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~ WUSHTA ~

WASHINGTON UNIVERSITY

SENIOR HONORS
THESIS ABSTRACTS

~ SPRING 2018 ~



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The logo for the Office of Undergraduate Research, on the front cover of this publication, consists of an "impossible triangle" within a starburst. To some, the triangle evokes the challenge of puzzles to be solved or the eternal research question "How does that work?" To others, the triangle represents the Greek letter Δ , the mathematical symbol for change.



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FOREWORD

The Office of Undergraduate Research is privileged to publish our tenth edition of the Washington University Senior Honors Thesis Abstracts (WUSHTA), an annual compendium presenting the work of our most talented and dedicated graduates.

Each year, our student contributors are recognized for rigorous and in-depth research projects which serve as capstones for their undergraduate years. These projects earn students the distinction of honors in their departments, colleges, and schools. Over the course of their undergraduate careers, these students have contributed an extraordinary body of new knowledge to their fields in ways far beyond what is generally expected at this stage of their lives, demonstrating that deep intellectual inquiry, exploration, and innovation is a hallmark of the Washington University undergraduate experience.

In recognizing the work of the students and the honors they have earned, we also recognize their mentors, academic departments, colleges, and schools, whose careful guidance has inspired these students to contribute their own original conclusions to growing bodies of academic research.

Finally, the Office of Undergraduate Research is greatly indebted to the late Kathryn Hoopes, whose generous bequest in support of undergraduate research continues to provide students with the means to perform outstanding research and us with the means to introduce it to a wider audience.

Congratulations to the Class of 2018. We are honored to present your work.



LINDSEY PAUNOVICH
Editor



JOY ZALIS KIEFER
*Director of Undergraduate Research
and Associate Dean in the College
of Arts & Sciences*

WUSHTA

WASHINGTON UNIVERSITY

COLLEGE OF
ARTS & SCIENCES

SPRING 2018



SEEING SHADOWS: THE GENDERED SURVEILLANCE OF BLACK WOMEN

Kiara Sample

Mentor: Jonathan Fenderson

This project, “Seeing Shadows: The Gendered Surveillance of Black Women,” explores the ways gender and race influenced the FBI’s surveillance of Black women activists. Previous scholarship has covered the role of surveillance in repressing revolutionary movements and neutralizing radical organizations. Male leaders such as Martin Luther King, Malcolm X, and Huey Newton have been the overwhelming focus of surveillance research in social movements. However, little scholarly attention has been paid to the ways the FBI monitored the lives of Black women. Historically, within many social movements, Black women have been marginalized, silenced, or reduced to only their gender because of patriarchal leadership. As a result, the persistence of sexism within these Black movements has affected Black women’s visibility within movement organizations. My research asks, how does gendered marginalization impact their surveillance and visibility to the FBI? It seeks to understand the influence of race and gender on the FBI’s surveillance of three women—Louise Thompson Patterson, Betty Shabazz, and Mabel Williams. By examining components of their FBI file—such as the language used to describe them, the content (not) included in each file, and the narrative built by the agents and informants—the project provides a comparative analysis across gender and across time to theorize the dynamics of surveillance, race, and gender. Based on a close analysis of their FBI files, I argue that the tension between hyper-visibility of surveillance and invisibility deriving from gendered stereotypes, resulted in two things: First, it created a cover for the women to continue their political activity without the repercussions of extremely suppressive surveillance, and second, it produced a vague understanding of the women’s lives, on the part of the FBI.

MEANING IN PRINT: EXPLORING THE MEANING OF MAKING IN THE PRINT SHOP

Savannah Bustillo

Mentor: Kedron Thomas

How do we think of our relationships to tools and materials in an age of massive digital technological innovation and proliferation? By using printmaking as a case study, I attempt to understand the interplay between digital technology and how making is navigated by practitioners. Based on semi-structured interviews with printmakers, bookmakers, and different types of craftspeople in the U.S. and Germany, I argue that printmaking can be rethought around the boundaries of technology, high art, and craft via three unique lenses: labor, making, and visual expression and application. To understand the organization of labor in print shops, I draw on anthropological theories of kinship, especially Marshall Sahlins' "mutuality of being" framework, to demonstrate how meaning is made through a process of creation and coordination. I approach "making" via Bourdieu's concept of habitus and practice theory, arguing that making in the print shop is a type of embodied practice experienced through small repetitions and coordination with machinery, which acts as an agentive force that also bears its own unique mark. Finally, I explore visual expression and application by looking beyond the boundaries of the print shop, where practitioners engage in making as part of various art- and craft-oriented occupations. Far from hindering 'authenticity' or 'tradition,' I find that digital technology helps fine-tune their decision-making even as they combine the digital with handwork to produce desired aesthetics and effects. This thesis achieves a holistic view of how printmaking can activate our understandings of what the handmade means in an increasingly digitized world. Being a 'maker' can be carried out successfully in many capacities, and practitioners are not afraid of continuing to move from more traditional methods into newer digital methods. My research thus contributes to and advances an expanding field of anthropology that champions making from the perspectives of people that manipulate and engage materially with their surroundings.

UNDERSTANDING LOCAL MEDICAL EMERGENCIES AND TREATMENT OPTIONS TO IMPROVE PRE-HOSPITAL EMERGENCY MEDICAL CARE IN IGANGA DISTRICT, UGANDA

Peter G. Delaney

Mentor: Bradley Stoner

Through understanding local medical emergencies and treatment options, my research intends to improve pre-hospital emergency medical care in Iganga District, Uganda. Using an ethnoscientific approach, I completed 60 semi-structured interviews with local community stakeholders, distilling local conceptions of trauma and current treatment, informing how best to conduct interventional work, respecting the duality between western and traditional medicine present in the district. Data on 60,000 traumatic hospital patient encounters covering 26 months was collected to analyze the most prevalent injuries and sources of trauma. For road trauma, this was determined to be from motorcycle taxis, which comprised over 50% of the entire road trauma burden, becoming my main target for road traffic incident (RTI) treatment and reduction strategies. Leveraging the pre-existing transportation infrastructure of the motorcycle taxi network, I established a lay emergency first aid responder program in the municipality by training 154 motorcycle taxis in first aid and locally sourcing first aid kits to treat the road trauma burden. Within three months, 250 victims of trauma were treated by trainees, demonstrating a pre-hospital emergency medical system composed of lay first responders can be developed leveraging pre-existing transport organizations, offering a scalable alternative for low- and middle-income countries (LMICs). To reduce the road trauma burden, I propose a novel RTI mitigation strategy seeking to implement a financial incentive scheme to influence driver behavior, the most important factor in crashes. Developed in collaboration with a local advisory council of community stakeholders, the proposal is a low-cost, versatile program that can foreseeably be used to mitigate reckless motorcycle taxi driver behavior. In the final chapter, I hypothesize how breaking what I identify as the deleterious cycle of affordable transportation alternatives in LMICs could actually reduce endemic poverty, discussing several financing options for safer transportation systems, as investments in reductions of road trauma are of critical importance to a nation's economic and infrastructure development.

ANALYSIS OF READY-TO-USE-THERAPEUTIC-FOOD (RUTF) FOR THE TREATMENT OF ACUTE MALNUTRITION IN CHILDREN AGES 6-59 MONTHS IN BRONG-AHAFO REGION, GHANA

Joanna Kim

Mentor: Geoff Childs

Acute malnutrition affects over 52 million, or one in twelve, children worldwide. Though a preventable and treatable condition, malnutrition is responsible for 45 percent of deaths among children under the age of five. Until recently, care for children with acute malnutrition was restricted to hospitals and therapeutic feeding centers. The discovery of ready-to-use-therapeutic-foods (RUTF) has drastically transformed malnutrition treatment from a facility-based approach to a community-based approach.

The current study analyzed two different types of RUTF acute malnutrition in 6–59-month-old children in a 12-week home-based feeding program the Brong Ahafo region of Ghana. A double-blinded and randomized clinical equivalency trial was conducted in order to compare an alternative, locally-produced RUTF to standard RUTF. The effectiveness of both RUTF was analyzed using anthropometric measurements such as weight-to-height Z score (WHZ) and mid-upper arm circumference (MUAC) measurements. With the introduction of locally-produced RUTF, the study aimed to find means of reducing production costs and integrating malnutrition treatment in a sustainable and local manner.

With the introduction of RUTF, management of acute malnutrition must also take the social and cultural factors into consideration. The causes of malnutrition reach need to be understood on a macro, meso and micro level. Interviews with mothers and community health workers were used to analyze beliefs surrounding malnutrition and interactions with traditional healing practices. With an ethnographic perspective to supplement the quantitative data, the study presented how the therapeutic foods could be more synergistically integrated with existing cultural and social practices of Ghana.

ZULU TRADITIONS DURING PREGNANCY AND BIRTH: A PRELIMINARY STUDY OF INTERGENERATIONAL DIFFERENCES IN MASHTA, SOUTH AFRICA

Momoko Oyama

Mentor: Bradley Stoner

In Zulu culture, several traditions and rituals are practiced during a woman's pregnancy and perinatal period. However, as urbanization spreads and Western influences strengthen, these rituals risk being lost. This project aims to capture existing knowledge of these traditions and to assess intergenerational changes in practices and attitudes towards these traditions and rituals.

Information on Zulu traditions and rituals practiced during a woman's pregnancy and perinatal period was collected through two interviews and a focus group consisting of three elderly women in Masxha, a Black township in Durban, KwaZulu-Natal. Following the interviews and focus group, 32 Masxha residents were recruited to complete a survey aimed at understanding intergenerational changes in practice of the traditions.

For the purpose of this project, participants 18 to 35 were classified as "younger" and those over 35 as "older." The 35-year cutoff was determined by halving the age of the oldest participant, who was 68 years old, and rounding up. Survey results indicated that older Masxha residents believed in the importance of practicing the traditions more than younger residents. Statistical analysis revealed older people were significantly more likely to believe men should not be with a woman while she is giving birth and that a mother must refrain from cooking after she gives birth compared to younger people. Older mothers were also more likely to have practiced the traditions than younger mothers, suggesting a decrease in practice of Zulu traditions. Further study is needed to understand younger people's perceived importance of Zulu traditions and rituals, and why their practice is becoming less common.

DISASTER RECOVERY AND RESILIENCE IN ALIMAPU, “THE BURNT LAND”

Allison Stewart

Mentor: Rebecca Lester

The history of Chile has been fraught by natural and socionatural disasters. Nevertheless, there is limited research on mental and emotional health effects and the coping mechanisms people use to persevere. This qualitative, descriptive study explores the stories of those affected by the Great Fire of Valparaíso, Chile, in 2014 and the opinions of the professionals involved in the recovery process to reveal how resilience is manifested among the disaster survivors. The sample population was composed of seven disaster survivors from the communities of Cerro Ramaditas and Cerro Mariposa, as well as four professionals that participated in research and reconstruction following the fire. Through semi-structured interviews and participant and non-participant observation, the study sought to contextualize resilience in Valparaíso, originally known as Alimapu or “the burnt land.” As with other traumatic events, the fire left emotional damage on each individual affected. However, the interviews illuminated the attributes of positive mental health that have allowed the victims to move on and rebuild their lives. The powerful words of the respondents maintained that there exists a particular strength of Chileans to unite and overcome disaster, a motivation that comes more from within the communities themselves than from the external assistance they receive. Factors of resilience vary on an individual level, but various key components of community resilience emerged from the data: shared history of natural disasters, solidarity, attachment to place, and projection of a future life. Community resilience was additionally found to be tied to the struggle to gain representation for a vulnerable population and the long history of resistance among the indigenous peoples in south-central Chile. By revealing the flaws in official disaster response and highlighting the mechanisms used to persevere, this research has implications for the improvement of interventions that can reinforce resilience in the case of disaster or trauma.

LANGUAGE MATTERS: PATIENTS' EMIC CONCEPTIONS OF MEDICAL VOCABULARY IN TWO COMMUNITY HEALTH CLINICS IN ST. LOUIS

Rachana Vemireddy

Mentor: Bradley Stoner

St. Louis is referred to as the sexually transmitted disease capital of the U.S. Since STIs are a significant public health concern in this region, it is important to improve provider-patient communication because in medical practice, optimal communication results in measurable benefits, such as shorter hospital stays, fewer complications, better adherence to treatment, increased patient satisfaction and understanding, and decreased anxiety, uncertainty and likelihood of litigation.

This is an important issue because many patients (such as those from less education history) do not accurately understand the meanings of many biomedical terms that are frequently used in clinic visits. My project's primary aim is uncovering patients' emic conception of medical terminology and how that compares and contrasts with that of the commonly held medical viewpoint of these terms. It is important to elicit and gain an understanding of the patient population's emic conception of medical terminology because it has applications for improving communication.

A summary of project results includes that there was great variability in the way that different patients interpret and associate meaning with STI-related terminology, and patients' emic conception of many words differed from that of the commonly held medical viewpoint. Many of the individuals estimated that there is a significant number of medical terms that they don't understand—for example, Interviewee #7 said that "most time...6 or 7 medical words per visit is hard to understand."

PARTIAL KNOCKDOWN OF PUTATIVE *MTSA2* GENE
SUPPORTS ITS ROLE IN 6mA ADENINE
METHYLATION OF THE SOMATIC GENOME
IN *TETRAHYMENA THERMOPHILA*

Matthew Agritelley

Mentor: Douglas Chalker

DNA methylation can confer heritable epigenetic information critical for proper reading of the genetic code. Methylation on the fifth carbon of cytosine (5mC) has been broadly studied for its roles in gene regulation and epigenetic inheritance. In contrast, much less is known about the importance of methylation on the sixth nitrogen of adenosines (6mA) in DNA or RNA. 6mA is the only DNA modification known in the model organism *Tetrahymena thermophila*, whose nuclear dimorphism provides a unique context for studying epigenetic regulation. In this ciliate, 6mA is found exclusively in the somatic nucleus, which may suggest that it participates in the control of gene expression. The enzyme(s) responsible for this modification remain undiscovered. Methyltransferase targeting position N-Six of Adenine 2 (*MTSA2*) is a putative gene in *T. thermophila* that belongs to a larger family of genes theorized to encode proteins that add 6mA to DNA or RNA. *MTSA2* contains a highly-conserved MT-A70 domain with known function as the S-adenosylmethionine binding subunit of mRNA methyltransferase in eukaryotic mRNA. We examined *MTSA2*'s function using a localization assay of a yellow fluorescent protein construct and assessed relative levels of 6mA by generating an *MTSA2* knockout (KO) strain. We found that *MTSA2* localizes to the macronucleus during growth, supporting its role as a DNA methyltransferase. Moreover, *MTSA2* KO strains showed a substantial decrease in 6mA relative to wild type (WT) strains. Interestingly, it was difficult to generate strains in which all of the copies of the *MTSA2* were knocked out in the polyploid (50N) somatic macronucleus. These KO strains appeared to grow more slowly than strains containing a greater number of WT copies. These results suggest that *MTSA2* appears to be important or even essential for cell growth. Together these data show that *MTSA2* likely functions as a key 6mA methyltransferase in *T. thermophila*.

CHARACTERIZING B-LYMPHOCYTE RESPONSE TO NEOANTIGEN EXPOSURE IN EARLY-STAGE PANCREATIC CANCER

Katherine Alexander

Mentors: Samarth Hegde and David G. DeNardo

Even in its earliest stages, pancreatic ductal adenocarcinoma (PDAC) remains a highly lethal disease, with a five-year survival rate of < 10%. This is especially puzzling, given the known presence of neoantigens that should be acted upon by the host adaptive immune response. These epitopes are not recognized as “self” by the thymus, and are thus vulnerable to immune surveillance and attack. During the course of pancreatic cancer progression, immune surveillance is altered, even though the specific components responsible for altering anti-tumor immune responses have not yet been identified. Using a genetically engineered mouse model of PDAC that recapitulates human PDAC progression and secretes chicken ovalbumin (OVA), a moderately immunogenic epitope that models neoantigenicity, we investigated changes in the immune infiltrate in response to neoantigen exposure in early-stage pancreatic cancer. This was done using immunofluorescent staining and immune cell quantitation via HALO software. B cell infiltration was correlated to both tissue transformation and tumor grade to examine the relationship between antigen exposure and PDAC pathogenesis. Additionally, the induction of inflammatory response was examined by comparing B cell quantitation to granulocyte count. Our investigation revealed that infiltration of B220+ B lymphocytes increased in early stage tumors expressing OVA and corresponded with disease stage, progression, and inflammation, demonstrating an early host adaptive immune response against neoantigen in pancreatic lesions. Future studies will explore these parameters in later stage disease tissue to observe changes in the immune infiltrate and whether or not adaptive immune activation declines over time. These findings may further support why advances in immunotherapy have yet to yield results in treating patients with pancreatic cancer.

IN VITRO SCREENING FOR MODULATORS OF SYNAPTIC DEVELOPMENT IN A MODEL OF FRAGILE X SYNDROME

Kelsey Barter

Mentor: Aaron DiAntonio

Fragile X Syndrome (FXS) is the most common genetic cause of intellectual disability, caused by an X-linked mutation in the gene *Fmr1*, which encodes for Fragile X Mental Retardation Protein (FMRP). FMRP is essential for normal cognitive development and function, and across species, mutations in *Fmr1* drive mutant phenotypes at the synapse. Accordingly, the function of FMRP is highly conserved across species; FMRP is a translational repressor with over 800 mRNA targets identified in the mouse. In the absence of FMRP, loss of translational repression over target mRNAs results in overexpression of the respective protein products. In mammals, there are obvious and functionally relevant defects in the development of dendritic spines, which are the sites at which a neuron receives excitatory synaptic input from other neurons. Cortical neurons of *Fmr1*-knockout (KO) mice, a well-established mammalian model of FXS, have immature, thin dendritic spines. A virtually identical malformation of dendritic spines has been observed in the brains of humans who had FXS, indicating that proper spine development is a conserved and critical aspect of FMRP function. This phenotype also affects synaptic function; cortical neurons from *Fmr1*-KO mice are hyperexcitable. We developed an assay to culture *Fmr1*-KO mouse embryonic cortical neurons to screen for genetic and pharmacological manipulations that can reverse these defects. The goal is to discover novel genes and proteins that, when knocked down or inhibited, reverse the *in vitro* immature spine phenotype of *Fmr1*-KO neurons, suggesting they are normally targeted by FMRP. We hypothesize that overexpression of these key targets may drive *Fmr1*-KO mutant phenotypes at the synapse. FXS is a developmental and intellectual disorder of entirely genetic origin; because it is frequently linked and shares similarities to Autism Spectrum Disorders (ASD), a hit from our screen could have therapeutic potential for the larger class of disorders.

MODELING 'ADDICTION' IN *DROSOPHILA MELANOGASTER* FROM THE PERSPECTIVE OF NEURONAL HOMEOSTASIS

Bijoya Basu

Mentors: Yehuda Ben-Shahar and Ross McKinney

Although genetics and heritability play a major role in its etiology, the molecular and neuronal mechanisms underlying drug addiction remain largely unknown. While current dogmas stipulate that addiction is specifically associated with the dopaminergic reward system, emerging data suggest that this model cannot explain all physiological aspects of the phenotype. Here we propose to test an alternative, non-mutually exclusive model, which looks at addiction as a direct product of neurodevelopmental processes associated with the homeostatic response to chronic drug exposure. Specifically, we hypothesize that drug exposure during critical periods of nervous system development leads to modulation of the molecular and physiological processes that maintain physiological neuronal homeostasis in the presence of the drug. Subsequently, once these pathways mature, the affected cells and circuit depend on the presence of the drug for their normal functions. To test our hypothesis, we are investigating the effects of chronic exposure of *Drosophila melanogaster* to nicotine, a highly addictive acetylcholine receptor agonist, on the neuronal homeostatic response to stress. By using behavioral and genetic approaches, my thesis work suggests that withdrawal from long-term nicotine exposure leads to impaired homeostatic responses to acute heat stress, which is associated with alterations in the expression levels of genes involved in nicotinic neuronal signaling. We conclude that chronic developmental exposure to nicotine leads to molecular and physiological changes, which affect the homeostatic neuronal response, and therefore, might provide a novel mechanism for drug addiction.

CREATING A PATHOPHYSIOLOGICAL MODEL TO PREDICT BLINK SUPPRESSION DISCOMFORT FROM BLINK TIMING

Haley Botteron

Mentor: Kevin Black

Functional neuroimaging studies have attempted to explore brain activity that occurs with tic occurrence in subjects with Tourette syndrome (TS); however, they are limited by the difficulty of disambiguating brain activity required to perform a tic, or activity caused by the tic, from brain activity that generates a tic. Inhibiting the urge to tic is important to patients' experience of tics. We hypothesize that failure of inhibition of a compelling motor response to a natural urge, such as the urge to blink which shares many similarities to premonitory urges, will differ in TS subjects compared to controls. Previous neuroimaging studies with the same hypothesis have used a one-size-fits-all approach to extract brain signal putatively linked to the urge to blink. However, our objective was to create a subject-specific and blink-timing-specific pathophysiological model, derived from out-of-scanner blink suppression trials, in order to better interpret blink suppression fMRI data. Eye closure and continuously self-reported discomfort were reported during five blink suppression trials in 29 adult volunteers, 15 with a chronic tic disorder. The novel model of discomfort during blink suppression was a much better prediction of observed discomfort than previously tested models. The TS group blinked almost three times more often during the blink suppression block, and reported higher baseline discomfort, smaller excursion from baseline to peak discomfort during the blink suppression block, and slower return of discomfort to baseline during the recovery block. By accounting for blink timing and each subject's individual response characteristics, we were able to create a model which, using a leave-one-out cross-validation approach, was found to better reflect each subject's urge to blink compared to two previously proposed models. Combining this approach with observed eye closure during fMRI blink suppression trials should therefore extract brain signal more tightly linked to the urge to blink.

RECURRENCE RISK FOR WOMEN WITH ABNORMAL FIRST AND SECOND TRIMESTER SERUM SCREENING MARKERS IN A SUBSEQUENT PREGNANCY AND RISKS OF ADVERSE OUTCOMES IN WOMEN WITH LOW PREGNANCY-ASSOCIATED PLASMA PROTEIN-A (PAPP-A) AND A NORMALLY GROWING FETUS

Casey Brooks

Mentors: Joanne Stone, Angela Bianco, and Chloe Getrajdman

Routine prenatal first and second trimester serum markers are measured in pregnant women for aneuploidy screening. Literature supports an association between abnormal markers and adverse pregnancy outcomes relating to placental dysfunction and fetal growth disorders. However, there is paucity of information on whether a woman with abnormal markers in one pregnancy is at risk for abnormal markers in a subsequent pregnancy as well as the risk of adverse pregnancy outcomes in women with low PAPP-A, a risk factor for fetal growth restriction, and a normally growing fetus (AGA). We present two analyses: (1) the risk of recurrent abnormal serum markers in consecutive pregnancies; (2) the risk of adverse outcomes for a woman with low PAPP-A and AGA fetus. Patients for both analyses were identified from a database, with data available for markers in consecutive pregnancies in (1) and maternal characteristics/delivery for (2). We performed a retrospective cohort analysis via chart review and used student's t-test, chi-square, or Fisher's exact test where appropriate. For each marker analyzed, there was an increased risk of having an abnormal marker in a subsequent pregnancy after having that marker in the first. In measuring cross-markers, we found no increased risk. In comparing low PAPP-A cases with normal PAPP-A controls, we found an increased risk of cesarean section for the cases with no trend regarding non-reassuring fetal heart rate. Further studies are necessary to investigate potential underlying maternal pathophysiology leading to abnormal serum markers and if fetal testing or planned delivery for low PAPP-A cases is indicated.

DOWNREGULATION OF RNA EDITING ENZYME ADAR1 REDUCES THE ONCOGENIC POTENTIAL OF TRIPLE-NEGATIVE BREAST CANCER

Emily Bross

Mentor: Jason Weber

Adenosine deaminase acting on RNA (ADAR1) is a RNA-editing enzyme that converts adenosine into inosine, resulting in alterations of the RNA sequence and subsequent downstream effects. It has been shown to be over-expressed in a variety of cancers including breast cancer but its exact role in tumorigenesis remains unclear. To better understand the effects of ADAR1 on breast cancer tumorigenesis, we generated shRNA-containing lentiviruses to knock-down the expression of ADAR1 in human breast cancer cell lines. We performed Western blot analysis to verify the successful knock-down of ADAR1 protein. We conducted focus formation assay to test the effect of ADAR1 knock-down on human breast cancer cell lines' proliferative abilities. We also performed scratch assay to test the metastatic potential of the same cell lines.

ADAR1 expression was successfully downregulated in all of the human breast cancer cell lines we tested. Interestingly, downregulation of ADAR1 reduced proliferation of triple-negative breast cancer (TNBC) cell lines while having little effect on the proliferation of non-TNBC cell lines. Scratch assay also revealed the downregulation of ADAR1 inhibited the migratory abilities of TNBC cell lines. These results suggest that ADAR1 is a key player in the oncogenic nature of TNBC. We are in the process of performing in vivo mouse studies to verify our findings from the cell culture system and to develop an animal model for future development of potential innovative treatment options. Further investigation promises to illuminate novel targeted therapeutic approaches currently lacking in the treatment of TNBC.

IDENTIFYING A NEUROTOXIC MECHANISM PRESENT IN WEST NILE NEUROINVASIVE DISEASE

Jasmine Brown

Mentors: Robyn S. Klein and Charise Garber

More than half of patients who survive West Nile neuroinvasive Disease exhibit chronic cognitive impairments, such as spatial learning deficits. With various studies implicating interferon gamma (IFN γ) in a mechanism responsible for cognitive deficits following viral infection, the lab studied WNV-infected interferon gamma receptor knockout (IFN γ R^{-/-}) mice to determine if signaling through this receptor contributed to spatial learning deficits. All IFN γ R^{-/-} mice were protected from spatial learning defects. I used this global gene deletion model to determine gene expression downstream of IFN γ that confers poor learning. Brain tissue was harvested from these mice at 7, 25 and 52 days post-infection. Virus is present in the brain at day 7 but cleared by day 25 and 52. I used this tissue to determine the changes in gene expression for an array of genes suspected to underlie memory dysfunction. I also studied Cx3Cr1-Cre^{ER}-IFN γ R^{fl/fl} mice, which have IFN γ R conditionally deleted from microglia and are also protected against spatial learning deficits. This allowed me to evaluate how interferon gamma signaling, specifically to microglia, plays a role in the cognitive deficits observed in WNV infected mice. I assessed changes in microglia activating gene expression in these microglia-specific knockout mice. The global knockout mice exhibited decreased expression of complement regulatory and microglia activating genes during early recovery. These results suggest that elevated expression of complement regulatory and microglia activation genes during early recovery may contribute to the spatial learning deficits present in wild type (WT) mice following WNV infection. Elucidating this neurotoxic mechanism is vital to the development of therapies for people experiencing cognitive deficits following WNV infection.

PHARMACODYNAMIC pHMRI WITH JOINT ESTIMATION OF THE ARTERIAL DRUG INPUT CURVE

Molly Charney

Mentor: Kevin Black

This study introduces a refinement to a method for quantifying the sensitivity of multiple brain regions to a drug. Rapid quantitative pharmacodynamic imaging simultaneously estimates pharmacokinetic (PK) and pharmacodynamic (PD) parameters from a region of brain through administration of a drug during fMRI BOLD signal collection. Here we use the fact that the concentration of drug in arterial blood is essentially the same for all regions of the brain to more tightly estimate the time–concentration curve and hence reduce unwanted model flexibility in estimating PD parameters. Furthermore, assuming linear pharmacokinetics, we can appropriately combine responses to the drug across doses. To test this approach, a dopamine D1-like agonist, SKF38393, was administered intravenously to baboons ($n = 4$) during BOLD-sensitive fMRI. Each subject received four different doses of drug on four different occasions with order randomized. Data from the hypothalamus, midbrain, and striatum were used to estimate the most likely time–concentration curve; the 90% confidence interval for this curve was much tighter than the range of curves when data for each region and dose were considered one at a time. The most likely time–concentration curve was then used as prior information to constrain quantification of drug sensitivity (EC_{50}) voxel-wise throughout the brain. The results support the use of rapid quantitative pharmacological imaging in determining appropriate and effective dosing for brain disorders such as Parkinson's disease as well as for determining arterial drug concentration measurements when this data is not directly available.

PATERNAL CIGARETTE SMOKE EXPOSURE INDUCES FETAL DEMISE AND TESTICULAR GERM CELL DEATH: UTILIZATION OF *IN VIVO* AND *EX VIVO* TOXICOLOGY MODELS

Paul Felder

Mentors: Kelle Moley and Prabakaran Esakky

Cigarette smoking and secondhand smoke exposure cause 480,000 deaths in the U.S. per year, more than HIV, illicit drug use, alcohol use, motor vehicle injuries, murder, and suicide combined. In human males, exposure to nicotine is known to reduce sperm count and motility, and increase abnormal sperm morphology. However, effects of paternal smoking on fetal outcomes and the threshold levels at which cigarette smoke disrupts spermatogenesis have not been determined. In this study, we utilized a mouse testicular explant model and a mouse mating model to test the hypothesis that exposure to cigarette smoke condensate (CSC) above a certain threshold induces DNA damage and apoptosis in the testes and spermatogenic lineage cells, which proves to be detrimental to fetal development. Our testicular explant data demonstrate CSC has a spermatogenic germ-cell toxicity threshold in mice of 160 μg (7.06 mg of nicotine/kg body weight) which is below the lower bound of the nicotine exposure range of light smokers ($< 7.5\text{-}24$ mg nicotine/kg), defined as adults who smoke fewer than 15 cigarettes per day. In male mice, we found that this level of CSC exposure in a single cycle of spermatogenesis (35 days in mice, 76 in humans) is sufficient to produce DNA damage leading to germ cell and spermatocyte death through activation of both intrinsic and extrinsic apoptotic pathways. In murine mating studies with CSC-treated males and unexposed females, we found a higher rate of fetal resorptions, which in humans correlates to fetal demise. We believe that CSC exposure has the potential to produce heritable genetic defects that increase the risk of developmental abnormalities in offspring.

INTERACTIONS OF *STAPHYLOCOCCUS AUREUS* WITH OSTEOCLASTS AND OSTEOBLASTS

Emily Goering

Mentor: Deborah Veis

Osteomyelitis is infection-driven inflammatory disease of the bone primarily caused by *Staphylococcus aureus* (*S. aureus*), which results in pathological bone loss. Historically, *S. aureus* was thought to be an extracellular pathogen, yet new research has shown that *S. aureus* is internalized into many cells. To investigate the behavior of intracellular *S. aureus* in bone cells, we used an *in vitro* gentamicin protection assay to examine intracellular bacterial survival in osteoblasts, the cells that build bone, and osteoclasts, the cells that destroy bone, over several time points. We found that *S. aureus* persists in differentiated osteoblasts but is unable to replicate over the course of infection. However, in differentiated osteoclasts intracellular *S. aureus* is able to proliferate over time, whereas it is eliminated in osteoclast precursors. We next examined the intracellular location of *S. aureus* in osteoclasts to determine how *S. aureus* avoids elimination and replicates in these cells. We used fluorescence-based confocal microscopic imaging of the fluorescent dye LysoTracker, which marks acidified intracellular vesicles, with GFP-labelled *S. aureus* during *in vitro* infection of osteoclasts. We found that intracellular *S. aureus* is localized to lysosomes early in infection but not late in infection in osteoclasts, indicating a role for lysosomes in mediating clearance of intracellular *S. aureus*. Finally, to determine if the NLRP3 inflammasome affects intracellular *S. aureus* pathogenesis in osteoclasts, we utilized NLRP3 knockout osteoclasts in the *in vitro* gentamicin protection assay. Initial results suggest that loss of NLRP3 results in increased levels of intracellular bacteria over time, suggesting a role for the NLRP3 inflammasome in limiting bacterial growth in osteoclasts. Overall, the ability of *S. aureus* to persist within osteoblasts and osteoclasts and avoid progression of endocytic vesicles to lysosomes may provide a niche in which *S. aureus* can escape professional phagocytes and extracellular antibiotics, mediating the pathogenesis of osteomyelitis.

IDENTIFYING NOVEL EPIGENETIC DEPENDENCIES IN PRE-LEUKEMIC HEMATOPOIETIC STEM CELLS

Emily Haussler

Mentors: Grant Challen and Elizabeth Ostrander

The DNA methylation modifying enzymes DNMT3A and TET2 are essential for proper differentiation of hematopoietic stem cells and are frequently found to be mutated in a range of blood cancers. Although their functions in regulating DNA methylation have been characterized, a specific connection between methylation patterns and altered gene expression has not been established to explain the observed disease phenotype. We hypothesize that DNMT3A- and TET2-mutant HSCs are dependent on other epigenetic regulators to corrupt normal hematopoietic pathways. If this is the case, inhibition of the chromatin modifiers on which driver mutations DNMT3A and TET2 depend could represent a novel therapeutic strategy for reducing the propagation of pre-leukemic HSC populations and preventing the onset of a range of blood cancers. To test this hypothesis, we employed a CRISPR-Cas9 based negative selection screen on cells derived from DNMT3A-null and TET2-null HSCs, targeting 180 chromatin modifying genes, using three to six sgRNA “guides” per gene. Results were obtained from three independent screens, and those genes showing significant fold depletion over time in DNMT3A-null or TET2-null cells were selected for further investigation as potential therapeutic targets. Specifically, *Brd2* and *Zmynd8* are being considered for future directions. Ultimately, we conclude that our negative selection CRISPR screen is optimized to detect those genes potentially showing an epigenetic dependence with DNMT3A and TET2 in hematopoiesis, and that further functional studies *in vivo* are needed to draw definite conclusions about their roles.

THE EFFECTS OF OOMYCETES ON PLANT-SOIL FEEDBACK INTERACTIONS

Hanusia Higgins

Mentors: Scott Mangan and Claudia Stein

The negative effects of soil microbes on plant communities have long been documented. However, plants' soil pathogens are often treated as a monolithic group instead of a complex network of specific interactions. Negative plant-soil feedback (NPSF) is one important type of interaction that promotes stable interspecies coexistence, and it hinges on plants' specialist soil pathogens. One category of microorganisms that contributes significantly to plant-soil pathogen interactions is Oomycota, a fungus-like class whose members cause several devastating plant diseases. However, one oomycete, *Pythium oligandrum*, is unique among its class because of its positive effects on plants: It promotes plant growth, in part because it parasitizes plant pathogens, including other oomycetes. The goals of my project were to first determine the effects of both oomycetes as a group and *P. oligandrum* in particular on the growth of several temperate forest tree species; and second, to determine how each of these treatments influences the strength of the focal tree species' NPSF. Although the experiments are still in progress, my preliminary results show that using a targeted biocide to exclude oomycetes from the soil community has no effect on temperate tree seedling growth, neither directly nor through impacting NPSF. The experiment treating plants with *P. oligandrum* has no preliminary data to report yet, but I hypothesize that adding *P. oligandrum* to the soil community will have a positive effect on plant growth and will weaken NPSF. This effect, in addition to attacking plant pathogens, could potentially destabilize plant species' coexistence mechanisms.

MUTANT *IDH* ALLELES CAUSE METHYLATION CHANGES IN THE HUMAN GENOME WHICH ALTER GENE EXPRESSION IN GENES WITH DIFFERENTIALLY METHYLATED GENE PROMOTERS

Reuben Hogan

Mentor: David Spencer

Acute myeloid leukemia (AML) is an aggressive form of cancer that occurs in hematopoietic stem cells. Previous work demonstrated that AML tumors contain many recurrent mutations. Some of these mutations occur in genes that are critical for epigenetic regulation, such as *DNMT3A*, *TET2*, or *IDH1* and *IDH2* (collectively referred to as *IDH*). Mutations in *IDH* occur in about 20% of AML samples. Mutant *IDH* enzyme develops neomorphic function; it produces the oncometabolite 2-hydroxyglutarate (2HG) instead of alpha-ketoglutarate. 2HG has been associated with DNA hypermethylation and increased histone methylation in AML. Both epigenetic changes alter the chromatin state, which can affect gene expression. Our lab hypothesizes that expression of mutant *IDH2* alleles increases the amount and type of methylation at genomic loci that can affect the transcription of genes with promoters located in differentially methylated regions (DMRs) of *IDH* mutant and wild type AML. To assess mutant *IDH2*-specific dysregulation, our lab developed a line of transgenic H9 human embryonic stem (hES) cells with a doxycycline (DOX)-inducible *IDH2*^{R140Q} mutant allele. We optimized DOX treatment for both expression of the mutant allele and cell viability by manual counting with a hemocytometer and then confirmed by mass spectrometry that mutant *IDH2* produces 2HG. As for changes in methylation, we demonstrated by Western blotting that expression of mutant *IDH2* increases overall trimethylated H3K9, a histone marker of gene silencing. We are currently preparing transgenic hES cell DNA for TrueMethyl bisulfite and oxidative bisulfite sequencing to quantify and locate DNA methylation. To understand differences in expression due to methylation, we took a subset of 871 unique gene promoters located in the DMRs of DNA. Using RNA-Seq data, we identified nineteen genes with dysregulation beyond what would be predicted. PANTHER Gene List Analysis of the 871 unique genes identified consistent themes for protein and nucleic acid binding as well as hydrolase and transferase activity.

A ROLE FOR THE POTASSIUM CHANNEL SEIZURE IN REGULATING INTRINSIC NEURONAL STRESS RESPONSE IN *DROSOPHILA MELANOGASTER*

Poorva Jain

Mentors: Yehuda Ben-Shahar and Alexis Hill

The human ether a go-go related potassium channel (hERG) has been previously implicated as a major contributor to the cardiac disorder Long QT Syndrome (LQTS). Patients with mutations in hERG also present higher rates of seizures than patients with mutations in other genes. This seizure phenotype has long been assumed to be an indirect consequence of defective heart physiology, therefore more extensive research has been done on the cardiac function of hERG and its homologs than on the neuronal functions. However, hERG is also expressed in the brain and there is evidence in *Drosophila melanogaster* (fruit fly) that mutations in the homolog of hERG, *seizure* (*sei*), elicit heat based seizure phenotypes. This suggests that the seizures associated with LQTS could be a direct consequence of disrupted hERG function in neurons. We wanted to use behavioral paradigms in *D. melanogaster* studying *sei* to better understand how hERG directly impacts seizure behaviors. We saw *sei* to be widely expressed in the nervous system of flies. By screening available potassium channel mutant lines, and downregulating their neuronal expression, we characterized *sei* mutants as unique in increasing seizure behavior in flies during heat stress. Changing our behavioral paradigm, our experiments using a cold stress assay support a model where SEI function is only relevant after a neuron reaches a threshold activity level. While our experiments demonstrate that *sei* impacts neuronal function, our initial behavioral experiments using *hERG* expressing transgenic flies do not indicate that hERG functions properly when expressed in *Drosophila*. Further studies must be performed to in order to understand how to better model hERG in flies especially as the fly model recapitulates some but not all human biology in providing essential proteins or correct trafficking for this ion channel to function correctly.

TOWARDS DISCOVERING INHIBITORS OF CYTOCHROME *c* BIOGENESIS

Shannon Jinxia Jiang

Mentors: Robert Kranz and Deanna Mendez

Cytochrome *c* (cyt *c*) is a heme protein found in most organisms (including human pathogens) that plays an essential role as an electron carrier in the electron transport chain and a signal for apoptosis. The biosynthesis of *c*-type cytochromes occurs by three different systems (Systems I and II in bacteria and System III in humans). Besides requiring different protein systems, their site of synthesis also differs. Systems I and II function in the bacterial periplasmic space while System III functions in the mitochondrial intermembrane space. These differences may allow for selective targeting of bacterial systems using antimicrobial compounds which could be beneficial in combating infectious bacterial diseases. My first project focuses on 1) the development, and 2) utilization of a robust assay to monitor cyt *c* synthesis in the presence of potential inhibitors. The Kranz Lab has engineered all three systems to function in recombinant *E. coli*, where Systems I and II produce cyt *c* in the periplasm while System III makes cyt *c* in the cytoplasm. My findings suggest that the luminescence assay developed by the Kranz Lab which detects the presence of matured cyt *c* in the periplasm does not detect cyt *c* production in the cytoplasm, most likely due to limited luminol access. I optimized a separate screen to quantitatively detect cyt *c* maturation by all three systems and analyzed cyt *c* maturation in the presence and absence of known and potential inhibitors.

FGF SIGNALING ROLE IN BONE HOMEOSTASIS

Josh Langberg

Mentor: Craig Smith

Fibroblast growth factors—FGFs—have proven to be strong regulators of embryonic development and homeostasis in many organ systems. When bound to FGFR1 and FGFR2 in bone cells, they play crucial roles in proliferation, homeostasis, and apoptosis processes. The double knockout of FGFR1 and FGFR2 results in a unique phenotype found in osteocytes in cortical bone. This was done using osteocalcin CRE, which targets mature osteoblasts. In mice between 12-16-weeks-old, the cortical bone thickens significantly, and the marrow cavity is eventually overtaken by mineralized cortical bone. There seems to be an opposite phenotype, however, at three weeks of age. Preliminary data shows that adolescent three-week-old mice have less bone than the wild type controls, but this has to be confirmed with further experimentation. This project intends to demonstrate the role of FGF signaling in adult bone homeostasis. Osteocalcin CRE, FGFR1 FLOX, and FGFR2 FLOX that target adult osteoblasts have increased osteocyte cell death even at early ages which significantly affects bone homeostasis. Using TUNEL staining, which detects cells undergoing apoptosis, and EDU staining that marks proliferation of osteoblasts, we intend to solidify our observations that FGF signaling is a survival factor for osteocytes and plays a significant role in bone homeostasis.

NOVEL GENETIC VARIANTS IN THE OXYTOCIN RECEPTOR UNDERLINE OXYTOCIN RESPONSIVENESS

Grace Y. Lee

Mentor: Sarah K. England

Oxytocin (OXT) is used on approximately 43% of women who give birth in the U.S. to induce or augment labor. The maximum OXT dose varies between women from $\leq 2\text{mU/min}$ to $\geq 20\text{mU/min}$. Those requiring $\geq 20\text{mU/min}$ of OXT are defined as “high-dose requiring (HDR).” The biological cause underlying these individual differences in OXT response is unknown, however, maternal genetics is suspected to be a factor. Our laboratory has identified three variants (H173R, R150L, and R151C) in the oxytocin receptor (OXTR) gene in women who are HDR. H173R, R150L, and R151C were located in the binding and signaling domains of the OXTR and were predicted by SIFT (“Sorting Intolerant From Tolerant”) algorithm to be damaging to protein function. Another variant, A218T, was identified in approximately 22% of HDR and LDR women but predicted to be non-damaging to protein function. We hypothesized that the variants found in HDR individuals and predicted to be damaging would attenuate OXTR signaling. OXTR variants were created via mutagenesis and transfected into HEK293T and hTERT cells. Monoclonal HEK293 cell lines stably expressing wild-type (WT) OXTR and R150L+A218T OXTR were generated. The OXTR signaling ability of the WT and variants was assessed with an ELISA assay using IP1 accumulation as the readout for OXTR signaling. Calcium imaging was also used to measure OXTR function.

WT OXTR were functional as measured by the ELISA and calcium imaging. Higher doses of OXT led to greater stimulation of the OXTR and greater IP1 accumulation in cells transfected with WT OXTR. Cells stably expressing R150L+A218T OXTR were found to produce less IP1 compared to the WT OXTR. Our studies show that genetic variants found in HDR individuals may attenuate OXTR signaling. If so, this may help improve clinical methods and treatments using OXT during labor and delivery.

RELATIONSHIP BETWEEN NATURAL DIETARY INTAKE OF TRYPTOPHAN AND DEPRESSION SEVERITY

Anita Mahadevan

Mentor: Deanna Barch

Major Depressive Disorder (MDD) is a prevalent and burdensome disorder. With the emergence of the monoamine-deficiency hypothesis, the neurotransmitter serotonin (5-HT) has been implicated in MDD pathophysiology. Though effective treatments targeting serotonergic pathways exist for MDD, numerous barriers prevent patients from accessing or continuing treatment. Tryptophan, an amino acid, is a precursor to serotonin and consumption may manipulate serotonin availability in the central nervous system, thereby presenting a potentially more accessible method of MDD treatment through modulation of dietary tryptophan consumption. The purpose of this study was to examine relationships between natural dietary tryptophan consumption and depression symptomatology to determine whether individual differences in depression symptomatology correspond with tryptophan consumption. Two hundred and forty-four Washington University in St. Louis students (192 with usable data) participated in this study by completing questionnaires assessing mood, food intake, sleep, and exercise habits. Mood, sleep, and exercise were evaluated using the Center for Epidemiologic Studies Depression Scale, Pittsburgh Sleep Quality Index Questionnaire, and International Physical Activity Questionnaire respectively. Dietary tryptophan consumption was evaluated using a novel survey assessing the type and amount of a wide range of tryptophan-containing foods. Contrary to our hypothesis that modulating dietary tryptophan consumption may mitigate MDD symptoms, no significant relationship between tryptophan consumption and depression symptomatology was found. Sleep was the only predictor of mood, which was observed in both sexes. Numerous sex differences were observed: tryptophan consumption was predicted by sex, with males consuming more tryptophan-rich foods, and more exercise predicted lower depression symptomatology only in females. Limitations of this study include lack of information on participant psychotropic use and challenges accurately quantifying tryptophan consumption. Given these limitations, future studies are recommended that take medication into account and measure tryptophan in a more direct manner.

ENHANCING LIPID METABOLISM PROMOTES CYTOKINE-INDUCED ACTIVATION AND IFN- γ PRODUCTION IN NAÏVE HUMAN NATURAL KILLER CELLS

Emily K. Moore

Mentor: Megan A. Cooper

Natural killer (NK) cells are cytotoxic lymphocytes in the innate immune system. NK cells play a key role in early response to virally infected cells and tumor cells. As such, NK cells serve as an important potential form of cellular immunotherapy for patients with acute myeloid leukemia (AML). During an immune response, the cells of the immune system undergo changes in their cellular metabolism. Immunometabolism studies have shown that many cell types alter their use of cellular metabolic pathways to initiate an immune response. Since metabolism is an important regulator of immune cell differentiation and effector functions, in this study, we sought to determine what metabolic pathways were important for NK cell activation and production of the immunostimulatory cytokine, interferon-gamma (IFN- γ). NK cells cultured for seven days in lipid-supplemented media, in the absence of any other stimulus, showed enhanced IFN- γ production following a six-hour cytokine activation. Additionally, treatment with metformin, an enhancer of fatty acid oxidation (FAO), further increased NK cell activation, especially when combined with lipid supplementation. These findings suggest the importance of lipid metabolism for NK cell activation. Further work is being done to investigate the mechanism by which lipids and metformin enhance NK cell activation, using techniques including cell culture with the FAO inhibitor etomoxir, extracellular flux assays, and gene expression analysis. These discoveries may aid the activation of NK cells for use in cellular immunotherapy in AML patients.

ANALYSIS OF CYCLOPHILIN A LEVELS IN SUBARACHNOID HEMORRHAGE PATIENTS

Devin Patel

Mentors: Gregory Zipfel and Itender Singh

Subarachnoid hemorrhage (SAH), a unique form of hemorrhagic stroke, remains a serious health problem with a 30% mortality rate in the United States. Of those surviving the initial hemorrhage, more than half deteriorate in the days following SAH due to delayed cerebral ischemia (DCI) and early brain injury (EBI). The predominant vascular deficit leading to EBI is blood-brain barrier (BBB) disruption, along with the release of cytotoxic agents and inflammatory mediators. Recently, a causal link between metalloprotease 9 (MMP9) and EBI after SAH has been suggested in rodent studies. A correlation between serum MMP9 levels and vasospasm in human SAH has also been noted. While a major contributing role of MMP9 in SAH-induced brain injury is rapidly being established, the upstream molecular events leading to its upregulation and the downstream molecular events by which it causes EBI are poorly understood. Cyclophilin A (CypA) is a proinflammatory molecule that is known to drive MMP9 expression via the transcription factor NF- κ B p65. Previously we discovered that CypA plays a causal role in AD-induced cerebrovascular deficits, including APOE4-linked BBB disruption and CBF deficits. CypA is secreted from cells in response to inflammatory stimuli, such as hypoxia and oxidative stress. Whether CypA plays a role in EBI and DCI following SAH, however, is not known. Our key goal is to identify if CypA levels increase in SAH patients and are involved in DCI and EBI. We hypothesize that reactive oxygen species (ROS) released by hypoperfusion and the degradation of hemoglobin stimulate the secretion of significant amounts of CypA, which contributes to neurological and cerebral dysfunction. Furthermore, we hypothesize a prevalent role of CypA in DCI, EBI, and poor clinical outcome and therefore hope to identify CypA as a therapeutically targetable molecule.

INVESTIGATING ERYPTOTIC TRIGGERS AS POSSIBLE MECHANISMS FOR SEPSIS-INDUCED RED BLOOD CELL DYSFUNCTION

Jaya Prakash

Mentors: Allan Doctor and Stephen Rogers

In sepsis, a number of red blood cell (RBC) defects have been (individually) described: altered oxygen affinity, membrane deformability, enhanced aggregation/adhesion, and dysregulated RBC-based nitric oxide processing. We suggest that these defects comprise a class of organ failure, which we term sepsis-induced RBC dysfunction (SiRD). We propose that SiRD disables oxygen transport to tissues, limiting vital organ respiration, even when oxygen supply is sufficient.

We used a murine cecal ligation and puncture (CLP) sepsis model to explore eryptotic mechanism(s) as potential causes of SiRD initiation. Mice underwent sham (G_{cont}), mild CLP (G_{mild}), or severe CLP (G_{sev}). Day one RBCs were collected from each group and analyzed for: (1) intracellular Ca^{2+} accumulation +/- calcium ionophore (Fluo3-based flow cytometry), (2) phosphatidylserine exposure (annexin V binding - flow cytometry), (3) caspase 3 and μ calpain activation (western blot), and (4) cdB3 proteolysis (western blot).

RBCs from septic mice demonstrated: (1) Increased baseline intracellular Ca^{2+} (G_{cont} : $100\% \pm 0\%$, G_{sev} : $133.0\% \pm 26.9\%$; $p < 0.05$), (2) Increased sensitivity to calcium ionophore, ionomycin (G_{cont} : $100\% \pm 0\%$, G_{sev} : $1826.9\% \pm 458.2\%$; $p < 0.05$), (3) Evidence of eryptotic mechanisms: calcium positive cells (G_{cont} : $22.4\% \pm 12.8\%$, G_{sev} : $30.4\% \pm 17.8\%$; $p < 0.05$) and phosphatidylserine exposure (G_{cont} : $3.9\% \pm 1.8\%$, G_{sev} : $6.9\% \pm 5.5\%$; $p = 0.12$). (4) Increased caspase 3 activation (G_{cont} : 0.12 ± 0.02 , G_{sev} : 0.15 ± 0.003 ; $p < 0.05$), (5) Increased μ calpain activation (G_{cont} : 1.0 ± 0 , G_{sev} : 1.14 ± 0.2 ; $p < 0.05$), and (6) Increased proteolysis of cdB3 (G_{cont} : 1.0 ± 0 , G_{sev} : 0.77 ± 0.1 ; $p < 0.05$).

Septic RBCs are unable to regulate intracellular calcium, leading to calcium-dependent protease activation and cdB3 proteolysis. We propose that this cdB3 breakdown impairs RBC metabolic control, resulting in EMP activation, limited glucose-6-phosphate availability, and HMP flux constraint. This leads to antioxidant system failure and injury to proteins/lipids key to oxygen delivery homeostasis.

REPRODUCTIVE TISSUES IN PREGNANT MICE SHOW SUSTAINED INTRINSIC CIRCADIAN OSCILLATIONS AND CLUSTERING OF PHASE PRIOR TO THE ONSET OF LABOR

Tanvi Puri

Mentors: Erik D. Herzog and Carmel A. Martin-Fairey

Preterm birth is the leading cause of mortality in newborns and infants. In 2016, 9.54% of live births in the U.S. were premature. However, approximately half of all preterm births have no known cause. Previous studies involving pregnant shift workers have reported a correlation between disrupted circadian rhythms, and premature labor-onset and birth. This led us to hypothesize that circadian rhythms in the mother play a role in preterm birth. Prior studies have revealed that reproductive tissues in mice have circadian expression of *mPeriod2*, a mammalian clock gene. We used knock-in mice with the firefly luciferase gene fused to the open reading frame of the *Period 2* gene (*PER2::LUC*) to test whether circadian rhythms intrinsic to reproductive tissues change through the course of normal pregnancy. We recorded bioluminescence for five days from uterine, cervical, and placental tissue harvested at pregnancy days 9.5 (P9.5), P11.5, P15.5, or P18.5. We found all cultured tissues were circadian at all stages of pregnancy. We found that the intrinsic circadian period and amplitude remained constant over the course of pregnancy in the uterus, cervix, and placenta. The time of peak *PER2* expression in P18.5 uterine and placental tissue reliably peaked in early subjective day. Tissues collected at all other ages had less reliable phases. We conclude that pregnancy does not change the intrinsic circadian period or amplitude of maternal reproductive tissues, but events around the day of delivery coordinate the time of peak circadian expression in uterine and placental tissue. These changes may underlie the initiation of normal parturition.

EFFECT OF MUTATION RATE AND POPULATION SIZE ON MICROBIAL RATE-YIELD TRADE-OFFS

Erica Ryu

Mentors: Joan Strassmann, David Queller, and Fred Inglis

Biological trade-offs are an inherent aspect of life because limiting resources force all organisms to compromise between multiple opposing goals. Bacteria have demonstrated that processes like virulence and metabolism are managed under a trade-off, because the environment influences whether one function is favored over another. These trade-offs are important for dictating evolution, as they allow for adaptability to the environment, which means that many factors can influence the trade-off. My project focuses on the rate-yield trade-off in microbial metabolism, which is the conflict of devoting resources to faster growth and resource acquisition or greater yield and reproduction. Previous work has shown that cooperation and competition are important factors in microbial metabolism. More competition favors faster resource acquisition, because bacteria are competing to acquire food before their neighbors deplete the environment. Oftentimes competition is a result of less relatedness, because there is a greater range of growth rates. Conversely, spatial structure creates microenvironments that favor cooperating bacteria. The result is the evolution of bacteria that can use their resources efficiently. My project looks at two more factors, mutation rate and population size. I hypothesized that greater mutation rate would evolve high-rate mutants as more mutations would result in more competition. I also hypothesized that larger population would result in more competition because there would be more bacteria competing for resources, and therefore it would be favorable to acquire resources quickly. Results supported the mutation rate hypothesis, but opposed the population size hypothesis. This result may be due to the effect of density and toxin build-up impeding the growth ability of the bacteria. My project demonstrates two more factors that influence the rate-yield trade-off. It is important that we continue researching the rate-yield trade-off as it has implications in understanding how metabolic pathways function and how they may evolve.

A GENETIC STUDY OF HETEROCHROMATIN FORMATION MEDIATED BY A GAA₃₁₀ TRIPLET REPEAT IN *DROSOPHILA MELANOGASTER*

Sukruth Amogh Shashikumar

Mentors: Elena Gracheva and Sarah C. R. Elgin

Genome integrity depends on effective silencing of repetitive DNA and transposable elements (TEs), as their mobilization can lead to gene disruptions, deletions, and translocations. Packaging DNA into heterochromatin is a mechanism used by higher eukaryotes to silence repetitive DNA. Heterochromatic regions are generally inaccessible to elements of the transcriptional machinery and are thus transcriptionally silenced. The human disease Friedreich's ataxia (FRDA), which has no cure, is caused by expansion of the DNA nucleotide triplet repeat GAA in the first intron of the gene *FXN* from 10 to 66+ copies, resulting in aberrant silencing of *FXN* via heterochromatin formation. To characterize DNA triplet repeat-mediated heterochromatin formation in *Drosophila melanogaster*, the Elgin Lab generated a transgenic fly line with a P-element construct carrying 310 copies of the triplet GAA (originating from an FRDA patient) upstream of an *hsp70-white* reporter. (The *white* gene is required for red pigmentation in the fly eye.) When this P-element is inserted near a heterochromatic mass (base of chromosome arm 2L), a variegating phenotype (PEV) is observed, indicating local heterochromatin formation. The PEV phenotype is dependent on the presence of the GAA₃₁₀ repeat. We launched a genetic investigation to characterize this repeat-dependent silencing. We tested the sensitivity of GAA₃₁₀-*hsp70-white* silencing to mutations in histone deacetylation, H3K9 methylation, HP1a binding, Polycomb binding, and RNA interference pathways. Eye pigment assays were used to quantitatively evaluate the dominant impact of these mutations on GAA₃₁₀-*hsp70-white* silencing. Genetic analyses indicate a role for histone deacetylation, H3K9 methylation, and HP1a binding in maintenance of silencing, in common with transposable element silencing. Investigating the genetic makeup of the silencing triggered by the repetitious GAA sequence could inform potential therapeutic strategies for FRDA aimed at reversing silencing at the *FXN* locus.

BRAIN SHAPE CHANGES ARE ASSOCIATED WITH THE ENLARGEMENT OF THE CEREBELLUM AND THE EVOLUTION OF A NOVEL SENSORIMOTOR SYSTEM IN MORMYRIDS

Jerry Shen

Mentors: Bruce Carlson and Kimberley Sukhum

Brain shape varies among vertebrates. Mormyrids, a family of weakly electric African fishes, have evolved extreme encephalization and have an enlarged cerebellum, leading to brain shape changes in which the cerebellum expands to dorsally cover all other brain regions. This is comparable to the extreme encephalization and subsequent brain shape changes of the neocortex in primates. By observing these structural brain changes throughout evolutionary lineages and looking for patterns of divergence, we can determine relationships between particular social and ecological variables and morphological brain changes. Mormyrids have evolved a novel electric sensory system in the form of electric organs and electroreceptors. Here, I ask if brain changes associated with sensory system evolution correlate with shape changes in other brain regions. If these changes are correlated, then the evolution of sensory systems may contribute to brain morphological diversification. If not, then the evolution of sensory systems may not affect brain shape. Instead, brain shape may be constrained by factors such as skull morphology. I created 3D reconstructions of mormyrid and outgroup species' brains and placed coordinate points on anatomical landmarks. To assess brain shape variation across species while eliminating the influence of brain size, I then performed geometric morphometric analysis to quantify how coordinates changed across species. I show that extreme enlargement of the cerebellum is correlated with changes in brain shape in mormyrids compared to non-mormyrids. My data provide further support for previous studies that demonstrate morphological relationships between individual brain regions. This study is the first to demonstrate a shift in brain shape corresponding to the evolution of a novel sensorimotor system.

NOVEL METHOD FOR RECORDING AND CLASSIFYING ELECTRIC ORGAN DISCHARGES FROM FREELY SWIMMING MORMYRID WEAKLY ELECTRIC FISH

Snigdha Srivastava

Mentor: Bruce Carlson

Communication is critical to survival and reproduction for many animals, facilitating essential social behaviors such as courtship, mating, coordinated group feeding, and territorial guarding. Weakly electric fish of the family *Mormyridae* allow for the study of animal communication because they have evolved an active sensory and communication system based on electrical signals. Mormyrids generate and receive pulses of electricity called electric organ discharges (EODs). Mormyrid EODs convey information about the species, sex, and identity of the sender. Variation of the inter-pulse interval (IPI), the time interval between EODs, has been shown to correlate with specific social behaviors. However, the contribution of electrocommunication to these behaviors in a natural setting is poorly understood. Studying electrocommunication requires a method that can accurately assign EODs to their senders in freely interacting fish. However, this poses a significant challenge as it is difficult to distinguish EODs of individuals within the same species. Previous studies have overcome this problem using playback recordings, dummy fish, or securing electrodes directly to individual fish, but such methods restrict natural behavior and thus, limit the study of natural electrocommunication. This paper describes a powerful new method developed to combat these limitations using an eight-channel electrode array and a MATLAB-based signal clustering algorithm that can classify EODs of two different fish while they are freely swimming and interacting, with a post-clustering sorting method that classifies unsorted EODs to a 99% accuracy. This novel tool has been used to gather preliminary data on social behavior in *Brevimyrus niger*, confirming that our method can reliably separate the EOD signals during social interactions within a single species. The ability to classify EODs while allowing free interaction provides the opportunity to conduct more naturalistic studies that will further our understanding of the evolution of complex behavioral and communication systems.

PI3K IS REQUIRED BETWEEN E14.5-16.5 FOR THE NORMAL DEVELOPMENT OF COCHLEAR HAIR CELLS

Yutao Su

Mentors: Lu Yang and David M. Ornitz

Hair cells are mechanosensory receptors in the inner ear responsible for transducing oscillations in air pressure into neural signals that are then encoded as sound. Fibroblast growth factor 20 (FGF20) signaling has been implicated in the differentiation of hair cells. Mice lacking a functional copy of *Fgf20* are deaf and have decreased hair cell numbers. However, the mechanisms that regulate differentiation downstream of FGF20 and its receptor, fibroblast growth factor receptor 1 (FGFR1), are not known. There are five major pathways that serve as downstream effectors of FGFR1 in other systems: PLC γ , MAPK (p38), MEK1/2, PI3K, and STAT. But, which one is involved in differentiation in the cochlea? To answer this question, we treated murine cochlear explants with inhibitors that block each major signaling pathways individually during the timeframe when FGFR1 signaling was found to be critical for differentiation, E14.5-E16.5. We found that inhibiting signaling through PLC γ , MEK1/2, and MAPK (p38) did not result in significant changes in total hair cell number. However, treating cochleae with LY294002, a PI3K inhibitor, did result in a decrease in hair cells similar to inhibition of FGFR1 signaling and phenocopies the *in vivo* *Fgf20* knockout phenotype. This suggests that PI3K signaling may play a role in mediating hair cell differentiation. Furthermore, AKT is a common downstream effector of PI3K. Inhibiting AKT, however, showed no decrease in hair cells suggesting that an alternative pathway is responsible for differentiation. We are currently experimenting with alternative signaling pathways downstream of PI3K.

ELUCIDATING NOVEL AUXIN REGULATORY PATHWAYS: ARABIDILLO-1 IS A PUTATIVE SUPPRESSOR OF *IBR5-1* IN *ARABIDOPSIS THALIANA*

Isabelle Trier

Mentors: Lucia Strader and Ryan Emenecker

Auxins are hormones vital to plant growth and development. Though the regulation of auxin-response in *Arabidopsis thaliana* is beginning to be understood, the discovery of mutants, such as *indole-3-butyric acid response 5-1 (ibr5-1)*, has indicated the existence of auxin regulatory pathways that have yet to be characterized. The *ibr5-1* mutant is resistant to the suppressive effects of auxins, abscisic acid, and ethylene on root elongation. Previously identified ethyl methanesulfonate (EMS)-generated suppressors of *ibr5-1* mutants display restored sensitivity to the exogenous auxins. Whole genome sequencing of one of these mutant isolates, MS16, revealed mutations in genes that may be responsible for suppression of the *ibr5-1* phenotype. Analysis of SALK lines containing T-DNA insertion alleles in these genes of interest has pointed to ARABIDILLO-1 as potentially causative in restoring the auxin sensitivity of *ibr5-1*. ARABIDILLO-1 is one of two F-box containing ARM-repeat proteins in *Arabidopsis thaliana*. Whereas recent studies have established a pathway by which ARABIDILLO-1 promotes lateral root development in plants, its ability to suppress the auxin resistance phenotype of *ibr5-1* suggests that it may also function in a novel auxin signaling pathway. Confirmation of ARABIDILLO-1 as the gene responsible for *ibr5-1* suppression and subsequent characterization of its functionality may shed some light on the molecular underpinnings of a non-canonical auxin-response pathway in plants.

MECHANISMS REGULATING THE ALTERNATIVE SPLICING OF SYNAPTIC ADHESION MOLECULES IN SOMATOSENSORY NEURONS

Judy Yoo

Mentor: Robert W. Gereau IV

Processing external stimuli from distinct sensory modalities is vital for the diversity of somatic sensation. Nociceptive transmission pathways exhibit vast plasticity in response to injury or prolonged exposure to noxious stimuli and can result in chronic pain states. While the plasticity of nociceptive circuits is well established, we possess a limited understanding of the molecular mechanisms that establish the wiring of sensory circuitry, and how this connectivity may be altered in chronic pain.

Neurexins are presynaptic cell-adhesion molecules which are essential in coordinating synapse formation through trans-synaptic interactions with myriad post-synaptic ligands. Mutations in neurexin genes are associated with a multitude of neuropsychiatric diseases, particularly autism spectrum disorders, Tourette's syndrome, and schizophrenia. Previous work suggests that neurexins regulate synaptic properties critical to coordinating neuronal circuitry in the central nervous system, yet the role of neurexins in somatosensory circuits remains largely unexplored. Extensive alternative splicing of neurexins generates thousands of different isoforms which has been proposed to impart a combinatorial "splice-code" for connectivity. Investigating the role of individual splice sites is an incipient area of study, and little is known about the regulation of neurexin splice variant expression in sensory neurons and its role in specifying sensory connectivity. Here, we test sensory neuron regulation of splice site 4 (SS4), a splice site shown to be modulated by neuronal activity, and physiologically relevant in synaptic plasticity, learning, and memory. We hypothesize that peripheral sensory neurons regulate neurexin alternative splicing in response to changes in activity or injury to alter somatosensory circuit connectivity.

A GUIDE TO SHELLFISH PURPLE IN THE GRECO-ROMAN WORLD

Russell Clark

Mentor: William Bubelis

It is surprisingly well known, as a bit of trivia, that the purple trappings worn and treasured by the ancient Mediterranean world's elite were made from great numbers of marine snails. However, there are a number of enduring misconceptions regarding the manufacture, origin, and symbolic roles of shellfish purple dye. In light of this, the present guide surveys the most notable occurrences of shellfish purple in texts ranging from Linear B tablets to late-Roman legal codices, as well as key pieces of archaeological evidence, in order to resolve the most glaring of these misconceptions. Chapter I outlines how shellfish purple was made, from the collection of the snails themselves up to the removal of the wool fleece from the dye-vat, and clarifies various details of the dyeing process that have been misunderstood by certain scholars. Chapter II explores the archaeological evidence for the earliest large-scale production of shellfish purple in the Bronze Age Aegean, both dispelling the theory that the Phoenicians were the first to discover the dye and challenging whether the notion of its “discovery” by any one community is an adequate framework for interpreting this archaeological evidence. The same chapter also provides a detailed examination of the earliest attestations of the *porphyr-* root (from which our word “purple” derives) in three Linear B tablets from Mycenaean Knossos. Chapter III addresses the issue of purple and status—a crucial subtext for the prior chapters—through a survey of the Greek and Latin sources, both literary and legal, on shellfish purple. As a whole, the guide aims to provide a thorough yet holistic overview of what we may rightly call the ancient world's most unique luxury good, a beautiful and mysterious dye that has held onto our fascination for millennia.

TRACKING THE TRICKSTER:
CRITICAL COMPARISON OF ANCIENT GREEK,
AFRICAN, AND AFRICAN-AMERICAN
TRICKSTER FIGURES AND MYTHS

Pascale Stain

Mentor: Timothy Moore

Myths play key social roles as they help individuals understand the world around them. Global myth often focuses on preserving order. Despite this enduring theme, the trickster, a highly disordering presence, remains one of myth's most ubiquitous figures. The trickster is both creator and destroyer. Clever, mischievous, intelligent, and cunning, tricksters use deception to disrupt established order. Although they are disordering figures, tricksters are also often depicted as heroes. As tricksters defy authority and disrupt order, they play important roles in the creation and reinvention of the world, humankind, and civilization. Even though myths tend to condemn malicious deceit, particular types of trickery are praised. Tricksters' use of intelligence and bravery to subvert despotic individuals or institutions is exalted and framed as crucial to the vitality of human culture and society. Tricksters are often portrayed positively, as they are willing to defy order at critical moments to benefit themselves or their communities.

Ancient Greek, African, and African-American trickster figures and myths reveal much about the definition, function, and meaning of the trickster. Though separated by thousands of years, Ancient Greek, African, and African-American tricksters bear core commonalities. These trickster myths highlight the power of intelligence, indicating a path through which conventionally weak figures can achieve their goals. Audiences often identify with trickster figures. Tricksters show that despite perceived weaknesses, with keen intelligence and harsh grit, individuals can rise to change and shape their world. These tricksters help maintain a necessary balance in human life between order and chaos. As tricksters deploy socially acceptable forms of disorder, they often spur creation or bring benefits to themselves or their communities. Comparison between the trickster figures of these three different cultures points both to the particularities of specific cultures and the overarching universalities of humankind.

THE AFTERLIFE OF HOLOCAUST TESTIMONY: REFRAMING COLLECTIVE MEMORY FOR A NEW GENERATION

Louise DiMarco

Mentor: Erin McGlothlin

As we come to rely on mediated sources of knowledge to learn about the events of the Holocaust, the relationship between houses of knowledge (archives), interpreters of knowledge (scholars, curators, and artists) and viewers becomes increasingly dialogic rather than authoritative. Holocaust narratives are often characterized by silence and fragmentation, stemming from the assumed “unspeakable” nature of the events they describe, the continued absences and gaps in narrative due to an inability to fully express trauma, and the contemporary taboos built around discussions of the Holocaust. I will present the precise mechanisms by which museums and literary narratives can push contemporary viewers to confront and reevaluate these three types of voids in common commemorative practices. Art Spiegelman’s *Maus*, which I have paired with the *Memory Void*, is equally about the narrator’s struggle to represent his father’s story than his father’s experiences during the Holocaust. Imre Kertész’s fictionalized account of his own experiences during the Holocaust *Fatelessness*, told by his awkward adolescent narrator, notably ends after the protagonist’s return to his hometown and includes several scenes in which the narrator attempts to explain his experiences to listeners with varying reactions. These two groupings, the *Memory Void* with *Maus* and the Terezín Memorial with *Fatelessness*, each demonstrate a different approach to navigating the fragmented testimonies that contemporary viewers now rely on in order to learn about the events of the Holocaust. However, both pairings ultimately illustrate the power of denying viewers a false sense of closure or complete comprehension while still managing to build a satisfying learning experience.

THE “RUSSIAN CRAZE” AND THE SILVER AGE: MISSED CONNECTIONS IN THE ANGLOPHONE CANON OF RUSSIAN LITERATURE

Hilah Kohen

Mentor: Anca Parvulescu

The canon of Russian literature that is widely read in English only began to form in the first three decades of the twentieth century. This thesis asks why renowned Russian writers contemporary to that period such as Marina Tsvetaeva and Maxim Gorky were excluded from that canon, which instead promoted older writers like Lev Tolstoy and Fyodor Dostoevsky. Contemporary writers, unlike their predecessors, could actively establish social networks that included figures like Virginia Woolf or H. G. Wells who had the ability to introduce Russian literature to a sustained Anglophone readership. This thesis analyzes the missed connections in those networks and traces deeper thematic relationships between early twentieth-century Russophone and Anglophone texts.

The first chapter of this thesis turns to the history of Zinaida Gippius's non-reception in English as a case study. I find that Gippius generated an extensive network in the Russophone world largely via social provocation, a strategy that limited her reception in English because it deterred potential translators. This chapter calls for renewed Anglophone attention to Gippius's writings, which confront issues like wartime violence and gender expression with remarkable creativity. In a second chapter, this thesis analyzes textual and social relationships between Marina Tsvetaeva and Virginia Woolf. Although Tsvetaeva's narrative poem *Tsar-Devitsa* (*The Tsar-Maiden*) expresses androgyny using specific aspects of the Russian language—a combination that fascinated Woolf in her novel *Orlando*—the two writers never encountered each other's work. As in Gippius's case, a blend of broad political forces and small-scale social coincidences kept Tsvetaeva's writing from reaching a substantial Anglophone audience during her lifetime.

Both chapters illuminate a broader Anglophone misconception that contemporary Russia is primarily a political, not a cultural, entity. The conclusion to this thesis examines how that misconception continues to prevent American audiences from engaging with outstanding Russophone writers of the present day.

CONSTRUCTING AN ISOTOPIC RECORD OF A SIERRA NEVADA LAKE CORE

Lauren S. Johnson

Mentors: Alexander S. Bradley, Bronwen L. Konecky, and David A. Fike

The isotopic compositions of leaf waxes from lacustrine sediments in the Sierra Nevada Mountains offer an opportunity to gain insight into correlations between paleoclimatological variation, biogeochemical cycles, and climate change. The annual snowpack in the Sierras vary strongly with rainfall and correlate with ENSO (El Niño – Southern Oscillation). In October 2013, a 27-meter core was recovered from Pear Lake, in Sequoia National Park, representing a 13,500 year record (the Holocene Epoch) of lake sediment. We have extracted organic material from ~1 cm intervals of the top 23 cm of this core, which represents a 208.6 ± 31.6 year record. At each depth we measured the deuterium/hydrogen ratio (expressed as δD) of sedimentary plant waxes, changes in which are interpreted to represent paleohydrological variation.

Analyses of mid- and long-chain alkanes revealed an Average Chain Length (ACL) for n-alkanes to be ~26, increasing slightly from 23 cm to the surface. Furthermore, the Carbon Preference Index (CPI) is ~6.9. δD varied by >50‰ in the top 23 cm, which represents a 208.6 ± 31.6 year record of the region. Our paleohydrological record demonstrates a strong coupling between hydrogen isotopic trends and ENSO events, but the cause of this coupling is yet to be understood. In our paleohydrological record, when an ENSO event switched from a succession of El Niño events to La Niña events or vice versa, a change in δD was observed. More negative δD values were observed during El Niño events, and more positive δD during La Niña events. These trends in δD were clear enough to predict the occurrence of ENSO events throughout the core. Refining these predictions are key to understanding hydrological cycles before the records of instrumental data to better predict their effects on future generations.

MICROSEISMICITY ALONG MAJOR ROSS ICE SHELF RIFT RESULTING FROM THERMAL CONTRACTION OF THE NEAR-SURFACE FIRM LAYER

Seth Olinger

Mentor: Doug Wiens

Seismicity within ice shelves arises from a variety of sources, including calving and rifting. In this study, we identify and locate cryoseisms in the Ross Ice Shelf (RIS) to better understand ice shelf internal stress and deformation. We use data from a two-year 34-station deployment of broadband seismographs operational from December 2014 – November 2016. Two lines of seismographs intersect near 79S°, 180° close to a large rift, and cryoseisms were recorded by up to 10 seismographs within 40 km of the rift tip. We identified around 5,000 events from 2015 and 2016 and grouped them based on number of stations recording and signal-to-noise ratio. The events show a long-period character compared to similar magnitude tectonic earthquakes, with peak amplitudes at 1-4 Hz and P, S, longitudinal, and surface wave arrivals. Cross correlation analysis shows that the events cannot be divided into a small number of repeating event clusters with identical waveforms. High quality events were located with a least-squares algorithm using Rayleigh arrivals, and the resulting locations show strong spatial correlation with the rift, with events distributed along the rift rather than concentrated at the tip. The events do not show teleseismic triggering, and did not occur with increased frequency following the Illapel earthquake (8.3 Mw) or subsequent tsunamis. Instead, we note a concentration of activity during the winter months, with several days exhibiting particularly high seismicity rates. We compare the full catalog of events with temperature data from the Antarctic Weather Stations and find that the largest swarms occur during the most rapid periods of seasonal temperature decline. Internal stress in ice floes and shelves is known to vary with air temperature; as temperature drops, the upper layer of ice thermally contracts, causing near-surface extensional stress to accumulate. We propose that this seasonal stress enhances the inherent N-S extensional stress prevalent in this area of the RIS to produce rift-associated microseismicity.

BORON ISOTOPIC CONSTRAINTS ON CHEMICAL TRANSPORT INTO THE DEEP EARTH

Savannah Rodriguez

Mentor: Rita Parai

The flux of surface material into the mantle is dependent on chemical and physical processes at subduction zones. Some material that enters the mantle in a subducting slab is lost into the mantle wedge. The rest of the material, however, continues deeper, where it can influence the chemical signature of parts of the mantle. The upper mantle is sampled by mid-ocean ridge basalts (MORBs), so MORB geochemistry can be used to characterize the composition of the upper mantle, and assess possible explanations for chemical variations among MORBs.

Here we present new B concentrations and isotopic compositions determined for a total of eight MORB glasses from the East Pacific Rise, the Mid-Atlantic Ridge, and the Southwest Indian Ridge. These samples were chosen for their spread in radiogenic lithophile isotope signatures, from a depleted MORB mantle (DMM) endmember to a HIMU endmember (“high μ ,” where μ is the U/Pb ratio). B isotope data from these samples was compared to radiogenic isotope ratios and trace element ratios, and contextualized within the existing literature measurements of typical MORBs.

The results of these comparisons, especially in two samples that exhibit the strongest HIMU signatures, support a HIMU origin model that includes the influence of both frozen low-degree partial melts, due to the samples’ high degree of trace element enrichment, and recycled surface material from subducted slabs, due to the heavy B signature of surface material. We are also able to use the B isotopic values from our HIMU samples to shed light on recycling of surface materials into the mantle: heavy boron isotopes in HIMU MORBs indicate that volatile-rich components in subducting slabs were retained through the subduction zone and ultimately recycled into the mantle.

PRECIPITATION AND $\delta^{13}\text{C}$ VARIATION IN PEARL MILLET

Lily Sanborn

Mentors: Rachel Reid and Alex Bradley

Accurate paleodietary reconstruction requires a baseline of $\delta^{13}\text{C}$ values characteristic to different C_4 plant varieties that accounts for isotopic variability in response to environmental conditions. The relationship between precipitation and carbon isotope ($\delta^{13}\text{C}$) variation in C_3 plants has been well examined, though C_4 plants—which are thought to be less sensitive to environmental variables—have received comparatively little attention. This study aimed to provide an understanding of the relationship between precipitation and $\delta^{13}\text{C}$ values in the seeds of pearl millet (*Pennisetum glaucum*), a C_4 cereal. Varying degrees of water restriction were imposed on 75 millet plants from five regional accessions. Three water treatment groups were maintained at average soil moisture levels of $0.43 \text{ m}^3/\text{m}^3$, $0.21 \text{ m}^3/\text{m}^3$, and $0.16 \text{ m}^3/\text{m}^3$, respectively. Using a generalized linear model, I found that seed $\delta^{13}\text{C}$ was significantly positively correlated with water availability, such that $\delta^{13}\text{C}$ was enriched by $0.21 \pm 0.04\text{‰}$ for each $0.1 \text{ m}^3/\text{m}^3$ increase in soil moisture. As the precipitation- $\delta^{13}\text{C}$ relationship is contrary to the established trend for C_3 plants, these findings suggest that C_3 and C_4 plants respond differently to water stress. Responses to water treatment were not significantly different between accessions, however sample origin (accession) was a significant predictor of $\delta^{13}\text{C}$. Investigation of potential explanations for the observed relationship between accession and $\delta^{13}\text{C}$ provided indication that adaptations to local environment could be a strong contributing factor. These findings highlight the role of regional differences in dictating $\delta^{13}\text{C}$ variability in millet and reaffirm the need for continued investigation of C_4 responses to environmental change.

EXAMINING *MÍNZÚ SHĒNFEN* IN LAO SHE'S WORKS, WITH SPECIAL FOCUS ON *XIAOPO DE SHENGRI*

Noah Weber

Mentor: Lingchei Letty Chen

The early career of Beijing author Lao She (老舍, 1899-1966) covers a wide range of genres and settings—from a realist romance set in London to a sci-fi satire set on Mars. Among these early works is *Xiaopo de shengri* (小坡的生日, *Little Po's Birthday*), a novella about Singaporean children written while Lao She lived in Singapore. The narrator of the novel fluctuates between a close third-person that attempts to reproduce its young protagonists' worldview, and a more adult-like perspective, which casts ironic distance on the children and their behavior. My paper's core claim is that the age discrepancy between the author and his characters is only one important factor explaining their distance. Differences of race (zhongzu 种族), nationality, and language also separate them. These make Lao She's attempt at close-third narration more difficult, and ultimately more flawed.

GAME THEORETIC ANALYSIS OF THE FAIR DIVISION MECHANISM “SPLIDDIT”

Jack Garton

Mentor: Jonathan Weinstein

In the fair division literature, the problem of assigning rooms and dividing rent in an apartment has been well studied. In recent years, several solutions have been developed, all of which employ envy-freeness as a criterion of fairness. These room/rent allocation mechanisms are able to yield remarkably desirable outcomes. However, any such mechanism that achieves envy-free allocations necessarily provides agents with incentives to misreport their true preferences. In this paper, the author studies strategic behavior when preferences are private information under the most popular of these mechanisms: the online rent division program Spliddit. Best strategies are computed for a class of special cases of the game induced by Spliddit involving two players. A parameterized probability distribution is used to develop a solution for computing best strategies for a broad variety of given preference distributions. These solutions constitute Bayesian Nash Equilibria of the game induced by the mechanism. A conjecture for how these results generalize to larger numbers of rooms and players is developed.

THE EFFECT OF STATE POLICY ON RENEWABLE ENERGY CAPACITY

Max Litvack-Winkler

Mentors: Maria Canon and Bruce Petersen

Since Iowa first created a Renewable Portfolio Standard (RPS) in 1983, state governments have been creating legislation to increase renewable energy capacity. Three policy groups in particular—RPS, Net Metering (NM), and Interconnection Standards (IS)—have been used to spur growth. Previous researchers have found positive correlations between RPS and renewable energy production, while noting mixed results between Net Metering/Interconnection Standards and renewable energy production. However, previous studies have quantified Net Metering and Interconnection Standards only as dummy variables. This thesis uses counting variables to find out whether more ambitious NM and IS policies produce higher correlations with renewable energy production, compared to more modest policies. This study also measures individual elements of each policy, finding a surprising negative result for program capacity limit—a NM element—and a significant positive result for number of breakpoints—an IS element. Additionally, the paper adds an RPS-related variable to determine whether states should create larger, more spread-out goals or smaller shorter ones, returning a significant result that favors the latter option. Overall, my findings should guide policymakers on RPS and provide a baseline for later papers on quantifying NM and IS as counting variables rather than as dummies.

WHAT CHARACTERISTICS OF A CITY ATTRACT EDUCATED MILLENNIALS?

Miles Woodhull

Mentors: Maria Canon and Bruce Petersen

Millennials, born between the years 1982 and 1996, are the largest demographic in the American workforce. They are also the most educated and the most urban demographic in United States history. Therefore, it is critical that city developers find ways to attract this demographic, or they risk their city falling behind economically. While large, coastal cities continue to attract millennials, a growing body of popular journalism suggests that smaller cities are starting to catch up. I design a dependent variable that measures the increase in millennial density of the 100 largest metropolitan statistical areas in the United States in 2005 and then in 2015. My descriptive findings of the “educated millennial density” variable support the notion that many smaller, unexpected cities are attracting millennials at faster rates than traditional magnet cities. Based on foundational work in spatial equilibrium by Rosen and Roback, and extended by Glaeser and Diamond, I regress “educated millennial density” against measures of wages, cost of living, and four amenities: transportation infrastructure, retail environment, environmental quality, and school quality. In empirical support of the Rosen-Roback model, I find that the effect of income and cost of living are off-setting and insignificant. School quality is the lone amenity that is significant at the 5% level. Isolating the impact of amenities, I run two more linear regressions: the first with a combined wage-rent variable and the four amenities, and the second with just the four amenities. In each of these two regressions, in addition to school quality remaining significant at the 5% level, I find that transportation infrastructure and environmental quality are significant at the 10% level. This research suggests that, beginning with school quality, city developers should examine what amenities they can improve to attract educated millennials.

APPROACHING RELIGION: EMBRACING DIVERSE PEDAGOGICAL APPROACHES TO ENCOURAGE THE INCORPORATION OF RELIGIOUS STUDIES IN AMERICA'S CURRICULUM

Jennifer Greenberg

Mentor: Michelle A. Purdy

Current literature supports the inclusion of the academic study of religion in public education but varies in the purposes and practices it recommends for teaching religious studies. For an educational subject that has historically been misunderstood and devalued, but carries tremendous potential to dismantle religious illiteracy and intolerance, an accessible, compelling, and purposeful pedagogy is necessary. In this thesis I argue that a critical move toward a comprehensively pluralistic society is increasing the presence of meaningful religious studies content in American public schools by presenting it through any or multiple academic approaches. A content analysis of seven U.S. high school social studies textbooks identifies the prevalence, strengths, weaknesses, and functions of seven different approaches to religious studies. Findings and discussion demonstrate that each approach recognizably translates its main theoretical ideals in its presentation of content in textbooks and that content remains meaningful and well-integrated when multiple approaches work side by side. Certain approaches appear incomplete though, whether in their limited prevalence, imperfect clarity, or failure to fulfill every goal of their ideal theoretical description. The findings of this study contribute to an understanding of the current relationship of religion and curricula in its historical narrative and an empirical understanding of how approaches can be used to their fullest potential, either by embracing their strengths or avoiding their limitations. Findings support the increased use of approaches to present religious studies content and continued empirical testing so that educators have clear and confirmed options for including religious studies in schools.

CHARTER SCHOOL MANAGEMENT STRUCTURES, DISCIPLINE, AND THE SCHOOL-TO-PRISON PIPELINE

Valerie Hirschberg

Mentor: Ebony Duncan-Shippy

This research focused on understanding how charter school organizational structure and the school-to-prison-pipeline interact in unique ways. Charter schools are often cited as having higher expulsion and suspension rates in comparison to traditional public schools, especially for racial minority groups. These disciplinary practices have been shown to have a multitude of adverse effects on students. Charter schools do not all subscribe to the same organizational structure, curriculum, or pedagogical values, yet they are often treated as monolithic in research and public discourse. Despite this variation, organizational structure—which was hypothesized to play a significant role in the perpetuation of the school-to-prison pipeline—is largely overlooked in previous research on charter school discipline. To add nuance to this literature, this quantitative research examined variation in charter school discipline rates by organizational structure. Drawing federal data from the U.S. Office of Civil Rights, this study used statistical analyses to identify significant differences in discipline rates among three types of charter schools. Findings revealed that vendor-operated schools suspended students at significantly higher rates in comparison to independent and charter management organization operated schools. In addition, analyses revealed that charter schools with predominantly Black or predominantly Black and Hispanic populations suspended students at significantly higher rates. Yet, when controlling for the racial composition of schools, analysis revealed that vendor operated schools still suspended students at higher rates, pointing to the importance of organizational structure in affecting discipline rates. Conclusions speak to the ways in which this study complicates our understanding of charter school organization and discipline, both of which perpetuate the school-to-prison pipeline.

THE FORTEAN CONNECTION: SCIENCE FICTION'S TIES TO CHARLES FORT

Tanner Boyle

Mentor: Gary Wohl

This paper tracks the influence of esoteric non-fiction writer Charles Fort on science fiction from its early days in the pulps to contemporary sci-fi writers Arthur C. Clarke and Philip K. Dick. The thematic elements of Fort's work are explored in contrast to the so-called "scientific dogmatism" of the time; his works take the outliers of data and scientific reports and develops theses from them. Also relevant is the prominence of what this paper deems "maybe-fictions" which developed alongside sci-fi. Through his appearance in the pulps and pulp sci-fi authors and editors' own admissions of influence, there is an omnipresence of Fortean themes in sci-fi works beginning with writers like H. P. Lovecraft and Eric Frank Russell. Due to later sci-fi figureheads like Clarke and Dick being heavily interested in pulp science fiction, these Fortean topics remain in their work as well. For Clarke, Fort's work and others like it are utilized as a wealth of sci-fi inspiration and as a matter of scientific interest. Dick, however, experienced firsthand a similar type of phenomena to that which Fort wrote about and gives an insight into the overlap between fiction and reality. Through careful chronological textual analysis, this paper reveals Fort's influence and its staying power from the initial publication of his works to the present.

THE FORM AND FEELING OF LEONARD MICHAELS' JEWISH-AMERICAN LITERATURE

Harrison Hall

Mentor: Nancy Berg

The conventional narrative to describe Jewish-American literature tracks a departure and possible return to a Jewish culture and heritage. However, the twentieth- to twenty-first century writer Leonard Michaels did not display such a shift. In the 1960s, his style evoked what he termed the “weird delirium” of a counter-culture in New York City. His early stories draw heavily on his onomatopoeic conception of the Yiddish language and describe cultural Jews living and fighting in Manhattan’s Lower East Side. Later in his life, Michaels adopted a simpler style and set his final collection, *The Nachman Stories*, in California. This change led some to criticize Michaels for abandoning literature more obviously aligned with mid-twentieth century Jewish-American experience. I first explicate Michaels’ tonal employment of postmodern performative prose, coupled with the Yiddish ethics implied in that theory, and then turn to *The Nachman Stories* to argue that Michaels reinterprets rather than abandons his personal understanding of Jewish literature. This arises from “feeling,” a word Michaels uses like the term “affect” to define both the saturation of passion in rhythmic prose and its notable lack in a paired down form. I additionally consider the Jewish practice of midrash to explicate how *The Nachman Stories* affect the reader by encouraging interpretive reading and introducing the potential for action, which ultimately lead to interpretive failure and inaction. I bring this literary figuration of Jewish philosophy and experience into conversation with reader-response and affect theorists Susan Sontag and Eve Sedgwick, Jewish-American writers Cynthia Ozick and Robert Alter, as well as the works of the Hasidic rabbi, Nachman of Bratslav, who similarly, though for more explicitly religious purposes, shifted his pedagogical style at the end of his life to tell seemingly simple moral fables that deny direct interpretation and create meaning through readers’ affective interactions with the texts.

BETTER WORLDS:
THE POLITICS OF HOPE AND EXCLUSION
IN THE LITERATURE OF JAMES BALDWIN
AND SHERMAN ALEXIE

Emma LaPlante

Mentor: Gerald Early

Twentieth-century author James Baldwin is just as celebrated for the stirring force of his prose as for his role as a leading voice in the American Civil Rights Movement. As a black, gay man from Harlem who spent years of his life abroad, Baldwin spoke often of his marginalization within most communities he was a part of; he was never fully accepted or embraced by them. In many ways, contemporary Native American author Sherman Alexie carries on Baldwin's legacy of blending art and activism, and their lives overlap in several meaningful ways, particularly when it comes to exclusion from social groups. Alexie was a bookish child with several disabilities, and in his young adulthood he left the reservation where he grew up, which he describes as being seen by his tribe members as a betrayal marking him as "not Indian enough." In this thesis, I investigate the ways that Baldwin and Alexie's personal histories inform their writing, taking their nonfiction writings and fiction inspired by real life events as my most prominent sites for analysis. I ultimately argue that the personal histories of Baldwin and (to a lesser extent) Alexie facilitate a queerness in their writing that allows them to imaginatively break down boundaries and borders. This helps account for the strains of hope and optimism in their bodies of work, even as they write movingly about social ills and structural injustice.

“WORDS FAIL ME”:
THE LOSS OF LANGUAGE AND THE LANGUAGE OF
LOSS IN VIRGINIA WOOLF’S NOVELS

Anna Lin-Schweitzer

Mentor: Vincent Sherry

In the wake of the First World War, veterans and civilians alike struggled to process the unprecedented mass destruction, feeling that their grief could not be put into words. It fell in part upon writers, therefore, to articulate this inexpressible pain. Literary modernism was especially well-equipped for this task, for the movement developed as a self-conscious break from traditional modes of representation and expression. I focus on the modernist writer Virginia Woolf, analyzing the three novels she wrote directly after the War: *Jacob's Room*, *Mrs. Dalloway*, and *To the Lighthouse*. In these novels, I identify two dominant language structures: the declarative and the imaginative. Declarative language places words in simple, past-tense constructions, confining the world within rigid syntactical and linguistic structures. Imaginative language, on the other hand, leaves room for revision—it remains tentative, using syntax and vocabulary to build a sense of continuous, generative movement. Imaginative language, I argue, is far better suited to fill the void left by the traumas of the War. Not only is imaginative language the basis for reparative empathetic connections, but it also has the capacity to destabilize rule-driven declarative language, which, I suggest, inhibits mourning. By analyzing these stylistic structures, I demonstrate the ways Woolf presents imaginative language as answering the cries of the postwar modernist age and propelling forward the liberty of modernism.

“MIGHT IT BE I?”:
MARIANNE MOORE, FEMINISM, AND BASEBALL
Julie Merrell

Mentor: Melanie Micir

Despite the poet Marianne Moore’s origins in the modernist circles of New York in the 20s and 30s, she became increasingly famous towards the end of her career, appearing in popular magazines like *Vogue* and *Harper’s Magazine* and shows like *The Today Show*. As Moore became a national celebrity, her public persona was increasingly linked with her interest in baseball. Yet, despite the recent revival in Moore scholarship, her interest in baseball, as both an aspect of her public persona and her poetry, is largely overlooked and unquestioned. Instead, it serves as a shorthand for painting Moore as an eccentric, elderly spinster. This thesis corrects this critical neglect by engaging with both Moore’s public appearances and baseball writing in conversation with her larger trajectory as a critically-acclaimed poet. Moore’s work on baseball not only challenges gendered expectations, but also adds complexity to understandings of Moore as an inaccessible, highbrow writer with no room for non-intellectual engagement with her work. Moore’s baseball writing—most notably the poems “Hometown Piece for Messrs. Alston and Reese” and “Baseball and Writing”—should not be understood as distinct from the rest of her oeuvre, but gives us a new lens for examining the poet. This thesis draws out the treatment of race and diversity, the inherent feminist impulse, the nationalist implications, and, above all, the enjoyment of the sport central to Moore’s baseball writing.

RADIO AS AN APPARATUS OF TRANSFORMATION: ADAPTATION OF EXISTING LITERARY FORMS IN TWENTIETH-CENTURY GERMAN *HÖRSPIELE*

Patrick D. Goff

Mentor: Caroline Kita

The advent of radio in the Weimar Republic paved the way for a new form of dramatic art—*Hörspiele*, or radio plays. Drawn to the medium for its “blindness” (or lack of a physical stage) and potential to reach a wider audience, many German literary figures adapted some of their existing stage plays, novels, and other literary works for the radio. In my senior thesis project, I examine how these adaptations changed, in form and content, over the course of the twentieth century through the use of three case studies: Bertolt Brecht’s *Mann ist Mann* (1926), Heinrich Böll’s *Doktor Murkes gesammeltes Schweigen* (1955), and *Neid*, a radio play written by Elfriede Jelinek in 2011. My project will answer these questions: how did each adaptation handle the intersection of art and politics? In what ways do these adaptations reflect the playwright’s own views on the medium itself, especially relative to radio’s usage as a propaganda tool during the Third Reich? Finally, how does Germany’s literary engagement with radio anticipate or complicate twentieth-century attitudes towards media?

MAPPING MORAL TREASON: ADULTEROUS COHABITATION WITHIN BLACK UNION WIDOW PENSIONS

Camille Borders

Mentor: Iver Bernstein

Denied widows pensions from the Civil War provide insight into the early welfare state as a regime that policed and surveilled black women's intimate lives. After emancipation, black women built intimate relationships which allowed for community growth. Representing a threat to patriarchal hegemony, these African-American households, including the popularity of flourishing fictive kinships structures, represented deviance in contrast to a normative nuclear heterosexual family structure. During emancipation, the Pensions Bureau criminalized adulterous co-habitation as a high stake moral infraction which tied black women's access to citizenship to their sexuality and their husbands. In response to invasive pension laws widows utilized techniques of diversion, distraction, creative storytelling, and active community action to limit the surveillance and access of the Pension Bureau to their intimate life. These tactics were deployed during special examinations and allowed freedwomen to glimpse relationships based on new forms of advocacy and allegiance. Ultimately, these high-stakes negotiations over material survival began a legacy, in which black women's intimate lives have been the price for citizenship and government benefits. Modern understandings of the Welfare Queen can be traced to the stories and actions of Black Union Widows in the nineteenth century.

WITCHES AS POLITICAL CRIMINALS: PROSECUTION AND DEPORTATION IN COLONIAL KENYA

James Drueckhammer

Mentor: Timothy Parsons

The passage of the Witchcraft Ordinance of 1909 placed Kenyan superstitions, beliefs, and practices regarding witchcraft under the jurisdiction of Britain's legal apparatus within the East Africa Protectorate. The Ordinance, as written, was implemented with the intention of both protecting Kenyans from attacks on their property or person through supernatural means and exposing those who fraudulently claimed to be in possession of supernatural powers. However, in practice, the application of witchcraft charges was inconsistent and often politicized by a provision that allowed chiefs and other Kenyan participants in colonial administration to practice freely and maintain order using the specter of supernatural force. Witchcraft prosecutions were frequently brought against ritual leaders, referred to as 'laibons' who sanctioned coming of age ceremonies and helped landless young men establish families through the acquisition of wealth, often measured by cattle. These laibons were frequent targets of witchcraft prosecutions (and orders of deportation if their guilt could not be proven in court) because their status as ritual leaders offered them opportunities to acquire wealth and prestige outside of a system of colonially sanctioned patronage. By examining court documents located in the Kenya National Archives in Nairobi and Administrative dispatches housed in The National Archive of London, this thesis will examine how colonial legal authorities, and Kenyans whose wealth was tied to colonial patronage, charged and deported supernatural leaders in order to eliminate rivals to the elites created by the colonial administrative and economic system. The success of administration officials, and elites such as colonially appointed chiefs, in bringing forth witchcraft accusations will be contrasted with the difficulties facing ordinary, non-elite plaintiffs, who often have their claims of theft or injury due to witchcraft dismissed as superstition.

BLACK POWER: THE ROLE OF BLACK VOTERS IN TRUMAN'S 1948 PRESIDENTIAL BID

Zoe Gallagher

Mentor: Margaret Garb

By 1944 the African American votes in key northern states could decide a close presidential election. In 1948, it did. America's long history over voter suppression and voter mobilization can be well explained by a study of Truman's presidential campaign leading up to 1948. Attempting to manage an extremely course political landscape, Truman (with advisor Clark Clifford) developed a strategy that would, with luck and much skill, allow him to defy the odds and defeat Republican nominee Thomas E. Dewey. In doing so, Truman had to court Black voters, a key component to the new Democratic coalition of African Americans, laborers, farmers and Liberals. Scholarship has discussed Truman's relationship with African Americans in the past, but generally within the context of problems outside his campaign for election, such as desegregation of the United States Military or his Committee on Civil Rights. The research and study of his campaign (including actions as President leading up to the election) will be the subject of this thesis, and will attempt to analyze the degree to which Truman intentionally perused African-American voters, and how. Ultimately, this paper will conclude that Truman was very intentional in his treatment of African Americans, and was very aware of his need to accommodate them in order to accomplish his goals. In his successful pursuit of this demographic, Truman helped to shape the future of the Democratic party as well as access to vote, an issue that maintains relevance to this day.

“THE EVIL WAS CENTERED AROUND 110TH STREET”:
BLACK WOMEN SEX WORKERS, ENTREPRENEURIAL
ECONOMIES, AND MORALITY IN PROGRESSIVE
ERA NEW YORK CITY

Savannah Jacobson

Mentor: Douglas Flowe

My project examines black women sex workers in Progressive Era New York City. I ask why black women turned to sex work, and what happened to them when they did? First, I look at the context in which black women sex workers in New York City lived. I explore the effect of the Great Migration on New York City, and particularly in the creation of the city's two most black neighborhoods, Harlem and the Tenderloin District. I further contextualize these women within the white slavery panic that characterized the Progressive Era. Using this setting, I investigate how black women sex workers thought of their own lives. I question how they conceptualized their work: Did sex work become an integral part of how these women formed their identity, or was it simply a source of supplementary income? Then, I explore the perception of black women sex workers, from their neighbors and spouses, to local and federal government. To answer these questions, I turn to the Committee of Fourteen archives housed in the New York Public Library. The Committee itself, as a leading investigative reform group during the Progressive Era, provided fertile ground to conduct research. I explore how the Committee of Fourteen conducted their work, and the effect that their widespread surveillance made on black women sex workers. My project argues that black women sex workers were acutely aware of the stereotypes against them as blacks, women, and sex workers, and propagated these images themselves to firstly, subvert the surveillance state perpetuated by Progressive Era morality reformations and secondly, create thriving entrepreneurial economies.

“ENGLAND FOR ALL”: THE SOCIAL DEMOCRATIC FEDERATION’S SUCCESSSES THROUGH FAILURE

John Kemp

Mentor: Corinna Treitel

The 1880s saw a resurgence of Socialist politics in the United Kingdom after almost three decades without any substantial working class social or political movements. This renewal of Socialism was spurred on by the creation of the Social Democratic Federation in 1881, the first Marxist political organization in Britain’s history. Founded by the wealthy Henry Hyndman, the Social Democratic Federation survived for nearly 30 years before being absorbed into a different Socialist party. The Social Democratic Federation’s impact on the British political landscape is substantial, both directly through its politics and strategies and indirectly from its failures, as the later Labour party was consciously able to avoid the pitfalls the Social Democratic Federation fell into. Historians have long considered the Social Democratic Federation as a peripheral group in the history of British Socialism, one that played little role in the working-class movement that would culminate in the creation of the most influential and enduring British political groups, the Labour party. Given the Social Democratic Federation’s lack of success in parliamentary elections and their inability to grow effectively through most of the country and to keep a strong, consistent membership, their historical label as a failure is not surprising or strictly undeserved. However, this does not mean that their historical role in and influence on the working-class movement and the subsequent Labour party should be disregarded. Studying the official newspapers, writings, and letters of both members of the Social democratic Federation and from rival groups, supplemented by local newspapers that detailed the everyday events of the federation, a different picture emerges. It is clear from looking at the actions of the Federation holistically that both the successes and failures of the Social Democratic Federation contributed vitally to the establishment and success of labor politics in the United Kingdom.

ROBERT M. W. KEMPNER AND
THE POLITICS OF POSTWAR JUSTICE
Sophie Lombardo

Mentor: Anika Walke

Using Nuremberg prosecutor Robert M. W. Kempner as a case study, this thesis examines the successes and shortcomings of the International Military Tribunal (IMT) and American-led denazification proceedings in Germany from 1945-1949. By examining Kempner's conduct as lawyer, researcher, and public figure, it considers the extent to which geopolitical and legal pressures shaped and limited the Nuremberg Trials. It contends that Kempner, a German-Jewish émigré who had previously served in the Prussian Ministry of the Interior, proved an invaluable researcher and interlocutor between German and American parties at Nuremberg. In his efforts to navigate a complex web of legal, pedagogical, and pragmatic aims, however, he struggled to maintain the war crimes enterprise's legitimacy in the eyes of the German and American publics. Amidst particularly strong backlash, he even recommended entering into a guilty plea with defendant Bohle—ultimately, the only defendant to plead guilty at Nuremberg. Moreover, this project shows that, amidst emerging Cold War tensions, a successful American-led denazification would be an incomplete denazification. As revealed by Kempner's relationships with a number of former Third Reich officials, prewar networks reemerged during the proceedings, both to legal and geopolitical effect. By consulting autobiographical sources as well as trial transcripts, court memos, prosecutorial correspondence, and other archival materials contained in the Robert M. W. Kempner Collection at the U.S. Holocaust Memorial Museum, this thesis provides a biographical case study as a lens through which to better examine the forces that influenced a historic set of proceedings. An analysis of the trials Kempner prosecuted both “within the kingdom of the Nurnberg courthouse” and “in the eyes of the German and European public,” this project provides considerable insight on the Allies' qualified success in denazifying Germany after World War II.

“IF THERE’S A SLUMP IN THIS COUNTRY, THERE’LL BE A CIVIL WAR!”: THE SIMBULE AFFAIR’S REVELATIONS ON BRITISH VIEWS OF RACE AND IMMIGRATION

Luke Voyles

Mentor: Tim Parsons

On April 15, 1967, Zambian High Commissioner to the United Kingdom Ali Simbule referred to Britain as a “humbled toothless bulldog” regarding the settler-dominated nation of Rhodesia. The British newspapers only mentioned the content of Simbule’s words without providing the necessary context. He said his famous statement in response to George Thomas visiting Kenya and Uganda and criticizing the Zambian government’s aggressive stance on Rhodesia. The essay analyzes how the British government, the British civil service, the Conservative member of the House of Commons, newspaper writers, and a large majority of ordinary Britons expressed their outrage at Simbule’s comment. While most Britons did not care about Britain’s imperial power, they cared a great deal about national pride. Immigration and economic dissatisfaction also contributed to the disgust of many Britons toward both Simbule for his remark and the Labour government for failing to prevent his appointment as High Commissioner. Britain could not afford the empire, and the government therefore gave a narrative of benevolent decolonization that stood in stark contrast to other Western European nations. The thesis reveals that most British people did not believe that the nation retained international prestige as Prime Minister Harold Wilson assuaged the government of the United States and Britain faced deflation and would eventually face the devaluation of the pound. Even if a large number of Britons did care about the empire, they resented immigrants for supposedly taking their jobs and hated Simbule for revealing Britain’s weakness, no matter if they had known the context or not. Conservative and Labour politicians took notice, and worked together in proposing a harsher immigration law in 1968 that provided a template for future restrictions on immigration that occurred in 1981 and that continue to this day. Thus, the Simbule affair revealed the underlying resentment that many Britons held toward immigrants that did not directly correspond to the views of their wealthier representatives in the House of Commons, but they were able to influence immigration law for several generations afterward.

FROM DE QUINCEY TO A. A.: PERSONAL ADDICTION NARRATIVE AND ITS ROLE IN CONSTRUCTING ADDICTS' IDENTITIES

Rachel Butler

Mentor: Douglas Flowe

The introduction of the genre of personal addiction narrative and the fellowship groups that grew out of it added new voices to public discourse about addiction: those of the addicts themselves. From Thomas De Quincey's *Confessions of an English Opium-Eater*, published in England in 1821, to personal narratives written by members of the Washington Temperance Society in 1840s America, to the international phenomenon that is Alcoholics Anonymous and its derivatives, addicts in modern Western society have used personal narrative as a means both for recovery and for challenging social constructions of addict identity. Personal addiction narratives have helped create new paradigms of what it means to be an addict in Western society—at turns both liberating and constricting. In this thesis, I analyze these personal narratives to examine how addicts relate their personal experiences to their addictions, and how the notion of addiction as the result of moral deficiency plays into their personal accounts. As a result of the history of addiction and its treatment, addicts' identities remain intricately tied up with notions of morality, guilt, and willpower, and addiction cannot be reduced down to a medical condition. By examining the history and evolution of the genre of personal addiction narrative, this thesis aims to provide insight on the role of personal addiction narrative for addicts today and what the scope of its inclusions and exclusions mean for social perspectives about addicts and those addicts' perspectives about themselves.

THE MAKING OF IDENTITIES AND DISCOURSES: URBAN GRASSROOTS ENVIRONMENTALISM IN CHINA

Yixin Huang

Mentor: Bret Gustafson

Environmental movements have long taken root in China through works of environmental scientists and professional NGOs in relatively rural regions since the country's reform period in the early 1980s. The recent phenomenon of urban grassroots environmentalism, however, commands people's attention to the interaction between environmentalism understood here as specific sets of cultural thoughts on the environment and the Chinese urban public's daily life experiences in cities. This study offers a historically situated ethnographic exploration of a specific organization, Friends of Nature, a national environmental NGO based in Chinese cities, and its members' cultural, social, and psychological experiences as urban grassroots environmentalists. Founded in 1994 in Beijing, Friends of Nature (FON) is the first environmental NGO in China and wields fundamental influence over the urban public's understandings of environmentalism. Its membership system with over 16 thousand members who are everyday urban residents working in heterogeneous industries and organize local environmental events on weekends differentiate itself from other professional environmental organizations. Through participant observation, interviews, and essays and poems by members collected during my fieldwork at the Guangzhou and Shenzhen groups of FON in July 2017, I examine how the group of urban grassroots environmentalists under study have shaped a cultural discourse on the environment through their experiences as immigrants from the countryside to cities, and in turn, have undergone self-transformation in their identities as environmentalists and recent settlers in cities. This study also suggests the non-politically threatening nature of urban grassroots environmentalism in China which intentionally and unintentionally prioritizes the less political personal pursuits of the urban public while forgoing potential outright confrontations against governmental and business entities.

RADICAL REVOLUTIONARIES:
THE GERMAN FORTY-EIGHTERS' LABOR POLITICS,
EXTRALEGAL ACTION, AND INFLUENCE ON
AMERICAN ABOLITIONISM

Nathan Rickard

Mentor: Venus Bivar

My project examines the lives of the Forty-Eighters—a group of socialist revolutionaries who instigated the 1848-49 revolutions in the German-speaking territories before immigrating to the United States and organizing as radical abolitionists. This project confronts two disparate strands of historical narrative. First, this project begins with a challenge to the traditional views of the revolutions of 1848-49, particularly through the lens of the German revolutions, to highlight the radicalism undergirding the movement. Then I build on this radicalized version of the German revolutions to disrupt the singularity of American history in the mid-nineteenth century as independent of the people's revolutions happening throughout the world and insert the international influence of such radicalism in the American Civil War. Broadly, this paper destabilizes notions of who contributed to the revolutionary class by redefining political engagement. Rather than focusing on a narrowly defined political class or the biographies of prominent, known revolutionaries, I examine the large classes implicated in the social revolution. As a history of grassroots movements, this project attempts to provide voices to the voiceless and reinstate the role of the lower- and working-classes that once were commonly recognized within the historiography of the 1848-49 revolutions but have long been absent from the narrative of the Civil War for its subversion of acceptable American political practices. A social history of the 1848-49 movements in the German-speaking territories provides the necessary background to reimagine the United States Civil War as a part of the international social revolutionary age encompassing much of the mid-nineteenth century.

POETICS OF ICONICITY: READING AMERICAN SIGN LANGUAGE POETRY

Deborah Rookey

Mentor: Anca Parvulescu

The idea of creating original signed art in American Sign Language (ASL) surprises many hearing people. Why not just write? What makes it different? To answer the first question: people want to create literature in their native language, and as ASL does not have a standardized written form, this art is not written. The second question is more difficult and is the subject of this thesis.

My project focuses on analyzing a handful of rhetorical methods and devices utilized in the creation and performance of American Sign Language Poetry. My hope is that by focusing on some key elements, the reader will gain a sense of what it means to perceive language and literature in the visual-performative mode. My goal with this project is to introduce a taste of what it means to shift our restrictions on literature to embrace a new form. This thesis provides an introduction to ASL Poetry as an art form and leaves open several questions for further study. The field of ASL poetics is no more restricted than the field of English poetics, and more original art appears every day that might challenge some of the conventions relied upon for my conclusions.

I hope this thesis can provide a starting point for those who do not know ASL to immerse themselves in an unfamiliar art form and explore a new way of conceptualizing linguistic expression. For those who do know the language, I hope that this thesis highlights components of the art that might not have occurred to you previously and builds connections between ASL Literature and the broader literary canon.

THE INSANE TRUTH: NORMALIZING SHELL SHOCK THROUGH TWO WOMEN'S NOVELS IN INTERWAR GREAT BRITAIN

Katherine Taub

Mentor: Melanie Micir

In Interwar Great Britain, the societal conception of shell shock, and subsequently mental illness, changed drastically. Although the returning afflicted veterans were commonly ostracized from mainstream society, the literature from this time often paints a different picture. This thesis works to show how two specific representations of the disease helped in the easing of understanding, otherwise known as the naturalization, of it. First contextualized with medical and political texts from the Interwar period, close readings of *The Return of the Soldier* by Rebecca West and *Mrs. Dalloway* by Virginia Woolf serve as the focus for this thesis. These analyses are intertwined with letters from British nurses on the front lines, demonstrating the process in which the image of the shell-shocked soldier was not only preserved, but also manipulated, into an unexpectedly sympathetic character. In the case of West, the titular soldier steps away from the spotlight, and the non-combatant women in the narrative are given a more direct role in the act of understanding his shell shock. In Woolf's text, the shell-shocked veteran Septimus Smith's disease is made more palatable for the reader because of his intense connections with other characters. Due in part to these texts, mental illness as a whole became understood in a different way in Great Britain; for instance, the laws which defined a mentally-ill person as either sane or insane were challenged. This assertion is not to say that every person's mind was changed on the topic, but rather, that these two texts played a small role in a far greater process.

AN IRISH EXIT:
MODELING THE EU REFERENDUM
IN NORTHERN IRELAND

Kelly Barr

Mentor: Andy Sobel

In the wake of the 2016 EU Referendum, pollsters and the public alike have tried to piece together how the United Kingdom left the EU and what this means for the future of Europe. An often-overlooked region of the UK—Northern Ireland—voted Remain as expected, but defied forecasts with 40% of its constituencies choosing the Leave vote. This paper regresses a range of demographic variables for the electorate of Northern Ireland to understand if voting motivations for the EU Referendum in Northern Ireland differs from those in Great Britain. Results reveal that what determined the vote between the two regions could not have been more different—an ethno-political cleavage with roots in historical conflict unexpectedly overwhelmed the vast majority of the Northern Irish vote.

AGRIBUSINESS IN ARGENTINA: EFFECTS ON THE TOBA QOM INDIGENOUS COMMUNITY

Katie Blenko

Mentor: Glenn Stone

Argentina's Agricultural Secretary legalized the commercial use of the country's first genetically modified (GM) crop, the Roundup Ready soybean, in 1996. This decision was followed by the widespread adoption of transgenic seeds, a phenomenon that altered the country's agricultural landscape through land consolidation practices and a new proliferation of powerful agribusinesses. The rapid transition to GM soy across Argentina and the implementation of an agricultural-export model can be attributed to a variety of intertwining factors, including political context, farmer demand, economic benefits, and weak intellectual property laws.

This so-called soy boom was closely preceded by processes of international and domestic indigenous *visibilization*. Increased awareness of indigenous communities' suffering and past rights abuses triggered dramatic changes in international covenants and Argentine legislation throughout the 1980s and 1990s. Argentine politicians amended the country's constitution in 1994 to recognize the pre-existence of indigenous societies and affirm their legal rights to land ownership and bilingual education. Despite these efforts of historic reconciliation, Argentina's indigenous communities are still having their basic human rights infringed upon, as new health, economic, and land conflicts have emerged with the strengthening of agribusinesses. Through the examination of David Harvey's *accumulation by dispossession* model and a case study conducted in Northern Argentina's Chaco region, this research finds that the government's ongoing prioritization of economic opportunities associated with GM soy's expansion undermines legislation created to protect indigenous communities. If Argentina's indigenous peoples are to have their human rights properly recognized, the government must ensure laws are enforced on the ground.

TERRORISM IN THE NEWS: EXPLORING THE INFLUENCE OF THE TRUMP AND BREXIT CAMPAIGNS ON PRINT MEDIA

Abby Hermes

Mentor: Jeremy Caddel

The recent success of right-wing political campaigns in both the United States and Europe has drawn upon nationalist and anti-immigrant sentiments. At the same time, Isis continues to claim responsibility for a number of deadly attacks orchestrated by both singular actors and coordinated terror cells. This paper seeks to examine the relationship between successful right-wing politics and the reporting of “radical Islamic terrorism.” More specifically, I hope to understand if the Trump and Brexit campaigns of 2016 had an influence on the U.S. and U.K. newspaper coverage of terrorist attacks, resulting in more anti-Muslim rhetoric being disseminated through the news. Existing theories have proven the newsworthiness of both terrorist attacks and political campaigns, and I aim to analyze the relationship between the two. Using a dataset containing all terrorist attacks from 2014-2016 in addition to the number of news articles from six different newspapers coded as terrorism each week during the two years, I test various variables using a statistical model. I test existing theories related to the effect of attack number, size, and location on news reporting, and I also test my new theory that the Trump and Brexit campaigns would result in an increase in terrorism reporting. I then perform a discourse analysis on the articles surrounding four attacks, looking at both American and European attacks, to determine if a change in framing occurred during the Trump and Brexit campaigns. The results of this study support the existing theory that Western events drive news coverage, and the qualitative analysis supports the hypothesis that the Trump campaign resulted in more anti-immigrant rhetoric in American press but reject the hypothesis that the Brexit campaign resulted in more support for closed door policies in U.K. terrorism reporting.

SECURITY AND EMPOWERMENT?: JORDANIAN WOMEN'S POLITICAL PARTICIPATION AND THE WOMEN, PEACE, AND SECURITY AGENDA

Melissa Kay

Mentor: Trevor Sangrey

This thesis analyzes the transformative potential of civil society discourse on women's empowerment and political participation in Jordan. It asks how different civil society organizations approach empowerment and political participation in the context of the increasing securitization across the Middle East and the increasing significance of the refugee population in Jordan, after more than seven years of the Syrian conflict that have impacted Jordan's politics, economy, and society. Through a critical discourse analysis of 10 organizations, using semi-structured interviews with representatives from those organizations and primary sources from their websites, this thesis argues that the international and national civil society organizations in Jordan working to promote women's political participation are fragmented in their approaches, and that they empower women, through a transformative process of change, with varying degrees of success. Traditional methods of women's formal political empowerment through campaign training continue to demonstrate that empowerment is instrumentalized for democratization purposes, but other approaches to empowerment consider the transformation of Jordanian society in a broader sense. In addition, the introduction of the United Nations Security Council Resolution 1325 (UNSCR 1325) on Women, Peace and Security to Jordanian civil society through the redrafting of a National Action Plan for its implementation beginning in 2015 has resulted in a shift in discourse on women's political participation. Organizations operating within its framework are focusing more on women's participation in conflict resolution, in the security sector, and as refugees. Despite the transformative potential found in the theoretical implementation of the UNSCR 1325, discourse around the National Action Plan's development often revealed a silo effect, creating distinctions between pursuing gender equality through women's political participation and the Women, Peace and Security field.

CENSORSHIP AND THE CREATION OF EGYPTIAN CULTURE IN 1952 INDEPENDENT EGYPT

Rashi Narayan

Mentor: Jeremy Caddel

This project examines the creation of Egyptian culture under Nasser in the 1950s by comparing *That Smell of It* by Sonallah Ibrahim and *Miramar* by Naguib Mahfouz. Despite marked similarities between the two novels, only Ibrahim's novel faced censorship. The authorities and leading literary critics decried Ibrahim's novel as vulgar and immoral due to its reference to masturbation and sexual acts. However, Mahfouz's novel also contained sexual material. The two novels also had similarities with regards to content as they included discussions of degradation of emotional connections, lack of sexual fulfillment, and overall disillusionment with the regime. The main difference is in the writing style and outlooks of the two novels. Mahfouz's novel and its reception confirms the notion Nasser censored literature in order to manipulate the public image of Egypt. The regime chose to censor Ibrahim's work because it did not project a Western-palatable view of Egypt and threatened Nasser's ability to assert his country as a world power. This project argues that the Nasser regime worked with prominent literary critics in order to create a Western-palatable idea of independent Egypt, enabling the regime to project the new country as a major world power.

To support the argument, this project utilizes widely available secondary and primary sources which were either all published by main stream presses or in the public domain. These sources include novels, posters, and parliamentary minutes as well as peer-reviewed journals and books.

LES FRANÇAIS RADICALISÉS: UNDERSTANDING CAUSES AND VARIANCE OF FRENCH RADICALIZATION

Jessica Schreier

Mentor: Andrew Sobel

In the post 9/11 world, radicalization has emerged as a top domestic security concern for nearly every country. In the past five years, France has been the subject of more jihadi-inspired attacks than any other Western nation. Additionally, 2,000 French citizens have joined the Islamic State as foreign fighters, with many now returning back to France. These statistics render France the most important country in Western Europe in regards to counterterrorism, yet little scholarship has been published on French-specific radicalization. This thesis aims to fill this gap by utilizing a theoretical framework to assess the correlations between six variables—unemployment, foreign and immigrant population, population density, Islamic Institutions, and votes for Le Pen—and the rate of radicalization in 96 French *départements*. The findings demonstrate high statistical correlations between these independent variables and rates of radicalization in *départements*, which supports the theory that alienation and economic exclusion of Muslim communities correspond to increases in radicalization. These results represent an innovation in the field of radicalization, both in drawing conclusions on French radicalization and in using empirical evidence to support theory, a rarity in radicalization studies. Ultimately, this thesis recommends tangible changes that can be made to French counter-radicalization policy to curb systematic inequalities against Muslim communities and focus on decreasing rates of radicalization by diagnosing the root causes of the problem, rather than its symptoms. This thesis also suggests the need for nation-based studies on radicalization, as domestic and local circumstances likely influence radicalization.

REGISTRATION REVOKED: AN EXAMINATION OF THE MODI ADMINISTRATION'S USE OF THE FOREIGN CONTRIBUTION REGULATION ACT

Victoria (Tory) Scordato

Mentor: Shanti Parikh

The recent uptick in media coverage of a longstanding Indian financial and political regulation, the Foreign Contribution Regulation Act, has brought about new criticisms of the current Indian government, led by Prime Minister Narendra Modi. Modi and his administration have been accused of using the law, which regulates which non-governmental organizations are eligible to use funding from international sources, for their political benefit.

There is a lack of academic literature that has focused on the Foreign Contribution Regulation Act, especially recent usage of it. This research project aims to fill some of that gap by examining the validity of claims made by both domestic and international media outlets. My hypothesis is two-fold: the Modi administration is revoking the registration of non-governmental organizations at a higher rate than previous administrations, and organizations associated with religious minorities are more likely to have their permission to accept foreign funds rescinded.

In order to test this, I have compiled a database of all of the civil society organizations in 17 states that currently have approval under the Foreign Contribution Regulation Act or have had their approval revoked. The data was first examined by looking at the number of organizations that lost their registration and the year in which it occurred. Then, I attempted to calculate if there was a correlation between the classification of an organization and the likelihood of it still being eligible to receive foreign funds.

The results of the study show a slight confirmation that the Modi administration has increased the number of organizations losing their registration, but does not show a strong connection between the type of organization and its likelihood of losing access to foreign funding.

EVALUATING DIVERSIFICATION PLANNING AND EFFORTS IN QATAR: A STUDY ON DEVELOPMENT AND HYDROCARBON RELIANCE WITHIN THE GULF COOPERATION COUNCIL

Divya Walia

Mentor: Andrew Sobel

This study attempts to categorize and evaluate Qatar's economic diversification plans in the context of its place in the Gulf Cooperation Council (GCC) and the world to answer the question, how has Qatar uniquely addressed the challenge of economic reliance on hydrocarbons? Using content analysis of state planning literature and assessing economic data over time, I conclude that Qatar is attempting to carve a specific niche of comparative advantage within its diversification efforts; however, the nation faces many of the same developmental barriers as its GCC neighbors based on similar economic and political structures. Qatar's diversification niche, as illustrated by their investments and planning documents, attempts to center future development around four themes: (1) A focus on excellence in education and creating intellectual capital; (2) A focus on establishing self-sustaining entrepreneurship and innovation; (3) A focus on creating an international role for Qatar; and (4) A focus on overcoming Qatar-specific limitations in natural resources.

These themes are a product of Qatar's place within the hydrocarbon market, specifically its dominance in the liquefied natural gas (LNG) market, which has presented unique challenges as compared with its crude-heavier GCC counterparts. Specific case studies and comparison with the diversification efforts of Saudi Arabia reveal the extent to which Qatar's size and position has given it a different course from its larger, crude-exporting neighbors. Trends in expenditure reveal an emphasis on education and capital expenditure suggested by Qatar's planning documents. Trends in oil and non-oil GDP growth show the extent to which Qatar's economic development efforts have been tied to the growth of its LNG industry and potential challenges to future diversification.

AUTONOMY AND GENDER IN MUSIC TRAINING: CLASSICAL MUSIC EDUCATION IN FIRST- AND SECOND-GENERATION CHINESE IMMIGRANTS OF ST. LOUIS

Nancy Zhao

Mentor: Linling Gao-Miles

Scholarly and non-scholarly literature often presents a one-dimensional image of Chinese immigrant families, one in which the first-generation parents have high expectations and the second-generation children lack autonomy. While these narratives praise these immigrants for their “perfect” integration into American society, they nonetheless neglect the complexities of the Chinese American experience, ultimately perpetuating the formation of certain stereotypes related to the “model minority” status. One of these aspects is the overrepresentation of second-generation immigrant Chinese children in the classical music realm. This study examines the rising trend of classical music training in the Chinese population of St. Louis. Research topics include the reasons behind the popularity of extensive Western classical music education in these families and the consequences affecting the acculturation process of these immigrants. Data gathered from ethnographic interviews and surveys show that unlike scholarly and non-scholarly literature portrayals of Chinese immigrant families, the children possess a certain degree of autonomy in their music training. Moreover, parents have different expectations in music training for their sons and daughters, which becomes evident in the transition period from middle to high school. Although both the parents and children are aware of the involvement of the Chinese community in the classical music arena, they still willingly participate in the practice. Yet, despite the huge investment in Western classical music education, parents still desire for their children to seek career options in STEM. Music is generally viewed as a mandatory hobby rather than a plausible career path. Instead of merely being a component of the immigrant lifestyle, classical music education is a crucial aspect of individual identity and pride. There lies a deeper irony in this established tradition of classical music training without any noticeable benefits to the family.

PREDICTING THE OUTCOMES OF BATTED BALLS IN MAJOR LEAGUE BASEBALL

Seth Karpel

Mentor: Victor Wickerhauser

With the goal of building a predictor that can correctly determine whether or not a ball batted into play will result in a hit or an out, three classifiers are implemented—random forest (RF), support vector machine (SVM) and neural network (NN). The three individual classifiers are then aggregated into a final prediction, each equally weighted in a “voted” vector (requires agreement amongst at least two of the three classifiers to declare either “hit” or “out”). Three seasons, 2015, 2016, and 2017, were considered in building the predictor. The 2015 season, the first in which the MLB began tracking featured metrics such as “exit velocity,” served as the training set for the predictor, which eventually attempts to classify events from a pooled set of the remaining years.

AN ESSAY ON INDEPENDENT COMPONENT ANALYSIS

Joanna Lyu

Mentor: Jimin Ding

Measured signals are often mixtures of several source signals. Without enough prior information about the source signals or the mixing process, recovering the source signals is nontrivial. As one of the most popular blind source separation techniques, independent component analysis (ICA) provides a solution by expressing the observed variables (data) as a linear combination of statistically independent latent component variables (sources). An important application of ICA is to identify spatially or temporally independent patterns in functional Magnetic Resonance Imaging (fMRI) data. ICA decomposes the observed data matrix into a source matrix, which contains statistically independent spatial maps in its rows, and a mixing matrix whose associated columns (time-course) characterize the internally consistent temporal dynamic with each spatial map. Different activated brain maps associated with various bodily functions (breathing, reacting to stimulus, etc.) can be extracted from fMRI scans. The most commonly used group ICA methods can be categorized into two types—ad hoc post reconstruction and iterative EM algorithm. We use a simulation study to compare the efficiencies of existing group ICA methods.

REPRESENTATIONS OF THE SYMMETRIC GROUP AND NONSTANDARD QUANTUM STATISTICS

Alexander Mason

Mentor: Renato Feres

In quantum mechanics, a particle in one of N possible states is typically described by a vector in an N -dimensional space X . One calculates the probability of a given event occurring by representing the event as an operator on this space and taking the trace of product of this operator with the projection onto the line defined by the particle. To define states consisting of n particles, the typical method is to begin with the n th-degree tensor product of X , and then restrict to certain subspaces determined by the physical properties of the particles in question. For example, when dealing with bosons we require that the distribution be symmetric with regard to switching any two particles, producing the symmetric tensor product space. As it turns out, the whole tensor product space can be completely decomposed into such smaller spaces, in correspondence with the irreducible representations of the symmetric group. Here, we investigate the probabilities a multi-particle system inherits from the single-particle distribution in each of these spaces.

APPLICATIONS OF MIXED EFFECTS MODELING IN OBSERVATIONAL STUDIES AND CLINICAL TRIALS FOR ALZHEIMER'S DISEASE

Karthik Rohatgi

Mentor: Ed Spitznagel

White matter hyperintensity (WMH) is increasingly recognized as a core pathology of Alzheimer's Disease (AD). However, the association between WMH and mutations conferring AD (irrespective of actual AD diagnosis) is less well known. We studied this issue through linear mixed effects modelling, using data from the Dominantly Inherited Alzheimer's Network ($n = 456$). The model confirmed that mutation carriers have greater WMH than non-carriers after controlling for other predictors ($t = 6.23, p < 0.0001$).

We also used three different methods (ANCOVA-like model, unadjusted and fully adjusted linear mixed models) to calculate rate of change (ROC) in WMH. Loess regression was used throughout to qualitatively explore relationships in the data. Using the fully adjusted model, we determined that the ROC in WMH significantly exceeds zero at Baseline EYO of -23.56 years for non-carriers, and at least -25 years for carriers. Percentile bootstrap confidence intervals were also obtained for these EYO points. Our findings suggest that medical intervention is necessary for mutation carriers several decades before symptom onset.

More generally, we also sought to determine an effective linear model for a randomized controlled trial (RCT) with dose escalation at a fixed time point. To do this, we simulated 1,000 clinical trials, used 4 different mixed models for repeated measures (MMRM) to analyze each trial, and then calculated the statistical power of each model. The model which included a continuous dose variable interacting with time was found to have the highest power (0.534).

HECKE ALGEBRA CHARACTERS EVALUATED AT KAZHDAN-LUSZTIG BASIS ELEMENTS GIVE THE BETTI NUMBERS OF HESSENBERG VARIETIES

Ryan Schneider

Mentor: John Shareshian

A finite Coxeter group is a reflection group defined by a set of generating elements and a set of relations specifying the order of any product of two generators. These groups are related to a number of algebraic and geometric objects. Algebraically, Coxeter groups are associated to Hecke algebras, where each group element naturally corresponds to a basis element of the algebra. Geometrically, a Coxeter group is associated to both a root system—a set of vectors in a Euclidean space on which the group acts by reflection—and a Hessenberg variety.

In this thesis, we study the representations of Coxeter group Hecke algebras and the Betti numbers of Hessenberg varieties. Each Hecke algebra representation associates elements of the algebra to a matrix; the corresponding trace character of the representation maps an element of the algebra to the trace of its matrix under the representation. On a certain set of distinguished elements of the Hecke algebra—Kazhdan-Lusztig basis elements—these trace characters give polynomials. We prove for certain Hessenberg varieties and conjecture for all types that the Betti numbers of the variety are recorded as coefficients in these polynomials. Since the Betti numbers give information about the topology of the variety, as well as the geometry of the corresponding root system, our work illustrates a connection between the geometric and algebraic interpretations of finite Coxeter groups.

PREDICTING PITCHING INJURIES IN MAJOR LEAGUE BASEBALL

Phillip Underwood

Mentor: Nan Lin

Over the past few decades Major League Baseball has seen a steady increase in the amount of injuries facing pitchers. Given the continued expectation of professional pitchers to perform seemingly inhuman tasks, e.g., throwing a ball 90 miles per hour 100 times in a row, the stress on their arms is not surprising in the least. While the injuries may not be surprising, past theories from medical and statistical standpoints that have attempted to explain their primary cause show minimal degrees of success. The lack of predictive ability in pitching injuries caused by fatigue, overuse, or one just bad pitch not only causes great pain for the player, but also creates unwelcome challenges for teams competing for championships. Our goal in this paper is to develop a statistical model using many seasons of in-game data that will predict when pitchers are at a higher chance for injury and what factors contribute to this increased risk.

QUANTUM TECHNIQUES FOR CLASSICAL SYSTEMS

Zach Virgilio

Mentor: Renato Feres

Masao Doi noticed that certain techniques from quantum field theory had broader applications in the late 1970s. Specifically, the creation and annihilation operators of quantum field theory could be used to construct operators for classical systems. Systems composed of identical classical particles lend themselves especially well to such a description. Recently, John Baez and others have added to Doi's early results, specifically in the analysis of stochastic reaction networks, systems which are used in chemistry. This paper covers some of those fundamental results, most notably the construction of the 'master equation' in terms of creation and annihilation operators. Along the way, Baez's presentation of the material is improved and many similarities between classical stochastic systems and quantum systems are highlighted. We then consider a system constructed from many identical reaction networks that allows diffusion and show that these techniques extend to this new system. Lastly, we introduce some questions indicated by these results.

A WALK THROUGH EINSTEIN'S GENERAL THEORY OF RELATIVITY

Zack Weinstein

Mentor: Quo-Shin Chi

Einstein's general theory of relativity postulates that matter and energy curve and contort the geometry of space and time. A proper understanding of Einstein's theory utilizes the remarkable power of tensors in constructing generally covariant physical laws. In this thesis, we first establish tensor analysis and differential geometry as the mathematical framework for general relativity. We then derive and discuss the uniqueness of Einstein's field equations in four dimensional spacetime, and finally showcase several special solutions of the field equations, including the Schwarzschild metric and gravitational waves.

SYNTHESIZERS, VIRTUAL ORCHESTRAS, AND ABLETON LIVE: DIGITALLY-RENDERED MUSIC ON BROADWAY AND MUSICIANS' UNION RESISTANCE

Liam Gibbs

Mentor: Todd Decker

As Broadway musicals embrace contemporary popular music styles, orchestrators must in turn embrace the digital technologies necessary for producing convincing simulations of genres like hip-hop and electronic music. At the same time, as production values soar, producers work to minimize their budgets, often putting downward pressure on the size of the orchestra. Although digital and electronic music technologies can expand the sonic register of the Broadway orchestra, they can also replace traditional acoustic instruments and save money. The Broadway musicians' union, Local 802, has regularly sought to control the use of digital technologies and ensure that live musicians produce as much music as possible. Thus, Local 802's advocacy for the employment of their members can limit the sounds heard on Broadway.

The following narrative considers three digital technologies—synthesizers, virtual orchestras, and Ableton Live—and examines case studies and controversies surrounding their use in Broadway orchestras. Informed by interviews with industry professionals, author observation of pit orchestras in performance, archival research, popular media articles, and previous scholarship, I argue that the union's entrenched interests and antiquated regulations can stifle musical innovation on Broadway by resisting the use of digital music technologies.

GUNS, GOVERNMENT, AND THE AMERICAN WAY: BALANCING LIBERTY RIGHTS IN A LIBERAL STATE

Elizabeth Levinson

Mentor: Kit Wellman

A liberal government is charged with the protection of its citizens and their individual rights. In order to satisfy this role, the state must determine when it must intervene on the self-governance of its people, and when it must leave them alone. The controversy over gun control in the United States is illustrative of the characteristic tension between these foundational duties of the state. Philosophical discussion of this tension is generally limited to concerns about autonomy and security. This thesis expands the scope of inquiry to include the liberal rights to equality and culture. Cultural norms and the stereotypical “American” identity emphasize gun ownership as a symbol and tool of self-reliance, stoicism, and independence. Wholly disallowing ownership would belie the American emphasis on liberty and would suppress those national cultures in which guns are used as an expression of it. All else being equal, I argue that such measures would be morally wrong, as the absolute denial of legal gun ownership would violate the fundamental right of cultural identity, thus inhibiting the autonomy rights of American individuals to an impermissible degree. However, equality is an issue as well. Notably absent from the philosophical debates about gun ownership is the vastly disproportionate impact of gun violence on African Americans. This paper argues that the principle of equality and concern for public safety morally mandate that certain restrictions be placed on the availability of firearms and ownership—even when considering valid cultural claims to gun rights and the practical security issues that arise in non-ideal theory. Gun control and autonomy rights are not mutually exclusive. They exist in tandem, as all rights must. The question that must be asked, then, is which right outweighs another under what circumstances—a problem with necessitates a series of calculations, scaling, and social inquiry to reach an accurate conclusion.

INDIVIDUAL DIFFERENCES IN EFFICIENT LEARNING: THE RELATIVE CONTRIBUTIONS OF ATTENTIONAL CONTROL AND WORKING MEMORY CAPACITY

Hannah Becker

Mentor: Kathleen McDermott

This study acquired new knowledge regarding the potential role of attentional control in generating individual differences in learning efficiency and longer-term retention. Learning efficiency is defined by the rate at which individuals learn information and their ability to remember it over time, and is measured using the Learning Efficiency Task (LET). While Zerr et al. have demonstrated the LET as a reliable measure of individual differences in memory, the mechanisms underlying these differences have yet to be fully understood. One explanation for disparity in learning efficiency, as investigated by the current study, is that differences in learning and memory result partially from an individual's ability to control their attention. Attentional control is defined as the use of attention to focus on information relevant to a particular goal, specifically in the face of distractions.

The present project directly compared performance on the LET to three computerized measures of attentional control (Antisaccade, Arrow-Flanker, Stroop) and working memory capacity (Operation Span, Reading Span, Symmetry Span) in a within-subjects design. A total of 81 healthy Washington University undergraduates (76% female) with an average age of 19.5 years ($SD = 1.4$) participated in the experiment. The data revealed that attentional control performance was weakly, but not significantly, correlated with learning efficiency performance. These results support the conclusion that attentional control is not a significant driver of individual differences in learning efficiency. Additionally, the variability of performance on the LET in a college-aged sample further demonstrated the utility of the LET as a measure of individual difference.

THE SHIFT TO THE LEFT EFFECT: AN INVESTIGATION OF THREAT-INDUCED SHIFTS IN POLITICAL ATTITUDES

Katharine Chang

Mentor: Alan J. Lambert

Psychologists have long recognized that threatening stimuli can exert a powerful influence on attitude and behavior. Virtually all research in this area has shown that threat induces a "shift to the right effect," or a tendency to endorse conservative beliefs and perspectives. This raises an interesting and important question: are there conditions under which threat can reliably induce people to endorse liberal perspectives? The overall goal of this research was to provide evidence for this possibility, and to elucidate the affective mechanisms by which it occurs.

The current thesis will examine these "shift to the left" effects using attitudes surrounding environmental protections. Participants were exposed to three conditions: a story of a child dying due to air pollution, a story of childhood illness caused by water pollution, and a control condition.

Participants in the experimental conditions were more likely to endorse liberal proenvironmental attitudes and less likely to endorse conservative healthcare attitudes relative to a control. Participants were significantly angered, saddened, and made fearful by the two experimental conditions. These findings demonstrate unique evidence that threats can significantly shift political attitudes to the left, and that negative affect plays a significant mediatory role between threat and shifts in attitude.

COLLECTIVE MEMORY, COLLECTIVE NARCISSISM, AND MORAL FOUNDATIONS THEORY: MORALLY MOTIVATED REASONING AND BIASED ASSESSMENTS OF GROUP INFLUENCE

Luke Churchill

Mentor: Roddy Roediger

In the current study we demonstrate how moral values may bias collective memory. We follow Wertsch and Roediger in defining collective memory as memories shared by members of a group that are relevant to that group's identity. The specific collective memories we examine are American participants' perception of their state's contribution to overall U.S. history. Prior work in our lab has demonstrated a state narcissism effect, in which participants over-attribute responsibility for U.S. history to people from their state. Putnam and his colleagues hypothesized that the group narcissism bias in collective remembering arises due to ego-protection biases, the availability heuristic, and base-rate neglect. We examine the phenomenon from a different perspective: morally motivated reasoning. We drew on Haidt's (CIT) moral foundations theory, and predicted that the binding values—loyalty, authority, and purity—would positively predict state narcissism. We collected data from 2,000 American Mechanical Turk workers. Participants rated their home state's contribution to U.S. history, as well as the contributions of 10 other states. They also filled out the Moral Foundations Questionnaire. We collected demographic data, such as level of education, home type, and degree of identification with home state. Endorsement of binding values positively and strongly predicted state narcissism. We attributed this to morally motivated reasoning, in which binding values may motivate people to include the group in their ego-protective biases, and to neglect historical contributions made by groups outside their own. Individuating values (fairness, harm) did not significantly predict state narcissism. Moral reasoning style, therefore, may moderate the extent to which the biases suggested by Putnam, et al. influence collective remembering. Moral reasoning can bias the way people judge and remember their group's role in history.

THE EFFECT OF SLEEP ON MICROGLIAL SYNAPTIC ELIMINATION: EXPLORING MICROGLIAL SYNAPTIC ENGULFMENT AS A POSSIBLE MECHANISM THROUGH WHICH SLEEP FACILITATES LEARNING

Haley Crosby

Mentors: Joseph Dougherty and Elizabeth Schechter

Microglia are the resident immune cells in the central nervous system, responding to pathogens and injury in the brain. Recently it has been shown that microglia also play a role in synaptic plasticity, engulfing and eliminating synaptic connections in an activity dependent manner. It has also been well demonstrated that sleep is a period in which synaptic connections and networks are refined, sleep being correlated with reduction in synaptic densities. In this paper, I explore the possibility that this variation in neuronal spine and synaptic densities during sleep is a product of altered interactions between microglia and synapses. The first study uses an immunohistochemical approach to examine differences in number of engulfed synapses in the forebrains of waking and sleeping mice. The second study explores a possible molecular mechanism of this alteration in microglial synapse modification, investigating the amount and localization in microglia of the RNA binding protein, QK6, known for regulating peripheral translation. By comparing both extent of synaptic engulfment and levels of QK6 in microglial cells at different time points, we attempt to illuminate differences in microglial synaptic engulfment between sleep and wake, and further propose a possible model for dendritic spine density attenuation during periods of sleep. Differences in microglial synaptic engulfment between sleep and wake could have implications for models of synaptic plasticity, and help to advance microglia engulfment as a possible mechanism of learning.

THE EFFECT OF SYMBOLIC, LINGUISTIC INFORMATION ON THE DISCOUNTING OF DELAYED, REAL LIQUID REWARDS

Ryan Hoopes

Mentors: Leonard Green, Carl Craver, and Mark Povich

Delay discounting refers to the decrease in subjective value of an outcome as time to its receipt increases. Unlike nonhuman animals, humans display a magnitude effect: larger, delayed rewards are discounted less steeply than smaller, delayed rewards. However, there are notable differences in the ways discounting experiments are conducted with humans and animals. Human experiments typically involve hypothetical, monetary rewards, with the amounts and delays stated explicitly. In contrast, in animal experiments, amounts and delays are experienced directly and outcomes are primary, consumable reinforcers. Thus, putative species differences in the effect of amount on degree of discounting may be due to these procedural differences. To evaluate this possibility, two experiments studied the effect of symbolic, linguistic information on the degree to which humans discount the value of delayed, real liquid rewards. There were two experimental groups: a symbolic group in which linguistic information was provided as to the amount of (9.6 and 28.8 ml) and delay to (5, 15, and 60 seconds) the liquid reward, and a non-symbolic group in which no information as to amounts and delays was presented. A computer-run, adjusting-amount procedure was used to estimate the relative subjective values of the rewards. Overall, the results showed a magnitude effect in the symbolic group, but no effect of amount in the non-symbolic group. In addition, there was a differential effect of delay on degree of discounting in the symbolic, but not in the non-symbolic, group. These results suggest that the difference between human and nonhuman animals in the effect of amount on degree of discounting is due, in part, to procedural differences and support the generality of the discounting approach to decision-making.

PAVLOVIAN-INSTRUMENTAL TRANSFER STUDY WITH MONETARY AND LIQUID INCENTIVES

Aaditya Manirajan

Mentors: Todd Braver and Joseph McCaffrey

Previous studies suggest a relationship between motivation and cognitive control, yet questions still remain regarding the motivational mechanisms of action. A recent study by Yee et al. developed a novel liquid paradigm to examine motivated cognitive control. With this paradigm, it was found that performance on a cognitive control task was modulated not only by increasing levels of monetary rewards, but also by the valence of delivered liquid feedback (positive = juice, neutral = tasteless, negative = saltwater). It is possible that different motivational mechanisms underlie the respective influences of liquid and money. In particular, learning research has demonstrated that two different processes, Pavlovian and instrumental, are principally involved in motivation. Although the interaction between Pavlovian and instrumental processes has previously been tested in both the human and animal literature, these interactions have never before been demonstrated in the context of a cognitive control task. In this project, a new variant of the liquid reward paradigm is explored that enables explicit examination of whether liquid rewards might influence cognitive control in humans via Pavlovian mechanisms. Specifically, liquid feedback is explicitly conditioned to aversive and appetitive Pavlovian cues, while monetary rewards are provided as instrumental incentives for cognitive control task performance during separate learning phases. The results yield new information regarding the degree to which liquid and money cues modulate cognitive control in this new paradigm, and provide a direct test of the hypothesis of distinct motivational mechanisms.

A NOVEL EXPECTED UTILITY MODEL OF DECISION-MAKING UNDER RISK

Roderick Seow

Mentors: Todd Braver and Brett Hyde

Theoretical models of decision-making under risk (i.e., regarding probabilistic gains and losses) typically start from the framework of utility theory, which state that decision-makers select outcomes with the highest subjective utility. In these frameworks, utility is conceived as a nonlinear decreasing function of amount (i.e., concave). However, a limitation of these models is that they cannot account for the amount effect, a phenomenon indicating that decision-makers become more risk-averse as the amount of a probabilistic gain increases. This project aims to explain the amount effect using a novel sigmoidal utility model, as well as capturing the transformation between risk-aversion and risk-seeking attitudes that is sometimes observed in individual decision-making. To establish a conceptual foundation for the sigmoidal model, a brief review of the literature on decision-making under risk is provided, covering the psychological rationale and mathematical formulations of current models of decision-making. Next, the proposed model is compared with these current models, using data from a probability discounting paradigm. The proposed model provides a potential resolution to both the theoretical and empirical limitations of existing models. Although the current work is just an initial step towards the development and validation of this new model, recommendations for future studies are provided from which to generate novel predictions that could strengthen the case for the model's utility and explanatory power.

LEARNING EFFICIENCY: IS IT GENERALIZABLE? IS IT DURABLE?

Justin Vincent

Mentors: Kathleen McDermott, Elizabeth Schechter, and Christopher Zerr

Recent work has shown that individuals who learn material more quickly also remember it better at different delays. This interaction between speed of learning and goodness of retention is referred to as learning efficiency; more efficient learning represents quicker, more durable learning. This thesis includes two experiments to address two general questions in the domain of learning efficiency. Experiment 1 sought to address the generalizability of efficient learning across different types of material. We compared participants' efficient learning of stimuli representing two domains of learning: phonetic Lithuanian-English word pairs and visuospatial Chinese-English word pairs. A key finding of Experiment 1 is that Learning Efficiency scores, which address both learning rate and retention in one metric, positively correlate between types of stimuli. Therefore, we conclude the construct is generalizable. Experiment 2 investigates whether quicker learners maintain a better memory than slower learners at longer retention intervals by comparing learning rates of Lithuanian-English word pairs with performance on cued recall tests at delays of 48 hours and one week. The fastest learners of the stimuli retained their retentive advantage over the other participants at both delays. From this finding, we conclude the construct is durable to delays between study and test phases. Expanding our understanding of the learning efficiency construct is important for learning and memory research, as the construct has theoretical and practical value for future experiments. It is possible that investigating this rate can elaborate on the apparent distinction between slow and fast learners.

SUMMATION OF POWER SERIES BY CONTINUED SQUARE ROOTS

Jonah Glick

Mentor: Carl Bender

It is proposed that a power series may be summed (analytically continued outside its radius of convergence) by converting it to a continued square root of the form $a_0 \sqrt{1 + a_1 z} \sqrt{1 + a_2 z} \sqrt{\dots}$. The continued square root coefficients a_i for a given function $f(z)$ are determined by equating the Taylor coefficients of the continued square root with those of $f(z)$. For most power series, the continued square root has a region of convergence much smaller than that of the Taylor series, continued exponential, or continued fraction. However, when the power series is of the form

$$d_0 + d_1 z - \sum_{n=2}^{\infty} \frac{\Gamma(\frac{n-1}{2}) \text{Cos}(\frac{n\pi}{2}) \sum_{i=0}^{\infty} f_i g_i^n}{2\Gamma(\frac{1}{2})\Gamma(\frac{n+2}{2})} z^n$$

for $\text{Re}(d_n) \geq 0$, $\text{Re}(f_i) \geq 0$, and $g_i \in \mathbb{C}$, the Taylor series and continued fraction representations break down and the continued square root converges for all $\text{Re}(z) > 0$ on the complex plane.

A NONLOCAL APPLICATION OF THE DISPERSIVE OPTICAL MODEL TO ^{208}Pb

Michael A. Keim

Mentor: Willem Dickhoff

A nonlocal application of the dispersive optical model to neutrons and protons in ^{208}Pb is presented. A nucleon self-energy is described by parametrized real and imaginary parts connected through a dispersion relation. This parametrization includes nonlocal Hartree-Fock and spin-orbit and local Coulomb real terms, and nonlocal volume and surface and local spin-orbit imaginary terms. A simple Gaussian nonlocality is employed, and appropriate asymmetry parameters are included to describe the N-Z dependence of the nucleus. These parameters are constrained by fitting to experimental data, including particle numbers, energy levels, the charge density, elastic-scattering angular distributions, reaction cross sections, and the neutron total cross section. From the resulting nucleon self-energy, spectroscopic factors, spectral strength, and the neutron matter distribution are deduced. The neutron skin thickness, important to the physics of neutron stars, is determined to be 0.154 fm, a value consistent with the results of recent parity violating elastic scattering experiments. Future constraints and applications of the model, including the high-momenta nucleon fraction and the ground state energy, are discussed.

DEVELOPING A COMPUTER VISION ALGORITHM TO DETECT MOVEMENT IN THE ENVIRONMENT FOR THE ARGUS II RETINAL PROSTHESIS

Alissa Ling

*Mentors: Kapil D. Katyal, The Johns Hopkins University Applied Physics Laboratory,
and Erik Henriksen*

The Argus II is an FDA-approved retinal prosthetic device created by the Second Sight company. The prosthesis allows a subset of blind individuals to visualize information. This device has been proven to help individuals see information from the environment that is relevant to their daily needs. However, the current device has been limited to visualization of static, non-moving objects and has no permitted blind individuals to safely walk through an environment without running into objects. The goal of this project is to help visually impaired patients autonomously walk around by allowing them to visualize the motion of objects and people around them as they navigate through their environment. A computer vision algorithm was created in Python using optical flow from the OpenCV library to show the motion of the surrounding area as the user moves. The purpose of the algorithm is to differentiate between the motion of the user and the motion of objects and people around the user. The algorithm takes the motion data from optical flow and determines which vectors correspond to the user's motion and which vectors correspond to object motion, and it then transforms the vectors so that only the object motion is shown as the output. For more reliable results, a moving average filter is implemented into the algorithm so that edges and random jolts from the camera do not give false positives of object motion. This algorithm has met bench top level validation, but further testing needs to be performed before implementing in patients.

REAL-TIME RFI MITIGATION IN RADIO ASTRONOMY

Emily Ramey

Mentors: Richard Prestage, Green Bank Observatory, and James Buckley

As the use of wireless technology has increased around the world, radio frequency interference (RFI) has become more and more of a problem for radio astronomers. Preventative measures exist to limit the presence of RFI, and programs exist to remove it from saved data; but the use of algorithms to detect and remove RFI as an observation is occurring is much less common. Such a method would be incredibly useful for observations in which the data must undergo several rounds of processing before being saved, as in pulsar timing studies. Strategies for real-time mitigation have been discussed and tested with simulated data, but ideally the results of any approach would be validated by a detailed comparison of the final data products with and without mitigation applied. The goal of this project is to develop an RFI mitigation approach based on strategies suggested by Buch et al. and to test this program on real data from the observation of pulsar J1713+0747 at the Green Bank Observatory in West Virginia. We use a median absolute deviation (MAD) filter to identify interference in the observation and replace the compromised data with random Gaussian noise to match a characteristic radio signal from space. In order to verify our results, we analyze the pulsar's timing residuals obtained both from the mitigated data and from data processed through offline RFI removal software. Comparing the two, our preliminary findings indicate that our program is able to significantly improve the quality of timing results from the observation.

EXCLUSIONS BASED ON INTOLERANCE:
ON JUSTIFICATIONS IN DEMOCRATIC DEBATE
Shaun Diestelkamp

Mentor: Frank Lovett

There is much discussion by political theorists about what claims can be legitimately made in a democracy. Theorists have suggested various restrictions, often on religious reasons or comprehensive doctrines, claiming that citizens must focus on either secular or political reasons to support their arguments. I argue that restrictions should be made only against specific intolerant claims, thus allowing most arguments, even those based on tolerant comprehensive doctrine, in debate.

EXPLAINING IDEOLOGICAL PREFERENCE CHANGE ON THE U.S. SUPREME COURT

Hannah Greenhouse

Mentor: James Spriggs

The nine Justices who serve on the U.S. Supreme Court set precedent and issue rulings that affect American lives for generations. Understanding the factors that lead to judicial preference drift can have important policy implications regarding how Justices voting patterns will change during their tenure on the Court.

While it used to be a widespread belief that U.S. Supreme Court Justices held immutable policy preferences throughout their time on the bench, it has since been empirically demonstrated that many Justices undergo ideological preference change during their tenure. (Segal and Spaeth 1993; Martin and Quinn 2007; Epstein 2007). However, existing research does not attempt to explain why a Justice experiences preference change and why some Justices undergo more preference change than others.

This paper builds on previous research by providing an explanatory model, rather than just a descriptive analysis, for ideological preference change on the U.S. Supreme Court. Two separate regressions were used to examine change within a Justice and change between Justices. This change can be measured by analyzing the amount of change regardless of direction as well as directional change.

The models indicate that having a former occupation as a federal or state judge, former occupation as an elected official, and ideological change within the median Justice lead to preference change that can be understood in a systematic manner. Justices who previously served as a federal or state judge experienced less ideological change than Justices who had not served in these positions. In contrast, Justices who previously served in elected office experienced more ideological change than Justices who had not. It was also apparent that Justices tended to become more ideologically liberal when the median Justice moved in a liberal direction. However, the majority of factors, including tenure, ideological distance from the president, Senate, House, and public mood, affect Justices in idiosyncratic ways.

THE ART OF TERROR: ICONOCLASM IN RADICAL ISLAMIC TERRORISM

Christopher Hall

Mentor: Lee Epstein

Contemporary terrorism has received a great deal of attention in the news media and academia. These analyses tend to focus on the political and economic motivations of terrorists, which, while important, are missing a significant aspect of modern terrorism. Looking at major terrorist actions from 2000 to 2017, I find an observable pattern of iconoclasm in modern radical Islamic terrorism; iconoclasm being defined as the purposeful destruction of objects of perceived value, symbolism, or cultural unity for political ends. I find this strategy of iconoclasm to arise from economic and political grievances among Arab populations combined with the powerful draw and ideological bent of Western cultural exports such as Hollywood movies, television shows, and social media platforms. Those looking to position themselves in opposition to the West realize that these cultural exports enhance Western cultural or “soft” power and present a rallying point for mainstream Arabs. Radical Islamic terrorists thus seek to destroy objects that symbolize this soft power. In so doing, they aim to deny Arab populations alternative visions for the future of the Middle East, strengthening the radical Islamists’ claims to legitimacy. These findings further our understanding of the motivations and strategies of modern radical Islamic terrorism, highlighting the importance with which they view Western cultural goods and the degree to which combating modern terrorism is every bit as much a battle of ideas as a military and political conflict.

BREAKING RANK:
PARTY INFLUENCE IN CONGRESSIONAL DEFENSE
VOTING SINCE THE COLD WAR

Samuel Klein

Mentor: Steven Smith

Since the 1960s, studies of Congressional voting behavior on defense-related legislation have examined the influence of local interests. The Vietnam War seemed particularly divisive along partisan and ideological lines, and the literature suggests that Congress has grown even more polarized since then. Do district interests still influence voting behavior on defense? For selected Congresses in the post-Cold-War era, roll-call votes on House defense authorization bills are scaled. Consistent with broader trends, the influence of party seems to have increased in the realm of defense voting, while ideology has also remained a strong predictor. However, much of the variance is left unexplained by these factors, and I find evidence that defense-related district interests contribute to this discrepancy.

WHEN TWO LIKES ARE ALIKE: REVISITING MEDIA BIAS USING FACEBOOK LIKES

Eli Scher-Zagier

Mentor: Jacob Montgomery

This paper applies a recently developed method of estimating ideology with Facebook interactions to posts by media outlets. After using these ideological estimates to rank media outlets' relative ideology, it looks at whether authors affect the ideology of the articles they write when holding fixed the article topic and media outlet. It finds that authors jointly affect the ideological slant of articles, and more than half of the authors have a statistically significant individual effect on the ideology of their articles.

NEUROTICISM AS A MODERATOR OF THE DEPRESSOGENIC EFFECTS OF STRESS: EXAMINING THE ROLE OF NEURAL REWARD PROCESSING

Jared Balbona

Mentor: Ryan Bogdan

While early life stress (ELS) has consistently been established as one of the most potent predictors of depressive symptomatology in adulthood, not all who are exposed to childhood trauma develop depression as a result. Increasing evidence suggests that the depressogenic effects of stress may be impacted by both ventral striatum (VS) reward reactivity and neurotic personality traits; however, no study to-date has examined how these individual factors are related to one another in conferring overall risk for psychopathology. We sought to address this gap by examining fMRI and genomic data, as well as self-reported ELS, neuroticism, and depression from 1,174 undergraduate students. Linear regressions and structural equation models were developed and run to determine whether neuroticism moderates the relationship between ELS and VS reward reactivity, and whether VS activity subsequently mediates the relationship between ELS and depression; consistent with recent recommendations, covariate of no-interest x predictor variable interactions were also entered as covariates in our analyses. We found that that self-reported neuroticism (but not polygenic risk for neuroticism) significantly interacted with childhood trauma to predict VS reward reactivity, and that VS activity was somewhat associated with depression. These findings highlight neuroticism as a potentially important link in understanding the neurobiological effects of early life stress on depressive symptomatology, and provide possible avenues to future treatment and prevention strategies.

THE EFFECTS OF MEDIA CONSUMPTION ON PERCEPTIONS OF STEREOTYPES IN COMEDY

Simone Britto

Mentor: Tammy English

Research about off-color racial humor has had conflicting results, with some studies suggesting that it may be beneficial to intergroup relations, while others indicate that it reinforces negative stereotypes. This study examined the impact of exposure to media on people's responses to off-color racial humor by comparing White and Asian adults' perceptions of racial humor targeting ingroups and outgroups and how long-term media consumption predict these perceptions. I hypothesized that participants would find humor targeting stereotypes about their ingroup equally humorous but less accurate than humor targeting outgroups due to increased real-life exposure and sensitivity towards their own group's behaviors, thoughts, and feelings. However, the relationship between the target race of jokes and participant race did not predict stereotype accuracy or joke enjoyment. Additionally, I expected that people who watched more television would find stereotypes to be more accurate and less offensive due to increased exposure to stereotypes and internalization. For both ingroup and outgroup targets, heavy media viewers rated stereotypes as more accurate but did not report different levels of offensiveness compared to light media viewers. This outcome suggests that heavy viewers recognize the offensiveness of stereotypes in humor yet still internalize them. Findings highlight a need going forward for increased education on critical media consumption.

USING THE BEHAVIORAL ASSESSMENT SYSTEM FOR CHILDREN TO PREDICT ACADEMIC PROBLEMS IN CHILDREN WITH SICKLE CELL DISEASE

Margaret Clapp

Mentor: Desiree White

Children with sickle cell disease (SCD) can experience cognitive difficulties that can result in deficits to academic performance. To encourage earlier academic intervention for children at risk of cognitive and academic problems, brief and predictive screening instruments that can be administered by clinicians are crucial. To this end, the primary objective of this study was to assess if the Behavioral Assessment System for Children – second edition (BASC-2) parent report, as a behavioral measure, predicted academic achievement. A sample of 45 children with SCD were administered the BASC-2 parent report, the calculations and letter-word subtests of the Woodcock-Johnson III Achievement test (WJ-III), and reported whether or not they had ever been retained a grade. Linear regression analyses found that the BASC-2 behavioral symptoms (BSI) and scale T-scores were significantly predictive of T-scores on the letter-word subtest of the WJ-III. This association supports previous research suggesting that high scores on measures of behavioral problems are associated with lower scores on achievement tests, indicating academic difficulties. Additional exploratory linear regression analyses found that the BASC-2 attention scale T-scores were significantly predictive of T-scores on the letter-word and calculations subtests of the WJ-III, indicating that attention may be an important component of understanding academic achievement deficits in SCD that warrants further investigation. Although the BASC-2 may not be a useful measure in predicting academic outcomes such as grade retention, future research should expand on the use of behavioral screening measures in predicting academic and cognitive outcomes.

ENTRAINING NEURAL OSCILLATIONS: ALTERING AUDITORY PERCEPTION WITH AMPLITUDE MODULATED STIMULI

Hayley Clocksin

Mentor: Jonathan Peelle

Current research suggests that our ability to understand rapid and complex acoustic information such as speech stems in part from the entrainment of local neuron populations to the incoming stimuli. The ability to register and match the phase of neural oscillations to that of incoming information is thought to aid in predicting when salient information will be present in the environment and ensuring that the synchronized neural populations will be primed to respond. While past research has shown that external auditory stimuli have the ability to entrain neural populations, few studies have explored the extent to which this external modulation influences performance on auditory tasks. The goal of this study was to characterize the degree to which auditory entrainment affect perception of near-threshold stimuli. Following brief entrainment to a 3-hertz amplitude modulated auditory noise, participants detected 1 kilohertz tones near threshold spread evenly within the first cycle of the 3-hertz phase angle. While participants' ability to detect tones near threshold was differentiated by the phase of the modulation, the effects did not follow the smooth sine curve of the modulation as expected. Rather, it appears that the connection between neural entrainment and behavior is more clouded than suggested by the existing literature and that future studies should explore potentially intermediary neural correlates.

MISCOMMUNICATION AS A PREDICTOR OF EMOTION, EXPRESSIVE SUPPRESSION, AND RELATIONSHIP SATISFACTION IN DATING COUPLES

Isabelle Davis

Mentor: Tammy English

Relating to others effectively and positively is a crucial part of life, and a large part of this relation rests on effective communication. When communication in a relationship is poor, undesirable consequences tend to follow. The present study looks at dating couples, studying the association between miscommunication and observed emotion and expressive suppression while discussing conflict, in addition to self-reported relationship satisfaction. We hypothesized that poorer communication would be associated with more negative affect, less positive affect, more instances of expressive suppression, and lower relationship satisfaction. In addition, we predicted that lower relationship satisfaction would be associated with more instances of expressive suppression. Participants each filled out surveys indicating their overall relationship satisfaction, and conflict levels in 13 different categories within their relationship (e.g., money, religion, sex, careers), and were then assigned to discuss a conflict area both partners had rated highly for 10 minutes. This conversation was filmed and afterwards participants watched the film and made note of each time they regulated their emotions. Twenty different emotions were later coded for in each partner using the Specific Affect Coding System. We partially confirmed our hypotheses in finding that poorer communication predicted more negative affect, more expressive suppression, and less relationship satisfaction, but it did not predict less positive affect. In addition, we confirmed our hypothesis in finding that lower relationship satisfaction predicted greater instances of expressive suppression. These findings imply that couples who are experiencing distress in their relationship may have problems rooted in miscommunication, suggesting that improving communication could help resolve this distress. A future study may benefit from using a different technique for observing couples' conflict discussions, in order to broaden the implications of this research to include day-to-day interactions outside of a laboratory setting.

WHY DO PEOPLE USE UNREASONABLE ARGUMENTS? THE CASE OF THE AD HOMINEM

Lily Grier

Mentor: Pascal Boyer

This article examines discrepancies between reasoned logic and everyday argumentation. Specifically, it investigates the perceived and actual efficacy of the ad hominem argument, wherein an individual's character is attacked rather than the arguments that individual makes. Despite research suggesting that even children without any background in formal argumentation are able to recognize the ad hominem argument as unreasonable, people continue to fling ad hominem attacks about in politics, courtrooms, and everyday argumentation. The studies at hand employ a belief-change format to investigate the conditions under which people expect ad hominem arguments to effect change in others' beliefs as well as the conditions under which ad hominem arguments effect change in people's own beliefs. Study 1 looked at subjects' ratings of a hypothetical audience's degree of agreement with speakers on Brexit or net neutrality before and after exposure to ad hominem attacks against the speakers. Findings suggest that people expect ad hominem arguments to effect significant change in others' attitudes. Study 2 looked at subjects' own ratings of agreement with speakers on Brexit and net neutrality before and after exposure to ad hominem arguments. Findings suggest that ad hominem arguments can change people's attitudes, but with limited efficacy. Results from Study 3, which looked at changes in first-person agreement with speakers on Brexit and abortion, suggest that ad hominem arguments effect change in people's attitudes on Brexit, but not on abortion. Findings from Study 4, which looked at perceived changes in a hypothetical audience's attitudes on Brexit and abortion, suggest people expect ad hominem arguments to change others' attitudes across discussion topics. This article therefore argues that while people expect the ad hominem argument to change people's attitudes more than it does, the ad hominem argument can effect small but significant change in people's attitudes about issues less provocative than abortion.

NEONATAL CEREBELLAR VOLUMES AND CEREBELLAR COGNITIVE AFFECTIVE SYNDROME IN VERY PRETERM CHILDREN AT AGE FIVE YEARS

Apoorva Iyengar

Mentor: Cynthia Rogers

Researchers have associated the impact of damage to the cerebellum with cerebellar lesions and lack of cerebellum growth. Studies focusing on adults and older children have identified a symptom cluster known as Cerebellar Cognitive Affective Syndrome (CCAS) to describe the language, executive function, affect and spatial cognition commonly seen with those with cerebellar damage. Although Very Preterm (VPT) children experience higher rates of cognitive and behavioral deficits, few studies have explored the connection between CCAS and prematurity (VPT, < 32 weeks gestational age). The current study aims to identify whether VPT children experience greater rates of CCAS than their Full Term counterparts at age five years. Additionally, this study examines the extent to which total cerebellar volume and the contributions of the left and right cerebellar volumes contribute to the CCAS deficits in VPT children.

VPT children underwent neonatal MRI scanning at term-equivalent age and cerebellar volumes were calculated using the Morphologically Adaptive Neonatal Tissue Segmentation. Both Full Term and VPT children underwent CELF-P2 and WPPSI-III Performance scales to evaluate language skills and spatial cognition respectively at age five years. Parents completed the SRS-2 and BRIEF-P scales to provide information on affect and executive function. A principal component analysis was completed to assign each subject a CCAS composite score.

While VPT children had significantly poorer scores on the individual components, there was not a significant difference in CCAS composite scores between VPT and Full term children at age five ($p = .08$). We found that the CCAS composite scores were significantly related to the total cerebellar volume data ($p = .04$). Total cerebellar volume and SRS-II score for Restricted and Repetitive Behaviors was significantly related ($p = .03$). The study suggests that the development of CCAS symptoms at age five years, specifically those of Autistic behaviors, is related to preterm cerebellar volumes.

PREDICTIVE VALIDITY OF THE BRIEF FEAR OF NEGATIVE EVALUATION SUBSCALES

Gavin Rackoff

Mentor: Tom Rodebaugh

The Brief Fear of Negative Evaluation Scale (BFNE) is widely used in social anxiety research. Previous studies have demonstrated that the BFNE consists of two factors; the BFNE straightforward subscale (BFNE-S) and the BFNE reverse-scored subscale (BFNE-R). The BFNE-S has proven more internally consistent and predictive of trait, but not state, social anxiety. This study compared the BFNE subscales' ability to predict trait and state social anxiety in two samples using multiple outcome measures. Whereas the BFNE-S significantly predicted all outcome measures, the BFNE-R predicted none. The BFNE-S was significantly more predictive of trait social anxiety in both samples and more predictive of state social anxiety in one sample. A post-hoc test supported path invariance across the two samples, suggesting that the state anxiety comparison lacked significance in one sample due to insensitive measurement. Findings support the validity of the BFNE-S and demonstrate that the reverse scored items add negligible utility.

PRESCHOOL MAJOR DEPRESSIVE DISORDER: GENDER DIFFERENCES AND THE ROLE OF SELF-REGULATION IN COMORBID SYMPTOM PROFILES

Mindy Rosengarten

Mentor: Diana Whalen

This study compared comorbid externalizing and internalizing symptoms and disorders in a sample of subjects diagnosed with Preschool Major Depressive Disorder (PMDD). Although there were no gender differences in comorbid symptoms or comorbid internalizing disorders, males showed more comorbid Oppositional Defiant Disorder and Attention Deficit Hyperactivity Disorder, as well as more comorbid externalizing disorders overall. The study then assessed whether or not deficits in Self-Regulation (impulsivity, executive functioning, and effortful control) predicted future externalizing and internalizing disorders in children with PMDD. Deficits in Activation Control predicted internalizing disorders at school-age while deficits in Executive Control, Activation Control, and Effortful Control predicted externalizing disorders at school-age. Finally, the study assessed whether these components of self-regulations moderated the relationship between PMDD and comorbid externalizing or internalizing symptoms at school-age. Subjects with PMDD and deficits in Executive Control and Effortful Control experienced more externalizing symptoms at school-age. Executive Control was also found to be a moderator of the relationship between ADHD at preschool-age and increased ADHD symptoms at school-age.

CYBER SCREENING: THE EFFECTS OF SELF-ESTEEM AND SOCIAL COMPARISONS ON SOCIAL OUTCOMES

Danielle Scharf

Mentors: Tammy English and Isidro Landa

This work investigates the association between self-esteem, social comparisons, and relationship outcomes in the context of cyber screening—researching another person’s social media page before meeting them in real life in a benevolent manner. With the increase in social media usage, people are now able to browse other people’s profiles without knowing anything about them before meeting. It is not understood how self-esteem, social comparisons, and social evaluations relate to this concept of cyberscreening, which is what is observed in the study. The participants were 125 Washington University undergraduate students who took a survey on Qualtrics that included a cyber screening profile phase where subjects looked at a fake profile in addition to measures of self-esteem, social comparisons, likability, and closeness. Although self-esteem was not found to be related to any of the outcome variables, social comparisons had many significant relationships with closeness and likability of the profile. People who make upward social comparisons on Facebook liked the target in the profile more ($\beta = .03, p = .025$) and felt closer to them ($\beta = .25, p = .008$). People who tend to make downward social comparisons on Facebook, only liked the target more ($\beta = .03, p = .026$); they did not feel closer to them. These findings show that the act of making social comparisons on Facebook might be related to the perceived social relationship between target figures that the person might be looking at and making comparisons about.

WORKING OUT YOUR EMOTIONS: THE EFFECT OF PHYSICAL ACTIVITY ON POSITIVE EMOTION REGULATION

Debbie Shear

Mentor: Tammy English

Physical activity has been shown to promote psychological benefits, including both lowering negative affect (NA) and increasing positive affect (PA). While much research has been done to understand the relationship between physical activity and NA, there is little known about how the mechanisms of physical activity work to influence PA. Given that PA is essential for beneficial life outcomes and has important clinical applications, further work is necessary to explore the relationship between PA and physical activity to promote healthy behaviors. The current study aimed to assess whether physical activity increases PA through the improvement of pro-hedonic positive emotion regulation (PER), i.e., more upregulation and less downregulation of PA. Thus, the study focused on emotion regulation goals, or regulatory direction, to determine whether physical activity may motivate individuals to more frequently regulate in a way pro-hedonic direction, thereby increasing PA. Participants were randomly assigned to engage in low intensity activity (stretching; control) or high intensity activity (gym class; treatment), and completed a day reconstruction survey measuring affect and emotion regulation at each episode of that day. Activity level differences were used to predict differences in use of PER as well as overall positive affect levels. While overall upregulation of positive emotion was significantly correlated with greater levels of PA as expected ($r = 0.33, p < 0.01$), there were no significant group differences regarding the frequency of upregulation of PA ($t(76) = 0.86, p = 0.39$) between treatment and control conditions. Participants also exhibited no differences in overall levels of PA due to physical activity level, inconsistent with previous evidence ($t(86) = -0.58, p = 0.56$). Results suggest inconclusive evidence that positive emotion regulation may be influenced by physical activity. However, future research implementing controlled activity conditions and more nuanced assessment of positive emotion regulation is warranted.

POETS AND THEIR PRINCESSES: ENCOMIASTIC POETRY OF THE SIXTEENTH CENTURY

Ally Dworetzky

Mentor: Colette H. Winn

For court poets of the sixteenth century, encomiastic (eulogistic) poetry provided a means of subsistence and of setting oneself apart from the competition. By examining some of the encomiastic poetry from this era, this thesis explores the role played by several powerful women as patrons of the arts. Through a study of the ways in which female patrons were represented and described in Renaissance poetry, this two-part thesis examines the relationships between the two most celebrated poets of the time and the royal women who supported them. In the first chapter, I explore the relationship between Pierre de Ronsard and Catherine de Medici, regent of France amidst a series of tumultuous civil wars. The second chapter concerns the relationship between Joachim du Bellay and princess Marguerite de France, protectress of poetry and humanist values. In their poetry, Ronsard and Du Bellay highlight the role of women in society and attribute a particular importance to the “feminine space” — the literary and cultural circles to which these women belonged. The images inspired by the relationships between poet and princess give us the impression that these poets were truly “nourished” by their relationships with their female patrons: Du Bellay as a child nourished by his mother, and Ronsard as an ambitious writer taking advantage of France’s unstable political state. They portray the female patron and female power in a favorable light, and even go so far as to praise the idea of a “gynecocracy.” Over four centuries later, their poetry remains in the collective literary memory, due largely to these two female patrons who have given it the gift of immortality.

LES POÈTES ET LEURS PRINCESSES: LA POÉSIE ENCOMIASTIQUE DU XVI^E SIÈCLE

Ally Dworetsky

Mentor: Colette H. Winn

La poésie encomiastique (élogieuse) était pour les poètes de cour du XVI^e siècle un moyen de subsistance et une manière de se distinguer des autres poètes en quête de mécénat. En examinant quelques exemples de la poésie encomiastique de cette époque, cette étude explore le rôle joué par la princesse en tant que mécène des arts. Examinant les manières dont les femmes mécènes sont représentées dans la poésie de la Renaissance, cette thèse en deux parties examine les relations entre les deux poètes les plus éminents de l'époque et les princesses qui les soutiennent. Dans un premier chapitre, j'explore les rapports entre Pierre de Ronsard et Catherine de Médicis, régente de France pendant des guerres civiles très tumultueuses. Le deuxième chapitre aborde la relation entre Joachim du Bellay et Marguerite de France, protectrice de la poésie et des valeurs humanistes. Dans leur poésie, Ronsard et Du Bellay ont valorisé les rôles des femmes dans la société et ils ont donné une certaine importance à « l'espace féminin » — c'est-à-dire aux cercles littéraires et culturels auxquels ces femmes appartenaient. Les rapports entre les poètes et leurs princesses inspirent des images qui nous donnent l'impression que ces poètes se sont véritablement nourris de leurs rapports à ces femmes : l'enfant nourri par sa mère chez Du Bellay, l'écrivain ambitieux qui profite de la situation politique tumultueuse en France chez Ronsard. Ils font de la femme mécène un portrait très favorable au point de louer le pouvoir féminin et en quelque sorte la « gynécocratie ». Plus de quatre siècles plus tard, leur poésie demeure dans la mémoire collective littéraire grâce à ces deux femmes mécènes qui l'ont hissée au rang de l'immortalité.

A REASONABLE FAITH? THE RELATIONSHIPS BETWEEN FAITH AND REASON IN THE MEDICAL WORLD OF THE SIXTEENTH CENTURY

James McMullen

Mentor: Colette H. Winn

Ordinarily, we recognize the Renaissance as a revolutionary break in Western society—the irreparable division between modernity and the intellectual stagnation of the Dark Ages. The dogmas of religion are often critiqued, if not denounced, for stifling this progress for centuries; humanism, and its doctrine of scientific rationalism, is credited in turn for breaking through the philosophical oppression of that era. But are such clean characterizations just? Does logical reason inherently subvert the concept of faith? Certainly humanism demands a committed faith in humanity, but does that belief preclude faith in God? In recent years, there has been a tendency within Western society to diametrically oppose the institutions of science and faith. But where does this dichotomy originate? Did the writers of the 16th century indeed approach this conclusion of incompatibility between faith and reason, or is such an attribution anachronistic to their beliefs? This thesis, written under the guidance of Colette H. Winn, thus examines these questions, many of which still touch our modern society. Using period medical texts as a point of departure—medicine being the logical intersection between applied science and faith (be that faith in God or in humanity as the case may be)—this work analyzes the manner with which three authors synonymous with the French Renaissance address these questions. In the first chapter, the relations between the grotesque and the ‘true tales’ of François Rabelais are considered. In the second chapter, the religious imagery is analyzed in the didactic poetry of the physician, Jerome Fracastor. In the final chapter the rational skepticism of Michel de Montaigne is discussed in regards to its implications for religious belief. This thesis thus suggests that faith and science represent different fashions of considering the same existential questions: approaches that need not be mutually exclusive.

UNE FOI RAISONNABLE ? LES RAPPORTS ENTRE LA FOI ET LA RAISON DANS LE MONDE MÉDICAL DU XVI^E SIÈCLE

James McMullen

Mentor: Colette H. Winn

D'ordinaire, on considère la Renaissance comme une période « révolutionnaire » dans le monde occidental—qui marque l'écart irréparable entre l'époque moderne et l'immobilité intellectuelle du Moyen Âge. Les dogmes religieux sont souvent critiqués, condamnés même, pour étouffer ce progrès à travers les siècles ; l'humanisme et sa doctrine de rationalisme scientifique sont généralement reconnus pour avoir percé l'oppression philosophique de cette époque-là. Pourtant, de telles caractérisations sont-elles tout à fait justes ? La raison logique subvertit-elle par nature le concept de la foi ? Certes, l'humanisme prône la foi dévouée à l'humanité, mais cette croyance empêche-t-elle la foi en Dieu ? Ces dernières années ont vu apparaître une tendance dans la société occidentale qui consiste à opposer diamétralement les institutions de la science et de la foi. Mais d'où cette dichotomie tire-t-elle ses origines ? Les écrivains du XVI^e siècle nous conduisent-ils vers la conclusion que foi et raison sont forcément incompatibles ou une telle lecture est-elle anachronique ? Cette thèse, écrite sous la direction du Professeur Colette H. Winn, examine des questions qui, on le voit, touchent encore notre société. En étudiant les textes médicaux comme point de départ—la médecine se trouve à l'intersection logique entre la science appliquée et la foi (soit la foi en Dieu soit la foi en l'humanité selon le cas)—cette œuvre analyse la manière par laquelle trois auteurs associés à la Renaissance française abordent ces questions. Dans le premier chapitre, les rapports entre le grotesque et les « récits véritables » de François Rabelais sont pris en considération. Dans le deuxième chapitre, l'imagerie religieuse dans la poésie didactique du médecin, Jérôme Fracastor, fait l'objet de mon analyse. Dans le dernier chapitre, le scepticisme rationnel de Michel de Montaigne est discuté ainsi que ses implications sur les croyances religieuses. En somme, cette thèse suggère que la foi et la science correspondent à des façons différentes de considérer les mêmes questions existentielles : ce sont en fait des approches qui ne s'excluent pas forcément.

WOMEN IN THE ENLIGHTENMENT:
POLITICAL, PHILOSOPHICAL AND LITERARY
DISCOURSE ON THE FEMALE CONDITION
IN REVOLUTIONARY FRANCE

Christie Wan

Mentor: Tili Boon Cuillé

The French Enlightenment is marked by a paradox of sorts: on one hand, the movement made significant progress in the realm of human rights, and has had a lasting impact that is felt even today, most notably through the publication of the *Declaration of the Rights of Man and Citizen*. Yet, on the other hand, women's rights and freedoms remained limited during this period, even after the Revolution, in jarring contrast to the Enlightenment ideals of progress and equality. This discrepancy inspired passionate debate over the role of women in the polity and in society at large, and many proto-feminist arguments that emerged from these debates paved the way for contemporary feminist movements. Drawing on political philosophy, sociocultural theory, and literary analysis, this cross-disciplinary project examines, in three parts, the origins, contents, and impacts of these debates surrounding women's rights in Revolutionary France. The first chapter explores the socio-political changes that led the public to consider the status of oppressed groups, including women. The second chapter follows the debates incited by these changes concerning the rightful place of women in society. In particular, the chapter analyses how defenders of women's rights responded to the rhetoric of natural law and the rights of man to make their arguments for expanding women's rights. Finally, the third chapter studies the literary exploration of these ideas in the works of Germaine de Staël, particularly her novel *Delphine*, in order to present her progressive vision for women in society.

LES FEMMES FACE AUX LUMIÈRES :
LES DISCOURS POLITIQUES, PHILOSOPHIQUES
ET LITTÉRAIRES DE LA CONDITION FÉMININE
À L'ÉPOQUE RÉVOLUTIONNAIRE

Christie Wan

Mentor: Tili Boon Cuillé

Les Lumières françaises sont marquées par un certain paradoxe : d'un côté, le mouvement a accompli des progrès significatifs dans le domaine des droits humains, et a eu des effets durables qui se manifestent actuellement, notamment par la publication de la *Déclaration des droits de l'homme et du citoyen*. Cependant, d'un autre côté, les droits et les libertés des femmes demeuraient limités pendant cette période, même après la Révolution, contrastant vivement aux idéaux du progrès et de l'égalité des Lumières. Cet écart a inspiré des débats passionnés sur le rôle des femmes dans le système politique et dans la société, et beaucoup d'arguments féministes avant la lettre qui ont émergé de ces débats ont frayé le chemin aux mouvements féministes contemporains. Se fondant sur la philosophie politique, la théorie socioculturelle et l'analyse littéraire, ce projet pluridisciplinaire examine, en trois parties, les origines, le contenu et les conséquences des débats sur les droits des femmes en France pendant l'époque Révolutionnaire. Le premier chapitre examine les changements socio-politiques qui amènent le public à réfléchir aux statuts des groupes sociaux opprimés, y compris les femmes. Le deuxième chapitre interroge les arguments qui découlent de ces changements au sujet de la position des femmes dans la société et la question de leurs droits. On analyse, en particulier, la manière dont les défenseurs des droits des femmes répondent à la philosophie du droit naturel et s'approprient la rhétorique des droits de l'homme pour faire leurs arguments. Enfin, le troisième chapitre étudie l'expression littéraire de ces idées dans le roman *Delphine* de Germaine de Staël.

COALITIONS, STUDENTS, AND AFFORDABLE HOUSING IN A COLLEGE TOWN

Kate Thorne

Mentor: John N. Robinson III

How does the relationship between the university, the city, and key players in a mid-size Midwestern college town influence the experience of housing for residents in the area, especially low-income residents and students? The goal of my project is to establish a case study of such a college town. By examining the unique issues of one particular city, such as the influence of the university, the relationship with students, and its distribution of resources, I hope to shed light on issues of affordable housing in college towns as a whole. I conducted 15 in-depth interviews as well as collecting online resources and special collections data concerning housing. I discovered that the University in this town acts as an information silo when it comes to affordable housing, as it contains many groups and individuals working on affordable housing issues but also other groups that create pressure for the housing market. For instance, University students prioritize housing that is close to campus and view the private market as a realm of greater freedom even as they view the city as a “landlord’s town” that takes advantage of students and deploy various strategies for dealing with high rent. Community members are disadvantaged in this scenario since community resources are clustered downtown and monopolized by the University and its students. As a result, low-income community members are pushed to the edge of town with a limited transportation infrastructure to bring them back in. Although producers, landlords, the city, and the University interact in ways that render housing unaffordable, they can also work together to create change, and change is beginning to take place. For the time being, community members, especially those with low incomes, are disadvantaged in this political landscape.

URBANITY AND ART: NEIGHBORHOOD CHANGE AND THE EVOLUTION OF HIP-HOP IN BEDFORD STUYVESANT

Robert Curran

Mentor: Carol Camp Yeakey

Bedford-Stuyvesant, colloquially known as Bed-Stuy, is the heartbeat of the African-American existence and identity in Brooklyn, New York. Acting as the primary residence of Black Brooklynites for more than 60 years, Bed-Stuy, or “Brooklyn’s little Harlem,” occupies an important place in the annals of American urban history. Formerly a wealthy, white neighborhood, Bed-Stuy became arguably the largest ghetto in the United States by the mid-twentieth century. Forming this transformation were various individuals, policies, and systems. Bed-Stuy’s particular transformation is noteworthy for it illuminates the inequalities, navigation tactics, and hegemonies within both a unique neighborhood and the City of New York as a whole. Moreover, the neighborhood’s economics, politics, migratory patterns, and infrastructural changes have acted as sources of water and sunlight for the blooms of local cultural and artistic responses. Among the many cultural outgrowths of the ghetto, perhaps none are more important than hip-hop, which will serve as a helpful lens in better understanding Bed-Stuy, its residents, and its historic and recent evolutions. In many ways, hip-hop is not just a reaction to life in the ghetto, but it is also the life of the ghetto; broken and battered, but beautiful and buoyant.

THE ATLANTA BELTLINE: HOW DE FACTO SEGREGATION LIMITS ITS SUCCESS

Sarah Dyott

Mentor: Carol Camp Yeakey

The city of Atlanta, Georgia, has struggled historically with segregation both racially and economically. Since its founding, Atlanta has experienced waves of gentrification, white flight, and racial violence that have created social barriers to success for individuals of particular races and socioeconomic backgrounds. In 1999, Ryan Gravel, a graduate student at Georgia Institute of Technology, wrote a thesis detailing how the city could utilize historic railroad lines that circled the city to increase connectivity of the outlying neighborhoods and provide new modes of transportation in the traffic-congested city. Parts of the thesis emphasized how the project could be carefully designed to benefit and not gentrify low income and minority communities. Now 18 years later, the Atlanta BeltLine project is underway. How has the city of Atlanta changed along with this new development project? Has the project thus far supported the low-income communities as intended? Are low-income and minority communities benefiting as much from the city's growth as affluent and white communities? This thesis seeks to research the goals of the Atlanta Beltline project with regard to low income communities and how those goals have been carried out in the planning and construction phases of the project. Additionally, this thesis looks into how low-income communities and the city of Atlanta have changed while this project is underway. Source data is derived from the City of Atlanta's public reports. Additional research data includes U.S. Census data to analyze how the city of Atlanta has changed physically and demographically since 2000.

CHILD FOOD INSECURITY AND ITS INFLUENCE
ON EDUCATIONAL ATTAINMENT:
THE DISCONNECT BETWEEN POLICY AND
REALITY IN OUR NATION'S CAPITAL

Delaney Earley

Mentor: Carol Camp Yeakey

The purpose of this thesis is to examine how access to food can act as a determinative influence on one's ability to succeed within a school environment. This research will examine Washington, D.C. as a geographic location that is conducive to food insecurity among youth, and assess how school performance may relate to high levels of childhood hunger and poverty within the region. The research questions guiding this project are as follows: What are the determinants of food insecurity among youth? What are the implications of hunger on childhood well-being? Does a relationship between food insecurity and academic performance exist? If so, why is this significant and how can policy more effectively meet the needs of food insecure children? This last question is particularly pertinent as discourse surrounding social welfare policies in the United States has historically emphasized the needs and well-being of children without providing adequate support to meet these needs. This project will draw on interdisciplinary research to examine the disconnect between political discourse, policy, and reality that exists with regard to child food insecurity and educational achievement in Washington, D.C., a disparity that may have broader implications for other geographic regions across the country.

GENDER EQUALITY OR GENDER OPPRESSION? UNDERSTANDING SWEDEN'S SEX WORK PARADOX

Maddie Krips

Mentor: Carol Camp Yeakey

Sex work is a well-studied topic that has been highly contested across time and space. Multiple social, political, and economic factors inform policies and cultural views toward sex work. In Sweden, the buyer of prostitution services is criminalized and prostitution is perceived culturally to be inherently v against women. Sweden presents an interesting case study of sex work because the impact of its policy is the opposite of its intent. The policy aims to eradicate gender violence yet ultimately perpetuates it. This study addresses the following research questions: (1) What historical and economic factors influence Sweden's sex work policies? (2) How do Sweden's policies related to gender equality relate to its legal stance on the purchase and sale of sexual services? This research presents three main factors that contribute to Sweden's aim to abolish sex work: Sweden's gender histories and welfare identity; anxieties following Sweden's economic crises of the 1980s and 1990s; and, changing migration trends and racism in Sweden. Policy recommendations are presented to encourage Sweden to objectively investigate the impact of its sex work policy and develop a harm reduction approach to legal reforms. This research study concludes that Sweden's current strategy to eliminate prostitution has been ineffective and stands in stark contrast to its historic commitment to gender equality.

HURRICANE HERALD: HOW NEW ORLEANS' HOUSING POLICIES BEFORE AND AFTER KATRINA CAN INFORM HARVEY RECOVERY EFFORTS

Monica J. Lim

Mentor: Carol Camp Yeakey

Natural disasters are often seen as the 'hand of God,' natural forces that no man can control. However, social and natural scientists assert that social factors create disasters. Racialized housing and social policies in New Orleans created a poor, black population vulnerable to the torrents produced by Hurricane Katrina. Following the disaster, demolition of viable public housing projects prevented the return of this population. Housing policies before and after disaster allow for disproportionate burdens on some populations more than others. In August 2017, Category 4 Hurricane Harvey made landfall in the United States, breaking a record 12-year-period of no major hurricanes making landfall in the country. The media did not harp on the racialized causes of disaster as it did during Katrina. However, does this mean that race did not and will not play a factor in Harvey? Housing policies in Houston reveal that this image of a diverse, less problematic city is false. This study is designed to address the following questions: Do differences in city demographics affect responses to disaster? How did city development policies create disaster? Was the burden of disaster proportionate among various populations? What effect did federal and local disaster relief policy changes have on governmental and community response? Finally, is the narrative of climate change relevant to the discussion? Research on city development strategies and displacement of people will inform action surrounding natural disasters, like hurricanes. This study will focus on the 12-year-period between Hurricane Katrina and Harvey and contextualize the disaster with city, state, and federal policies regarding disaster relief and housing.

PRIVATELY OWNED PUBLIC SPACES: ARE THEY TRULY PUBLIC SPACES?

Stella Marren

Mentor: Carol Camp Yeakey

Throughout the latter half of the twentieth century, major American cities experienced rapid population growth and a concurrent growth of commercial development in downtown business districts, leading to an increasing need for open public space. City governments turned toward the private sector to provide publicly accessible space as a part of new construction projects, introducing privately owned public spaces into the urban form. Today's cities face intertwined challenges resulting from the impacts of climate change and urban population growth. Designing cities that incorporate strong public space is one answer to these challenges. This thesis is an exploration of the history, development, and accessibility of privately owned public spaces in American cities, guided by two multi-faceted, multi-layered research questions. How can public space improve a city's functionality and success? Can it serve as a method to respond to effects of climate change and social and economic inequity? Second, has the privatization of public space led to an increase in barriers of access for people based on gender, race, ethnicity, and socioeconomic status? Has this, in turn, impacted the success of a city? New York City, San Francisco, and Los Angeles—major cities with diverse populations and high numbers of privately owned public spaces—offer examples of how well-designed public space has an unparalleled positive impact on the success of a city, but that the privatization of public space has led to a mass of inaccessible, unsuccessful public spaces. The results from this study serve the purpose of informing future planning, execution and analysis of inclusive urban spaces.

FROM HOP ALLEY TO PARKING LOT TO STRIP MALL: THE DECENTRALIZATION OF PHYSICAL SPACE AND COMMUNITY FOR CHINESE AMERICANS IN ST. LOUIS CITY

Eva Nip

Mentor: Carol Camp Yeakey

For almost a century from 1869 to 1966, Hop Alley in downtown St. Louis, Missouri, was a space for new Chinese immigrants to find a social community, job opportunities, and a haven from an unknown country. However, in 1966, the physical Chinatown was razed for Busch Stadium's parking lot. The Chinese community bounced around from location to location, eventually settling on Olive Boulevard. Even so, the centralized physical presence of Hop Alley was never replicated. As a result, the Chinese community has become a cultural community. The removal of the physical Chinatown and the eventual appearance of a New Chinatown on Olive Boulevard influenced as well as reflected how the Chinese American community in St. Louis shifted their social, cultural, and economic needs. This thesis will dive deeper into the change of the community's needs after displacement through examining the economics, institutions, and social networks, from Hop Alley to Busch Stadium parking to Olive Boulevard. Some questions to be considered include: why has the Chinese community become decentralized? How has the Chinese community network and ethnic identity changed due to displacement? What does the social and economic network look like without a centralized location? Are cultural expressions of identity prevalent when there is no centralized Chinatown or physical space? The influence of physical space on community experiences and how each change in response to the other reveals how the Chinese community in St. Louis was shaped and shifted from isolated and insular to independent, decentralized, and assimilated.

“OTHER KNOWERS,” OTHER GROWERS: GENDER-CONSCIOUS FARMING AND THE “ALTERNATIVE” AGRICULTURE MOVEMENT

Molly Brodsky

Mentor: Heather O’Leary

With the rise of women farmers and agripreneurs in the United States, the agricultural landscape is shifting; urban farms, organic farming, and the food co-op movement are all rapidly growing—and all led by women. While existing literature examines the concurrent trends of the increase in alternative agricultural and women farmers, this research explores what I call “gender-conscious farms,” agricultural communities that intentionally center their farming practices on gender.

Based on ethnographic fieldwork and interviews conducted in Northern California and Dehradun, India, this project examines the ways gender-conscious farms challenge current rhetoric and trends present in the alternative farming movement. Utilizing a crosscultural lens, this research identifies how gender-conscious farming challenges both current sustainable agricultural initiatives as well as contemporary feminist discourse by putting the two in conversation with one another.

Three common themes specific to gender-conscious farming manifest across both research sites: an ecofeminist ethic of care, a holistically diverse ecosystem, and an emphasis on bodily knowledge. By redefining a feminist “ethic of care,” gender-conscious farms recognize recipients of care, accounting for multiple players in an ecosystem. In turn, that ethic of care allows for building a “holistic ecosystem,” an ecosystem driven by paralleled social and environmental values, integrating diversity and sustainability across people, plants, and communities. Furthermore, in celebrating both feminism and farming, gender-conscious farms promote multiple ways of knowing, emphasizing the importance of learning with one’s hands outside the traditional Western classroom. This project also presents a tension that arises in performing cross-cultural ecofeminist research about food systems: what are the implications of labeling a movement, community, or even knowledge system “alternative?” By both challenging current “alternative” food discourse and providing innovative and nuanced ecofeminist-informed farming initiatives, gender-conscious farming presents a truly radical shift in the realm of sustainability.

CULTIVATING COMMUNITY: TOWARDS A BLACK WOMEN-CENTERED ALTERNATIVE FOOD POLITIC

Sally Rifkin

Mentor: Rebecca Wanzo

Black women are often on the frontline of the battle for food justice in their communities. This research examines the motivations, successes, and challenges of two food justice organizations in St. Louis City and County, both of which were started and are sustained by Black women. A central thread through this project is naturalization—how linking identity with inequality "naturalizes" social difference and limits the potential for radical reimaginings of equality and food justice. This research seeks to "denaturalize" the process of gentrification and the assumptions that food injustice can be solved on the individual level, that food work is women's work, that alternative food is for white people, and that parenting is apolitical. Operating with the understanding that lasting change originates within a community, not from outside, this project reveals how Black women have taken on leadership roles in food sovereignty projects in their own communities. It examines the organizing principles that guide these women, including maternalist politics, womencentered organizing, and the importance of free spaces. This research also discusses the potential for collaboration between people of different identities and between organizations while maintaining the vital importance of Black women. By revealing the historical roots of alternative food in Black communities, this research makes the case for a food justice movement built around survival strategies particular to Black communities. This project argues for a movement that centers the legacies of Black alternative foodways and Black women-centered community organizing as the building blocks for food justice and food sovereignty.

LET'S TALK ABOUT SEX, BABY: COMMUNICATION BETWEEN CASUAL SEXUAL PARTNERS IN THE COLLEGE HOOKUP CULTURE

Carly Wolfer

Mentor: Jami Ake

This project explores the emotional, physical, and sexual communication between casual sexual partners in the college hookup culture. Study 1 includes quantitative surveys (94 females, 73 males). Study 2 includes qualitative, semi-structured interviews (10 females, 10 males). I investigated 1) the extent to which hookup partners communicate about sexual health, pleasure, consent, and intimacy in a culture built upon casual and emotionless sex, 2) the relationship between sexual communication, health, and satisfaction, and 3) gender differences and power dynamics between and among these variables. I consider not only when partners communicate, but moreover when they do not communicate—when desires, needs, and voices are silenced or muted within the college sexual culture. Meaningful findings emerge in terms of the lack of communication surrounding sexual health, desires, and emotions, the discrepancies and gender patterns between learned and applied consent, and the influence of intersectional identity factors and social location on experiences of communication in the hookup culture. Additionally, the cultural pressure to comply to the implicit norms of the hookup culture—meaninglessness, lack of communication, and alcohol use—tend to paradoxically prevent positive outcomes of equitable pleasure, enthusiastic consent, and fulfilling, explorative sex upon which the culture was founded. This feminist, psychological, and sex-positive study informs sexual education, prevention, and intervention efforts to decrease interpersonal violence, enhance health and pleasure, and provide tools to facilitate safer communication on an interpersonal and socio-cultural level.

THE EMBODIED INTIMACY OF SURVIVAL:
PEER, PARTNER, AND CLIENT INTIMACIES OF
TRANSFEMININE SEX WORKERS OF COLOR
IN *TANGERINE* AND *AFUERA*

Emi Wyland

Mentor: Amber Musser

Using close readings of scenes from the films *Tangerine* (dir. Sean Baker) and *Afuera* (dir. Steven Liang), I analyze how transfeminine sex workers of color (TSWOC) negotiate and navigate intimate relationships with peers, romantic partnerships, and clients through a lens informed by queer of color critique, Black feminism, and Chicana feminism. Attending to the significance of touch between TSWOC, I argue that TSWOC peer intimacies in these films embody a form of deep alliance predicated on cooperative care labor and interpersonal accountability. Alternatively, verbal conflict with romantic partners illustrates how partnered intimacy relegates TSWOC to liminal space between co-dependent, yet oppositional determinations of colonial capitalist womanhood, and emerges as platform to negotiate TSWOC's relationship with capitalism and subject determination. Grounding these intimacies within the landscape of sex work, I engage my analyses of touch, labor, and subject determination thus far with the inherent uncertainty and power hierarchies in sexual labor. I argue that client intimacies serve as a conduit for physical and sexual violence against TSWOC, which queers Delany's theory of "contact." Ultimately, the imbrication of violent "contact" and analgesic "networking" within the sex trade produces ruptures in the bodily discourse of sex, which radically open ways differently raced, sexed, gendered, classed, and naturalized bodies can interact with one another and produce new meanings, mobilized to disparate ends of national discourse reification and queer world making.

(RE)LOCATING SOUTH ASIAN WOMEN IN APNA GHAR: EVOLVING CULTURAL NARRATIVES WITHIN DOMESTIC VIOLENCE INTERVENTION

Priyanka Zylstra

Mentor: Jami Ake

The stories and statistics of domestic violence worldwide are greatly alarming and a number of academic studies have found specifically high rates of domestic violence in the South Asian immigrant population in the United States. Situating these statistics within today's American political and neoliberal landscape led to my research on how service providers conceptualize domestic violence intervention in immigrant and South Asian communities. In the 1980s, numerous South Asian Women's Organizations formed throughout the United States to address domestic violence within the South Asian immigrant community, recognizing a need to center ethnicity in domestic violence intervention. I investigate how Apna Ghar, a non-profit agency that historically served the South Asian population in Chicago, understands and responds to the intersection of ethnicity, culture, and gender in its approach to intervention. Apna Ghar provides a crucial case study for assessing the current relevance of and need for culturally specific domestic violence organizations and a way to investigate the role of South Asian identity in domestic violence intervention today. Apna Ghar has expanded to specializing in immigrant women, leaving behind culturally regionally-specific model and embracing a deficit-based strategic intervention. I found the South Asian identity subsumed within a broader immigrant framework. The divisions to identify target clientele and what constitutes commonality have altered, focusing on identities as immigrant versus non-immigrant, invoking a citizenship-based binary to mark those at a distance from the conceptualized normative survivor. Examining how organizations, like Apna Ghar, understand their role in society and how they present themselves within today's political context in order to reach and expand a target population, receive funding from donors, and perpetuate or challenge patriarchal structures contributes to our understandings of NGOs in the neoliberal landscape and the contradictions and tensions that arise from the non-profit industrial complex.

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SO YOU THINK YOU CAN NEGOTIATE? A STUDY OF THE EFFECT OF PERSONALITY ON NEGOTIATIONS IN A JOB CONTEXT

Hana Davisson, Benjamin Kugelman, and Emma Turnbull

Mentor: William Bottom

The question we are exploring through this research is the link between personality traits and negotiation. More specifically, we are investigating whether one or more of the Big 5 Personality Traits affects willingness to negotiate and/or success in negotiation. This research question is especially relevant to recent college graduates who are interested in successfully negotiating for their first job benefits. We believe having a firmer understanding of the effect of certain personality traits on the outcome of negotiations will better inform and prepare graduates for life in the workforce, in addition to benefiting anyone who experiences various negotiation settings. The data was obtained using a personality exam and a simulated negotiation experience through a Qualtrics survey, and found our research participants through mTurk. This data was then numerically quantified in order to study correlations between various personality traits and negotiation outcomes. Based on results from the initial pilot study, the research showed that assertiveness is positively correlated with willingness to negotiate and achieving greater success in negotiations. Once the rest of the data has been collected, we anticipate seeing more positive correlation between certain personality traits and willingness to negotiate/success in negotiation as well as more personality traits that negatively correlate with willingness to negotiate/success in negotiation. This research question matters because it can show that success in negotiation does not just depend on learning negotiation skills, it also depends on knowing and recognizing different personality traits and how they play a part in the negotiation setting. Knowing one's personality type and how those types interact with others and with the world as a whole is important to better understand one's strengths and weaknesses as well as opportunities for growth.

FOLLOW THE MONEY — ANALYZING MONTGOMERY COUNTY CRIME STATISTICS BASED ON INCOME, RACE AND AGE AT THE CENSUS TRACT LEVEL

Weber Gaowen and Ji Hyun (Cindy) Hur

Mentor: Bernardo Santos Da Silveira

This work investigates differences in crime statistics based on income, race and age. We chose Montgomery County in Maryland because it is an economically and racially diverse area broken up into 210 census tracts. Using multi-linear regression, we show several notable results about the level of crimes committed based on the demographics of the population in the area. Our main empirical result indicates that there is a u-shaped relationship between average census tract income and crime severity, even when we control for other factors such as race and age. Both low- and high-income areas have disproportionately greater amount of crimes compared to areas with a large proportion of middle income population.

THE ECONOMIC IMPACT OF POLICY INCENTIVES IN ELIMINATING BAD HABITS: MANDATORY DRUG TESTING FOR TANF RECIPIENTS

Patrick Koenig and Ethan Schueler

Mentor: Tat Chan

Mandatory drug testing for TANF recipients has proved to be a contentious policy in state legislatures across the country for the past several years. TANF exists to provide “temporary financial assistance to low income families” and recipients are expected to gain employment and achieve self-sufficiency. Legislators arguing in support of mandatory drug testing laws contend that the implementation of such testing will provide an incentive to limit drug use, thereby creating conditions conducive for gaining employment. This study examines whether or not mandatory drug testing laws promote the purpose of TANF, that is, does mandatory drug testing of TANF recipients incentivize reduced drug use and increased employment?

Using two-stage least squares regressions, this research examines employment data from the Bureau of Labor Statistics and drug use data from SAMHSA to determine whether mandatory drug testing laws reduce drug use and unemployment. When analyzing state-wide employment data, the study indicates that mandatory drug testing did not have a significant impact on state unemployment or drug use, no matter the type of drug. However, when analyzing employment in low-income industries, the study found that marijuana use decreased due to mandatory drug testing. Despite the decrease in marijuana use, employment in low-income industries also decreased due to the presence of the law. These findings indicate that the law is effective in reducing marijuana use but may come at the cost of decreasing employment. For all other drugs, the law did not have an impact on drug use or employment for low-income industries. These results contribute to a body of research which lawmakers can use to assess the costs and benefits of mandatory drug testing as well as the effectiveness of policy incentives on decreasing drug use and increasing employment.

FEMALES IN CEO POSITIONS: THE IMPACT OF GENDER ON COMPANY PERFORMANCE AND MARKET VIEW

Kiran Kuttickat and Harry Varon

Mentor: Ohad Kadan

An already established body of literature examined the relationship between shareholder sentiment towards female CEOs and concluded that companies with female CEOs performed better than their male counterparts. Previous research has also been done to determine if negative expectations of a female CEO has led to the company's stock to outperforming expectations and providing excess returns for shareholders. While credible, previous research had weak statistical power and no certain conclusion was proposed regarding investors tendency to underestimate female CEOs leading them to have unrealized excess returns. To build off of past research, we are furthering these findings by analyzing the fiscal performance of S&P 1000 companies in regard to a new CEO announcement by using executive and stock price data from 1992 and 2017. To test this hypothesis, we examined newly announced male-to-male and male-to-female CEO changes to determine their effects on company's fundamental and market performance. By comparing market views to the company's actual performance this research examines possible market inefficiencies in pricing companies with female CEOs.

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ADENOVIRAL GENE PAINTING FOR USE IN CARDIOVASCULAR TISSUE ENGINEERING

Kailin E. Baechle

Mentor: Stacey Rentschler

In sick sinus syndrome, the heart's pacemaker does not function properly which often leads to implantation of a mechanical pacemaker to restore a normal heart rate. Current mechanical pacemakers have limited ability to change their rates based on physiological needs and do not accommodate growth, motivating the development of a biological pacemaker to address both of these issues. Recent studies in a porcine model have shown that Tbx18, a transcription factor normally expressed during development, induces a sinus nodal phenotype evidenced by increased heart rate and decreased dependence on a backup mechanical pacemaker. Studies from our laboratory have demonstrated that β -catenin, a component of the Wnt signaling pathway, induces certain nodal properties in mice. The goal of this work is to locally transduce mouse atrial cardiomyocytes with adenoviruses expressing transcription factors with the goal of reprogramming atrial cardiomyocytes into sinus nodal-like cells. Gene painting was used to apply a virus/polymer mixture to the left atrium of the mouse. Wild-type and immunocompromised NOD/SCID mice were painted with adenovirus expressing GFP and luciferase, and long-term expression of virally-delivered luciferase was monitored using bioluminescent imaging. The photon flux differed significantly between the NOD/SCID and wild-type mice at three days, with an even greater 893-fold difference at 23 days post-gene painting. This comparison suggests that the immune system is likely involved in clearance of viral particles or virally-transduced cells in wild-type mice. NOD/SCID hearts were evaluated for GFP expression and co-stained with α -actinin to identify localized expression in cardiomyocytes. The NOD/SCID hearts showed GFP expression in left atrial myocytes as expected, with additional regions of GFP expression observed in various regions of the left and right ventricles. Future experiments will utilize genetically-engineered adenoviruses with different backbones designed to specifically target the atria and improve local transduction.

CEFINDER: MACHINE LEARNING BASED PREDICTION OF NOVEL COMPETING ENDOGENOUS RNAs

Teng Gao

Mentors: Ha X. Dang and Christopher A. Maher

Despite the growing importance and biological relevance of long noncoding RNAs (lncRNAs) in disease biology, many challenges remain in dissecting their regulatory mechanisms. Competitive endogenous RNA (ceRNA) hypothesis attracted much attention as one of the major regulatory mechanisms of long non-coding RNAs in cancers. A ceRNA interaction triplet is characterized by the three-way interaction between a target mRNA and a long non-coding RNA (referred to as a ceRNA) that competes to bind with one or more microRNAs (miRNAs). Because currently available experimental methods to validate novel ceRNAs are expensive and low-throughput, various computational approaches have been developed to predict novel ceRNAs. However, the absence of a gold-standard dataset resulted in the lack of rigorous performance validation of the current in-silico prediction algorithms. Moreover, individual algorithm often performed poorly on new data. To address these problems, the present study aims to construct an experimentally validated ceRNA dataset, and develop an improved ceRNA prediction algorithm that learns from known ceRNA interactions and combines currently available prediction methods. Curation of public databases and recent literature yielded 65 experimentally validated ceRNA pairs from three major cancer types (BRCA, PRAD, LIHC). Utilizing public cancer expression datasets from TCGA, we trained a SVM model using the positive examples in the custom database, along with 65 randomly generated negative examples. We named the resulting classifier ceFinder. Five-fold cross-validation of ceFinder yielded a classification accuracy of 77%. To further corroborate our model using an alternative line of experimental evidence, we leveraged a ceRNA database based on High-throughput Sequencing of RNA Isolated by Crosslinking Immunoprecipitation (CLIP-Seq), StarBase. ceFinder separated CLIP-Seq validated positive pairs from StarBase and random negative examples. The receiver operating characteristic (ROC) curve reported an area-under-curve (AUC) score of 0.88. By selecting the optimal model that yields the maximal sum of sensitivity and specificity in the validation data, ceFinder achieved a sensitivity of 0.88 and a specificity of 0.90 in validation. In conclusion, we improved novel ceRNA prediction using supervised learning, and developed a pipeline that can aid the study of disease-relevant regulatory mechanisms in lncRNA biology.



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