocial dimension of public efforts to fight AIDS.

**Devyn Coar**

**Mentor: Professor Peter Locke**

***Movies and Mental Health: Brazilian Substance Abuse Films***

My research this summer focuses on mental health in films – specifically substance abuse in Brazil. Films serve many purposes within our society – entertainment, education, and art. All of which have societal ramifications. A film can shape attitudes around issues positively or negatively depending on their portrayals. The question becomes, how do these portrayals translate to a real-life policy, programs, or progress for the issues depicted onscreen. Addiction included. Global drug use has increased by 22 percent in the last decade.

However, adequate and quality addiction care and policy have not kept up with this growing issue. Brazil offers a unique perspective due to the high levels of poverty, crime, incarceration, and addiction that exist there. I watched three films, *Carandiru*, *Let it Burn*, and *City of God*, all of which portray themes of substance abuse differently. The question becomes how each portrayal hurts or helps shape attitudes and possibly policy surrounding this topic. Using aspects of film theory, I compare the films' portrayal of substance abuse and the atmosphere that surrounds it, while also collecting scholarly articles and data to ensure a well-rounded understanding of the realities of Brazil's current substance abuse issues and policies. This allowed me to draw conclusions on the effectiveness of each movie's portrayal. So far, I have been able to conclude that movies like *Let It Burn*, use realism to humanize those affected by drugs and allow risks glamorizing a world shrouded in police brutality and racial discrimination. In the future, I hope to build upon this question by analyzing films from various other countries.

**Pedro Guzman**

**Mentor: Professor Todd Parrish**

***The Effect of Training People to Stay Still on an MRI Scan***

Magnetic Resonance Imaging (MRI) is the primary tool to detect brain tumors, developmental anomalies, or other pathologies. The main drawback with MRI is that the patient must hold still during their imaging otherwise the images are useless. We propose that training patients with a motion tracker-based interactive game before their imaging improves their ability to hold still. First, we will determine if this method helps non-patients learn not to move over multiple trials with the interactive game. If non-patients can increase their ability to not move, then we can expect that clinical patients can do the

same. We plan to test this motion tracker-based interactive game in the clinic. From a small sample of non-patients, it is observed that most could stay still. 30% of the people started with low scores which meant that they moved with the motion tracker, but quickly learned to stay still after two trials. Based on this small sample, the amount of training people might need to learn to stay still before their MRI scan is less than expected. The results of training will lead to clear patient images compared to the blurry, useless images without training. Moreover, getting high quality images decreases the time the patient must be in the MRI machine which decreases the cost of imaging, and results in more accurate diagnoses and treatment plan. Motion-training might be the next step to increasing efficiency and improving outcomes in the medical field.

**Missy A. Trigos**

**Mentor: Professor Karen Alter**

***The COVID-19 Housing Crisis in Evanston: Federal, state and local actors work together to solve the problem***

The housing crisis has been a long withstanding issue before the coronavirus pandemic because of the lack of affordable housing and lagging wages. The COVID-19 pandemic worsened the housing crisis when low-income individuals and families lost jobs, daycare and schools. Moreover, the health risks created by the novel coronavirus made the issue of safe housing a life-or-death matter and therefore the government has responded by passing federal relief funding. The federal government awarded unprecedented aid to address this issue, yet significant monies remain undispersed, and many people still face great need. My research methods included literature and media analyses, as well as interviews with individuals and stakeholders involved in helping to address these issues from local staff at non-profit organizations to the mayor of Evanston. Through these interviews, I was able to examine how each actor understood their responsibility and how systematic problems hinder their efforts. I have learned that nonprofit actors and citizens believe that only a government adopted affordability plan can really address the issue, because such a plan holds elected officials responsible. On the other hand, elected officials believe that there are resources available for people who are in a housing crisis to use. Another problem with delivering federal relief funds for housing and rental assistance was the different requirements and deadlines from the state, county, and city. By focusing on Evanston's response to this national problem of affordable housing, I have gained a better understanding of the limitations that local actors face in addressing systemic issues and the localized challenges that federal actors face in implementing federal plans and programs.