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Foreword

Since 2009 the Office of Undergraduate Research has published 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 students have advanced beyond the scope of their coursework—exploring their topics to a degree usually expected of the graduate level—and earned the distinction of honors in their departments and schools. While these students receive their accolades individually, we would be remiss not to acknowledge the support of their mentors, whose careful guidance has inspired these students to contribute their own original conclusions to growing bodies of academic research.

As always, we owe a great deal of thanks to each academic department and school for encouraging their top students both to undertake their thesis projects and to submit their abstracts for publication. Without the help of departmental directors of undergraduate studies and honors programs, as well as departmental administrators, this publication would not be possible. We are also 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.

We are honored to present the work of the Class of 2013. Congratulations!

E. HOLLY TASKER
Editor

JOY ZALIS KIEFER
Director of Undergraduate Research
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In this paper, I explore literary and televisual representations of the vampire in Anglophone culture and how these stories radicalize notions of gender, race, and sexuality through physical and symbolic violence. By tracing the transmission and mutation of the vampire trope from Victorian literature to twentieth-century television, I demonstrate how these narratives represent violence by and against characters in marginal social positions.

Traditionally, literary attention to vampire stories has focused primarily on Dracula and on issues of gender and sexuality. Recent critics have turned to issues of race and class, but have yet to consider the interplay of these multiple categories. My goal in this project is to develop a holistic understanding of character tropes in order to reveal the nuances of privilege and oppression that are symbolically utilized and carefully dramatized in vampire tales. First, I examine and compare the primary victims and vampires in the nineteenth-century stories “The Vampyre,” “Carmilla,” and Dracula to reveal the continuity between and the changes in concerns for particular identity categories over the course of the century. Based on this close examination of character types and trends, I argue that the nineteenth-century vampire stories reveal particular cultural fears about the weakening power of western masculinity and the culture’s inability to guard feminine purity in the face of new identities resulting from modernity and imperialism, particularly aristocratic and queered ethnic outsiders. In the following section, I consider how the vampire trope is both reinforced and reinvented in the contemporary American television series, Buffy the Vampire Slayer. By closely examining the protagonist’s upheaval of the traditional female vampire victim and the overwhelming presentation of vampires as white men indistinguishable from the series’ suburban setting, I argue that Buffy opens the vampire trope to new questions about race, belonging, and passing.
Teaching the American Dream: Inequality, Aspirations, and Achievement of Urban Youth

Eve Herold

Mentors: Linda Lindsey, Heidi Kolk, and Rowhea Elmesky

This project synthesizes various educational theories in order to better understand how and why students of low-income, urban backgrounds present lowered educational aspirations. Using a case study of Philadelphia urban schools, I use theory to unpack the various challenges and obstacles a child in the urban setting faces. Focusing on the implications for the individual, I argue that our societal emphasis on the American Dream has permeated our public education system. This is evidenced through constructs such as the achievement ideology, which assigns culpability to the individual only and never to the system, and social, cultural, and economic forms of capital. I explain how these structural constructs collide with the neighborhood experience of the child, in which they are exposed to and internalize the reality of social immobility. I argue that this paradox, the promises of the American Dream and the realities of the immobilized neighborhood, results in lowered educational aspirations of the child.

I address key educational thinkers such as Pierre Bourdieu, Jay MacLeod, Otis Johnson, Robert J. Sampson, Pedro Noguera, and Horace Mann, among others. My theoretical synthesis is enhanced with grounding in the individual, showing how each aspect of theory connects to the individual students in the Philadelphia public school system. I look specifically at Breakthrough Collaborative—a program I argue is intervention-based, seeking to prevent students from following an anticipated downward trajectory. Breakthrough, therefore, is proof both of the failure of our public school system and the overwhelming potential of students when given an environment in which to excel. Moreover, I argue that while educational theory addresses the various shortcomings of our education system, it need focus more on individual repercussions. Thus, through synthesis of theory and application to the case study, I assert that problems in education are greater than any single shortcoming, and that our larger societal values have not adjusted to the more unfortunate social and economic realities.
Negotiating the Search for a Life Partner in Urban China: An Analysis of Youth Strategies in the Dating Game through the Lens of the One Child Policy

Sophie Amelia Bracken

Mentor: Priscilla Song

This thesis presents the enormous cultural impact on spousal selection created by state birth planning policy in urban China. I interpret the much-debated dating craze through the lens of the One Child Policy, which I argue has reformed normative marriage as a potential economic investment, and has contributed to the reinterpretation of the filial duties of a single child in urban China. Aspirations of global citizenship, modernism, and consumerism in combination with the economic anxieties of the dating crisis have created China’s current generation of young men and women in their 20s. I argue that the rampant materialism seen toward dating and marriage stems not from simple economic greed and gluttony, but from filial anxiety stemming from their position as the sole supporter of their family. Utilizing media studies as a framework for viewing social phenomena, I show how representations of various media sources, such as the upsurge in popularity of dating reality shows, is a reflection of widespread social concern and an organic expression of anxiety in regards to dating and marriage. Further analysis will stem from an in-depth look at newly created social institutions, such as dating agencies, dating expositions and rent-a-partner schemes. Supported by data accumulated through online surveys and ethnographic detail gathered from in-person interviews, this thesis aims to shed light on the anxiety of spouse-selection in urban China and its social and personal ramifications and roots.
African-American distrust of healthcare is often cited in studies as a possible source of health disparities. However, there has been no in-depth research of this issue. Distrust is an incredibly powerful deterrent to seeking healthcare. Utilizing ethnographic fieldwork—interviews with African-Americans and personal experiences as a community health worker in St. Louis over two years—I was able to begin exploring the complexities of distrust. Distrust of medical practitioners and hospitals in the African-American community is shaped by personal experiences and understanding of the history of one’s family and community. Specifically, the fieldwork points to sources of distrust as lack of insurance and thus feeling you are not entitled to good healthcare, life-saving medical interventions, urban legends, belief in Western biomedicine versus in alternative medicines, amount of contact with physicians and hospitals, the era in which you grew up and how prevalent outright discrimination was, one’s understanding of the family’s past experience with healthcare, personal current experiences of racism, and whether or not the individual felt the doctor understood him or her. Urban legends have long been the weapons of the marginalized as a way to conceptualize the world as they experience it. There were three urban legends in St. Louis that were particularly interesting symptoms of this distrust of healthcare. They were the ideas that the government had a contract with hospitals to kill off the black elderly, that black cancer patients had unnecessary surgery done to them, and that the St. Louis County sent their expired food to the city to be sold. Possible ways to address distrust must focus on how physicians can make patients feel valued and respected as individuals. Part of this method should be to teach physicians how to create culturally safe environments.
“And Yet We Grew Beautiful Crops”: Perspectives on the Food Systems and Agricultural Production of Shenandoah National Park Refugees

Susan DiMauro

Mentor: Glenn Stone

Contemporary American small farms are often discussed as paradigmatic of the way forward in encouraging grassroots food system reform. Yet during the early twentieth century, social scientists and government agencies characterized small farms—and the individuals and households who cultivated them—in Virginia’s Blue Ridge Mountains as socially backward, productively marginal, and morally deficient. In the 1920s and 1930s, these homogenized conceptions were used to justify the state-mandated dispossession, resettlement, and in some cases, institutionalization and forced sterilization of approximately five hundred Blue Ridge households, facilitating the creation of Shenandoah National Park.

In this work, I characterize Shenandoah National Park refugees as small farmers and agricultural producers. Using data sources including social science reports, government archives, popular literature, and oral history interviews, I explore and reconstruct the manners in which Blue Ridge households forcibly displaced from Shenandoah National Park functioned on an agricultural basis and have been characterized, constructed, and narrativized in the American collective memory throughout time. By examining the broader social, economic, environmental, and political contexts into which these households fall, I problematize the ideologies of backwardness associated with Blue Ridge farmers, and, more broadly, extensive agricultural practices and Appalachian mountain residents. In reanalyzing foundational literature and investigating the narratives and recollections discursively provided by New Deal-era Civilian Conservation Corps members and Park expellees themselves, this agricultural analysis demonstrates that Shenandoah National Park refugees were engaged in a wide variety of agricultural and social processes, tailoring agricultural production to the needs of their communities and local markets while inventively working within the limitations of local agroecosystems.
The chronic disease burden stemming from overweight and obesity is a serious issue that most countries in the world are now being forced to address. Chronic diseases now pose as one of the largest health problems, and this strain is expected to increase tremendously within the next few years. Brazil, one of the many countries whose governments have claimed responsibility over the health of its citizens, has already implemented several state-funded interventions to direct efforts against the upward trend of populational weight gain. The installment of open-air gyms in public spaces, formally known as Academias das Praças, has been a favorable option for many coastal municipalities. This study sought to explore the perceived accessibility of the Academias das Praças according to users in Salvador, Bahia, Brazil.
Concussion is an intriguing medical phenomenon in that it is widely known and experienced but poorly understood. Concussion may fail to be recognized as a legitimate medical ailment by the general public because there is no physical evidence for concussion, the patient’s complaints can be brushed off as being “all in their head,” and the consequences of head injuries are seriously underestimated. This study analyzes two major types of sources: medical research papers for biomedical information and recent cultural trends, and anthropological studies for constructs to begin analyzing concussions. Personal interviews were also conducted to investigate the impressions of concussion between doctors and patients.

This study indicates that concussion is a complicated, multifaceted issue with cultural concepts centered on the doctor-patient relationship and on special populations such as athletes. Culture guides the patient’s vulnerability to concussion, willingness to report their injuries, compliance with the doctor’s diagnosis and treatment plan, and integration back into healthy society. More than one million people have a concussion annually. It is difficult to diagnose and results in different symptoms of varying intensity for every patient. Furthermore, although most patients spontaneously recover, a small minority will persistently suffer post-injury symptoms, and some may even die from complications. Culture impacts every aspect of the patient’s experience with concussion. Further anthropological research would have the potential to improve the patient-doctor relationship, as well as to facilitate dialogue about a long-standing and frequent health issue.
Bachelor Gorillas of the Saint Louis Zoo: Behaviors, Patterns of Proximity, and Space Use before and after the Addition of Two Young Males to a Preexisting Silverback Group

Simone Godwin

Mentor: Crickette Sanz

The captive management of western lowland gorillas (Gorilla gorilla gorilla) has relied heavily on the formation and maintenance of breeding groups. These captive breeding groups mimic the structure of that in the wild and generally consist of one-male, multiple sexually mature females, and their offspring. Because of the 1:1 birth ratio of males to females in captivity, this focus on breeding groups creates a surplus of young males who have no imminent breeding opportunities. Rather than house males solitarily, many zoos have opted instead for creating bachelor groups. This study focused on the bachelor group of captive western lowland gorillas of the Saint Louis Zoo and analyzed social interactions, space use, and proximity before and after the introduction of a blackback and a subadult to the established group. Over 280 hours of data were collected from March 2010 to August 2012. Social behaviors were classified as displacement, non-contact aggression, contact-aggression, or affiliative; the occurrences of these behaviors were used to evaluate the social relationships on both the group and the dyadic level. Dominance relationships were highly influenced by age. Significant changes in affiliative and aggressive behaviors were observed for the group as a whole as well as for most individuals, and rates of initiation of these behaviors were also highly linked to age. The silverback males showed stronger preferences for certain regions of the outdoor enclosure than did the blackback or subadult. Silverbacks were in close proximity to each other least often, whereas the younger males were more frequently in close proximity to one another as well as to older individuals. These results help to show the varied social relationships within captive bachelor groups and shed light the efficacy of introducing two young males to a multi-silverback group as a captive management strategy.
The concept of risk is pervasive in contemporary discussions of childbirth—both amongst professionals and consumers. While risk is often presented as an objective entity within such rhetoric, in reality it is an elusive concept to define, particularly within the context of maternity care. Since the nineteenth century, obstetricians and midwives have conceptualized the risks of birth differently. This thesis examines how two disparate groups of maternity care providers in Missouri, obstetricians (OBs) and certified professional midwives (CPMs), perceive risk in childbirth. By combining archival research techniques with conducting original qualitative research, I hope to demonstrate that risk in maternity care is far from a static concept. Rather, analyzing risk perception requires looking beyond individual knowledge systems to examine who it is that holds authoritative knowledge and how that knowledge drives the defining of risk and the development of perceptions of what risk is acceptable in birth. After describing the history of maternity care in the United States, reviewing the relevant literature related to birth and risk perception, and presenting my study on the differences in risk perception between OBs and CPMs in Missouri, I move on to discuss the implications that differences and similarities in risk perception may have on the future of maternity care in Missouri.
Palestinian Identity Formation in UNRWA Refugee Camps of Lebanon

Alaa Itani

Mentor: Peter Benson

Over sixty years after the first 100,000 displaced Palestinians turned to Lebanon for refuge, the United Nations Relief and Works Agency (UNRWA) continues to provide aid and social services for today’s 260,000 to 280,000 Palestinian refugees. Over half live within refugee camps and are characterized by the Lebanese government as “foreigners” despite their long-term residency within the country. Because citizenship provides access to medical services, public schools, and the right to work higher status positions, assigning initial Palestinian refugees and their descendants transient legal status contributes to their social marginalization. Discrimination of Palestinian refugees, particularly following the Lebanese Civil War in a heightened atmosphere of suspicion, was integrated within the structures of the state and its services. These disparities manifest themselves biologically with the declining health of refugees as compared to the Lebanese population. In education, school dropout rates are not only higher than Lebanese rates, but also higher as compared to Palestinian dropout rates in refugee camps throughout the Middle East. There are three typical options to handle refugee populations: repatriation, resettlement into another nation, and integration into the current country refugees live in. This research examines how refugees responded to international dialogue regarding their future (opposition to resettlement and integration while expecting “right of return”). As the international community continues to disagree on these options, this research also assesses how social, economic, and political factors affected Palestinian identity in a context of marginalization and isolation. Analysis extends to the UNRWA because of its central role in camp life, and the organization’s impact on consolidating Palestinian refugee identity. Palestinians as well actively inscribed meaning and identity into the camps themselves, as well as challenged and molded UNRWA’s identity.
“The Haitian Way” in St. Louis: Diasporic Subjectivities and Conflicting Narratives of Remembering and Disunity

Joelle Julien

Mentors: Bret Gustafson and Joachim Faust

The term diaspora has dual connotations of both population dispersal and the formation of collective identity. These dual connotations engender questions that challenge traditional notions of community. Does a diasporic population by design equate to a community? Does the plasticity of culture inherent to diasporas necessarily lead to a breakdown of said diasporic community? Instead of conceptualizing diaspora in terms of collective identities, recent work on diasporic subjectivities suggest that diasporas are locally produced, subjective conditions, not simply groups of people. This theoretical approach challenges the popular perception that a shared country of origin renders diasporic populations as homogenous communities. Shifting away from viewing diasporic communities as a unified collective towards an analysis of how diasporic subjectivities are formed calls for thinking of diasporic communities as dynamic states of existence, collective experiences, and conditions of life that are shaped by internal and external power relations in both the homeland and the receiving community. I use this idea of diasporic subjectivities to critique the common scholarly perception of a singular Haitian diasporic community.

Through in-depth interviews of two waves of Haitian immigrants to St. Louis and textual analysis of news coverage of their arrival and community, this generational study examines the disparate representations and experiences of Haitian immigrants. While the first wave immigrated to St. Louis during the Duvalier dictatorship in the 1960s and were primarily bourgeois, the second wave of less affluent immigrants settled in St. Louis after the coup d’état of President Jean Bertrand Aristide in 1991. Examining the changing local social dynamics within this time period, in both Haiti as well as the US, aids in our understanding of how ideas about Haitianess are reproduced and transformed in the diaspora and why solidarity within diasporic populations may dissipate over time. My research is particularly interested in how Haitian cultural patterns such as the presumed rigidity of class identification transform through space and time. I argue that the commonly expressed cultural trope of “the Haitian way” serves as a uniting discourse to explain Haiti’s precarious social legacy while simultaneously inhibiting further conversations regarding challenges experienced within a Haitian diasporic community.
Although hunger has been defined and reinterpreted countless times, the most revolutionary changes to its conceptualization have come into the public eye within the last half-century. While the early view of hunger as the product of a world population too large to sustain has largely been eliminated, and the mainstream international community has come to accept that food insecurity results from issues of distribution rather than an insufficient global food supply, the emphasis on science (biotechnology in agriculture), humanitarianism (its role in international aid), and social justice (in international human rights law) in the contemporary era has contributed to other barriers that prevent hunger alleviation.

In this thesis, I argue that these previous contemporary developments have had the capacity to hide hunger. My analysis of technology and humanitarian aid is supplemented largely by a discussion of hunger in the remote village of Bom Jesus in Northeast Brazil. In this setting, cultural beliefs, political repression, and postcolonial structures influence the way hunger is conceptualized—as the individualized ethnomedical condition, *nervos*, rather the social condition it is. While I seek to prove that science and international aid and human rights law sometimes hinder efforts to relieve world hunger, so too does the fact that hunger is unrecognized in regions of the world adhering to cultural beliefs about it and their bodies.

Critiques of humanitarianism and international aid have existed in academia for years but have become increasingly prevalent over the last quarter century. This thesis is an effort to expound upon these existing criticisms while taking into account a wider breadth of circumstances that limit our ability to tackle this global health problem. My own analysis of cultural constructions of hunger shows how they can exclude certain populations from being considered in aid efforts, which themselves can be problematic.
This work analyzes the changing representations of HIV/AIDS in (primarily US) cinema, particularly in how representations differ before and since the advent of the first highly effective HIV treatment, Highly Active Antiretroviral Therapy (HAART), in 1996. I am separately analyzing the presence of AIDS in gay men in cinema and heterosexual women in North America and make the following argument: For gay males pre-HAART, HIV represents figuratively and literally a locus of discrimination and otherness, particularly exemplified by “fighting against the system.” Post-HAART, HIV in gay men is presented in multiple ways which represents not only the greater assimilation and general acceptance of men who have sex with men (MSMs), but the ability to live with the virus and lead a “normal life” without necessarily exhibiting physical manifestations of the disease. For heterosexual women pre-HAART, HIV is represented in terms of victimization and the framing of bodies, as well as lost innocence. Post-HAART HIV can be seen as a symbol of marginality in heterosexual women, as well as a result of past behaviors/life situations. In my analysis I note the ways that medical conditions (AIDS) and medical developments (HAART) create unique social conditions that implicitly influence developments in film representations. I am deliberate about separating representations of men and women living with HIV, and I find that even within a specific time period, men with HIV tend to be represented in highly disparate ways while there seems to be a common or monolithic representation of females with HIV within a given time period.
My senior honors thesis centers on tuberculosis in Brazil, specifically how it serves as a lens to the country’s longstanding social injustice. It uses anthropological outlook of disease based on text from Paul Farmer and João Biehl that ties disease to non-biological factors such as economic and social inequality. It then looks at the northeastern Brazilian favela Vila Velha, where tuberculosis is a social disease, meaning that it mostly stems from larger social issues that the community faces such as abject poverty and the lack of governmental recognition and public infrastructure. This information is primarily gathered from the fieldwork research I conducted with community health agents that are based in Vila Velha. Next, by using João Biehl’s critique, this paper argues how despite Brazil’s right to health and national universal healthcare, there are areas Biehl calls “zones of social abandonment,” where its residents are denied the supposed constitutional rights that they are promised. It then shifts back to Vila Velha, and by using quotes and observations, demonstrates how Vila Velha is a forgotten community with a socially neglected population. Afterward, the paper examines community-based interventions that work to provide social services to these disregarded areas, particularly the motivations of these social workers and their impact. It argues that despite the commendable dedication to helping those in greatest most need, the community needs greater assistance in order to significantly improve its social conditions. This thesis’s relevance is that Brazil is seen as a model developing country for its universal healthcare, especially its revolutionary AIDS policy with free antiretroviral therapies. However, this is not enough to overcome the longstanding history of political and socioeconomic inequality, and will continue to persist if attention is not brought to the millions of Brazilians that live in social abandonment.
The Archaeology of Walls: Excavations at Actuncan, Belize

Allison Nick

Mentor: David Freidel

Excavations of even the smallest architectural features, such as walls that lie low to the ground and connect different structures, can reveal important implications about the layout of a city and the social and political interactions between people who lived in that area. For this project, excavations were conducted on two separate wall structures located within the civic center of a Maya site, Actuncan, located in the Belize River Valley near the Belize/Guatemalan border. The two walls highlight important sections of the city: the first (named the King Lear wall in the field) runs through the middle of a plaza, or open space surrounded by three possible ritual structures on one side and an elite residence on the other side. The second (the Scout Wall) also encloses a plaza group and a possible ritually and cosmologically significant E Group of structures, outlining the edge of the civic center, beyond, which lie household groups. The Scout Wall is also located on the outer edge of the city and may have served an important defensive function, possibly as a palisade. For each wall, test units were dug bisecting the walls in order to best approach the front of the walls and gain a better understanding of their construction. Artifacts were sifted through ¼-inch screens and ceramics were collected from the wall fill for dating. Based on preliminary analysis, the King Lear wall may have served to delineate space or block access between the ritual structures and the elite residence. The Scout wall, on the other hand, may have served as a palisade with a perishable wooden component built up through the middle. The dating results will help to place the construction of these walls within the chronology of other structures in the site and therefore relate their construction to shifting politics within the site.
Linguistic Ideology in Morocco: An Exploration into the Complexities of a Multilingual Society

Simone Sept

Mentor: John Bowen

In this thesis, I explore how Moroccans conceptualize the languages spoken in their country as well as how they relate to the individual languages that they choose to speak in varied situations. I discuss the historical and structural features that render people emotional about the issue of language, such as the impact colonialism has had throughout the country. I elaborate on how these strong emotions play a role in forming people's linguistic ideologies. The research for this project was conducted in Rabat and the surrounding area in Morocco over a four-month period of time and was further enriched through literature review after returning to the United States. Drawing on anecdotes, interviews, and puzzling experiences from my time studying and researching in Morocco, I look at different aspects of linguistic ideology. Through each of these glimpses into the Moroccan linguistic experience, I examine how linguistic ideology relates to indexing social status, ethnic and cultural identities, and politics. Because Morocco is a complex, multilingual setting, looking at the diverse manifestations of linguistic ideology provides an enriched understanding of the culture, and lends insights into larger socio-political issues in the country. This research project contributes to the discussion of multilingualism and linguistic ideology in a specific context, providing a lens with which the broader issues in Morocco can be considered.
Malaria is critical health concern of HaMakuya, a remote village in the Northern region of South Africa. Despite the fact that malaria is both preventable and treatable, HaMakuya continues to be significantly burdened by the disease. Medical pluralism and relative authoritative knowledge of health experts are key factors in understanding the treatment seeking methods in HaMakuya. The Malaria Awareness Program (MAP) was created to sustainably increase awareness of malaria and ultimately decrease incidence. MAP addressed current and local barriers to health and malaria control in order to empower the community with both the knowledge and means to control the disease.
The Iniquity of Inequity: A Comparative Analysis of Chernobyl and Fukushima

Pooja Sohoni

Mentors: Bradley Stoner and Peter Benson

The 2011 disaster at the Fukushima nuclear power plant in Japan raised controversial questions about the future and safety of nuclear energy and called to mind some of the other major nuclear catastrophes of the past 30 years. In this thesis, I will compare Fukushima to the worst nuclear disaster in history: the 1986 Chernobyl incident in the former Soviet Union. Using a combination of ethnographic case studies and critical medical anthropology, I will investigate Fukushima and Chernobyl both from the perspective of the individual as well as how this relates to group suffering. Ultimately, I will show that while the management of Fukushima far surpasses that of Chernobyl, both disasters were preventable to some degree. Poor management and neglect of workers’ safety resulted in unnecessary morbidity and mortality in working class nuclear technicians, first responders, and military members. I will conclude by advising that the future of nuclear power should be extremely dependent on whether governments and companies can ensure safety for their workers and nearby civilians.
The United States may be one of the richest countries in the world and spend the most on healthcare per capita, but it is far from the healthiest country. This is, in part, due to the underdevelopment of primary care, a component of healthcare that has been proven to reduce health inequity and improve overall health outcome. However, the healthcare system plays only a small role in determining an individual’s health. Social determinants of health, namely the environment in which an individual lives and works have been shown to drastically affect health. These factors are a result of the socioeconomic structure in which an individual lives. For primary care doctors, understanding the influence structure and social determinants have on their patients’ lives is crucial in order to maximize the health of the population. One way to approach this problem is through educating residents about the factors that influence both the health of their patients as well as their patients’ compliance and health-related behaviors. By understanding the effect of structure and social factors on their patients’ lives, residents can take these into account when working with their patients and maximize their patients’ health outcomes.
Eat Less, Exercise More: Obesity in the United States from an Anthropological Perspective and a Case Study of Modern Interventions

Sarah Rose Werth

Mentor: Peter Benson

Using an anthropological perspective, this thesis will attempt to understand obesity’s rise and the failure of obesity interventions in the United States. The social and cultural context of obesity is set up through an examination of the evolution of obesity, the nutrition transition, and the development of an obesogenic environment. The nutrition transition in the United States was prompted by the growth of agribusiness and the food industry, which created food patterns that promote obesity and act as structural violence. Obesity interventions focus on personal responsibility and the advice to eat less and exercise more, but fail because they ignore structural factors. The prominent lifestyle model of disease relies on education and unsustainable behavior change. A case study of Let’s Move! and the New York City soda cap reveals that modern interventions acknowledge environmental causes; however, while Let’s Move! falls back on education, the soda cap actually targets environmental factors. The negative reaction to the soda cap may overwhelm its effect, but it should be a model for future interventions. To be effective obesity interventions need to alter societal structures and environments to make eating healthy easier.
A Vexing View:
A Study of the Visitor Effect
in the Saint Louis Zoo

Francis Wu

Mentor: Crickette Sanz

Studies of captive primates in zoos have shown that zoo visitors are a significant source of stress for the animals—this relationship is known as the visitor effect. This stress is often manifested through stress-indicating behaviors such as self-scratching and visual monitoring of visitors. This study was undertaken to determine whether black and white ruffed lemurs, lion-tailed macaques, chimpanzees, black-handed spider monkeys, white-faced sakis and cotton-top tamarins in the Saint Louis Zoo respond to the visitor effect, and whether these responses to stress differ across species. From February to March 2012, 75 hours of observation data were collected on black and white ruffed lemurs, lion-tailed macaques, and chimpanzees. From October to December 2012, 45 hours of observation data were collected on black-handed spider monkeys, white-faced sakis, and cotton-top tamarins. Data were collected on visitor density and the occurrence of animal behaviors; all-occurrence data were collected on self-scratching, aggression, and lemur calls. The study found that visual monitoring increases significantly with respect to increasing visitor density in all primate species (P < 0.0001 for all); the chimpanzee data demonstrates a similar trend that is not very significant (P = 0.059). Self-scratching frequency does show a positive correlation with visitor density in all species, but statistical significance is indeterminate. The lion-tailed macaque and white-faced sakis had higher visual-monitoring and self-scratching frequencies compared to the other taxa observed and a linear positive correlation between autogrooming frequency and visitor density was also observed for the lion-tailed macaques. These results suggest that lion-tailed macaques and white-faced sakis may respond more significantly to visitor presence rather than visitor number, and that consideration should be given to limiting open exhibit time for these two species in order to ameliorate their stress levels.
Participatory Empowerment and Sexual Health: Understanding Frameworks of Transformation among Peer Health Educators at the University of KwaZulu-Natal

Rebecca Zod

Mentor: Shanti Parikh

Peer education as a health strategy has received increasing attention, especially in the realm of HIV, as it focuses on participation and collective negotiation as a way to instigate social change and a change in sexual decision-making. While there are numerous studies on the impact of peer education on learners, little is written about the impacts of these programs on the peer educators themselves. Moreover, in the context of KwaZulu-Natal, South Africa, and its extreme HIV prevalence rate, there is a need to find new ways to address the behavioral risks associated with HIV. This thesis focuses on a group of peer educators at the University of KwaZulu-Natal and the empowerment that they experience, helping them to address and cope with the social issues that put them at risk for sexual health implications. Through participant observation of meetings and events as well as semi-structured interviews with peer educators, I sought to investigate the participatory empowerment that the peer educators experienced due to their roles as educators. I analyze their narratives through the lens of two key empowerment frameworks found in literature, namely “psychological empowerment,” which focuses on individual behavior, and “structural empowerment,” which confronts structural inequalities. Finally, I find that while this peer education program addresses many elements of psychological empowerment, it lacks several aspects of structural empowerment, suggesting that the program could be improved to address more of the social inequalities affecting university students. Understanding the transformative experiences of the peer educators’ participation in the program can provide critical insights for designing future empowerment initiatives.
Degas and the Dancers: 
Processing the Ballet

Erin Wrightson

Mentor: Elizabeth C. Childs

Edgar Degas’ ballet imagery makes up one of the most prominent and enduring facets of his body of work; the ballerinas became subjects he revisited consistently throughout his lifetime. The Paris Opéra and its ballet were at the heart of cultural life for the nineteenth-century bourgeois city dweller, as Parisians of all classes could attend its performances. Degas’ interest in the ballerinas of the Paris Opéra, however, transcended his commitment to depicting the realities of an important aspect of contemporary city life. Through a deconstruction of the idealized façade of the Paris Opéra, Degas exposes his fundamental interest in artifice and artistic process. In my thesis, I argue that the ballet works distill artistic process into a paintable subject, as Degas uses the works to construct a broader narrative of the creation of the ballet from start to finish, a narrative that closely matches historical references to the ballerinas’ experiences—arduous rehearsals, predatory admirers backstage, low social standing. Degas unites his representation of the rehearsal, the wings, and the performance with a probing gaze that both delights in and shatters the artifice of the stage through his obsession with the backstage realities, the process.

The second chapter of the thesis engages with Degas’ parallel interest in his own artistic process, arguing that the ballet as a subject became a metaphor for art making that extended to Degas’ own fabricated works. In this chapter, I discuss how Degas’ experimentation with various novel media and obsession with revision underscore this fascination with his specific processes. Degas thought carefully about his art, the subjects he included, the way he portrayed them, and even the steps he went through to create their images on the page. The creation of art, the processes he used, fascinated him so much so that he incorporated evidence of his processes into his own works for his audiences to contemplate. And so much so that he devised a subject that could mirror this artistic interest, the dancers of the Paris Opéra Ballet.
Biochemical Studies of Phosphoethanolamine Methyltransferase and Serine Decarboxylase from Nematodes, Plasmodium, and Plants

Tara Alpert

Mentors: Soon Goo Lee and Joseph M. Jez

Plasmodium falciparum, which is responsible for malaria in humans, requires rapid division and efficient phospholipid synthesis to survive. Unlike mammals, Plasmodium require phosphoethanolamine methyltransferases (PfPMT) and Serine Decarboxylase (SDC) to synthesize phosphocholine for membrane biogenesis. Disruption of the PfPMT gene causes severe growth, reproduction, and viability defects. Thus, this enzyme is a potential anti-malarial target. SDC is the gatekeeper for this pathway, and is the main source of ethanolamine in plants with homologous pathways (Arabidopsis thaliana). While the activity of SDC has been well documented in A. thaliana, the molecular basis of the reaction remains unknown and no homologs for SDC have been identified in Caenorhabditis elegans. The primary focus has therefore been twofold: 1) the crystallization of AtSDC to clarify active site architecture and 2) the cloning and characterization of a putative CeSDC.

To examine the role of residues in the phosphobase binding site and a potentially catalytic histidine in PfPMT, site-directed mutagenesis, functional assays, and protein crystallography were used. Point mutants targeting the phosphobase binding site and the catalytic histidine were expressed in E. coli and purified by affinity chromatography. Mutation of His132 resulted in proteins with no detectable activity; however, these proteins still bound substrates with affinity comparable to wild-type. The H132A protein was crystallized and a 1.19 Å resolution data set collected, and the resulting structure supports a critical role for the histidine in the reaction mechanism.

AtSDC crystals have been achieved; however, they have not reached diffraction quality. Four putative SDC genes have been identified from online databases with >40% sequence homology to AtSDC. Primers were designed to clone these genes from a C. elegans genome and they will be expressed in an E. coli system for purification and kinetic analysis to determine which, if any, is producing the ethanolamine stock for the organism.
Metabolism of Amyloid-Beta Isoforms from Human Plasma: Development of an Immunoprecipitation Protocol

Anna Bareiss

Mentor: Randall J. Bateman

Alzheimer’s Disease (AD), the leading cause of dementia, currently affects about 5 million people in the United States. In Dr. Randall Bateman’s laboratory, our research is focused on the cause, diagnosis and treatment of AD in humans—specifically the metabolism of the amyloid-beta (Aβ) protein in the central nervous system which appears to be altered in AD patients and peripheral Aβ metabolism.

In order to measure the metabolism of Aβ, the protein is labeled with stable isotope (13C₆-Leucine) and quantified over a 36-hour time course using an immunoprecipitation/mass spectrometry protocol. Our lab determined that the production of Aβ in the cerebrospinal fluid was unchanged while clearance rates were 30% slower in early stage AD patients vs. age-matched controls.

The next logical step is to determine and compare the metabolism of Aβ in human plasma from AD patients and age-matched controls. This will help to achieve a holistic understanding of Aβ in AD (throughout the central nervous and cardiovascular systems). Additionally, meticulous characterization of Aβ metabolism in the plasma could possibly lend itself to an AD blood test in the coming years.

Following two years of protocol development, we have created an immunoprecipitation protocol that enables human plasma samples for quantitation of labeling by mass spectrometry. This protocol allows excellent recovery of Aβ as the protein is purified and isolated for quantitation. Additionally, the protocol is sensitive enough to permit the discrimination of Aβ isoforms of interest (Aβ38, Aβ30, Aβ42), which are of critical importance for distinguishing/comparing clinical groups. We are now beginning to use the protocol on plasma sample sets that we have already obtained from AD patients and age-matched controls. Ultimately, the culmination of the data obtained from the samples will measure the first blood kinetic rates of Aβ isoforms in humans.
All cells of the blood are derived from hematopoietic stem cells (HSCs). These hematopoietic progenitors remain mostly dormant in the bone marrow microenvironment, a medullary region that maintains HSC homeostasis. When they do divide, HSCs are able to maintain their stem cell character through the property of self-renewal. Their daughter cells are able to become mature blood cells because they also possess the property of differentiation. During severe infection and inflammation, cytokines and alterations to the bone marrow microenvironment can dysregulate these properties in HSCs.

The cytokine granulocyte-colony stimulating factor (G-CSF) is an important component of the inflammatory response and mediates changes to the bone marrow microenvironment. To test whether G-CSF alters HSC activity and function, we examined HSC number and cell cycle activity. We found that G-CSF treatment paradoxically resulted in an expansion of bone marrow and total HSCs but an increase in HSC quiescence. We also examined HSC function by conducting competitive repopulation activity assays. These assays measure both HSC self-renewal and differentiation. We found that G-CSF conferred a marked repopulating activity defect for bone marrow derived HSCs.
Eukaryotes are dependent on beneficial microbes, but can be killed by harmful ones. How have they evolved responses that protect themselves from harmful bacteria while coddling the beneficial ones? An ideal system for investigating this relationship is the eukaryote social amoeba *Dictyostelium discoideum* because some clones carry commensal bacteria through the social state to use as future seed corn, while others do not. Most of its life, *D. discoideum* amoeba consume bacteria and divide by binary fission. Under starvation, amoebae aggregate into a multicellular body that crawls to light, then forms a fruiting body of 20% dead stalk cells and 80% living spore cells. During the crawling stage, some cells pass from front to back of the slug picking up toxins and bacteria, as a combined liver and innate immune system. We hypothesized that the farmer clones might be more vulnerable to harmful bacteria because they had to retain their helpful ones. In support of our hypothesis, we found that farmers have considerably fewer sentinel cells compared to non-farmers, indicating a potential trade-off between transporting bacteria for agricultural purposes and defense against harm from toxins and/or pathogenic bacteria. Future work will identify the mechanistic and genetic basis of this difference, making this an unparalleled system for understanding the evolutionary trade-offs in immune reactions in a complex environment of bacterial friends and foes.
CSPR-1 Regulates Formation and Maintenance of Proper Neuronal Morphology in C. elegans

Jie Chen

Mentor: Michael Nonet

Patronin is a microtubule minus-end capping protein, and lesions in its homolog, CAMSAP, lead to higher susceptibility to epilepsy in humans. Here I show that the C. elegans homolog of CAMSAP and Patronin, cspr-1, plays a role in cytoskeletal stability and interacts with a neuronal remodeling pathway to ensure proper morphology. We identified cspr-1(ju1286) allele in a N-ethyl-N-nitrosourea (ENU)-induced mutant screen for altered morphology in mechanosensory neurons. We used single-nucleotide polymorphism (SNP) mapping and whole genome sequencing to confirm that ju1286 is a nonsense mutation in the cspr-1 gene. Without CSPR-1, neurons show aberrant morphology. Some of the cspr-1 phenotypes are similar to those of known mutations that disrupt microtubule formation and higher order microtubule arrays. Slowing down microtubule polymerization in cspr-1 mutants leads to a higher occurrence of the ectopic neuronal extension phenotype. Throughout development, cspr-1 mutants show highly unstable neuronal morphology with both formation and retraction of branches. At early stages of development, the trafficking of protein cargos along microtubule seems largely intact, as the number of synaptic protein puncta is unchanged from wild type. Removing the inhibitor of a known neuronal remodeling pathway results in rescue of the ectopic neurite extension phenotype in cspr-1 mutants. These results indicate that CSPR-1 plays a role in pathways that feed into the microtubule cytoskeleton and potentially activates the neuronal remodeling pathways when its functions are disrupted. Understanding the functions of CSPR-1 is crucial in studying the pathogenesis of human diseases, such as epilepsy, that are associated with disrupted neuronal morphology.
Outcomes of Diabetic Metformin versus Non-metformin Users with Oropharynx Carcinoma Treated with Intensity-Modulated Radiation Therapy

Re-I Chin

Mentor: Wade Thorstad

Previous retrospective cohort studies in cancer sites such as breast, colon, and liver showed that metformin use is correlated with improved overall survival. However, the effect of metformin on outcomes in head and neck cancers is not as well established. We retrospectively reviewed the outcomes of ever- versus never- metformin use in type II diabetic (T2D) patients with oropharynx carcinoma who completed intensity-modulated radiation therapy (IMRT) in the definitive or adjuvant setting.

Using our institutional registry, 572 oropharyngeal cancer patients treated with IMRT between 1997 and 2012 were identified. Sixty-six (11.5%) were diagnosed with T2D before the start of radiation therapy, of which 37 had ever received metformin since their cancer diagnosis. At a median follow-up of 24 months for living patients, logrank tests showed no statistically significant differences between the ever- and never-metformin groups in overall survival (71.1% vs 72.1% at 2 years, $p = 0.501$), local control (91.0% vs 78.0% at 2 years, $p = 0.102$), locoregional control (84.2% vs 70.4% at 2 years, $p = 0.114$), and distant-metastasis free survival (83.1% vs 85.6% at 2 years, $p = 0.689$). Notably, a non-significant trend for improved local control and locoregional control for ever-metformin users was observed.

While no significant differences in survival outcomes between the ever- and never-metformin users were observed in this cohort of oropharyngeal cancer patients, the small sample size led to low power for detecting a difference. Larger-scale retrospective with longer follow-up and prospective studies are necessary to better understand the effects of metformin on head and neck cancer outcomes.
PSD-95 Translation Is Differentially Regulated by Cell Surface versus Intracellular mGluR5 in Striatal Neurons

Evan Cory

Mentor: Karen O’Malley

Fragile X syndrome (FXS) is the most common inherited form of autism spectrum disorder (ASD), and results in the loss of Fragile X Mental Retardation Protein (FMRP), a translational suppressor. FMRP is known to oppose the function of Group I metabotropic glutamate receptor 5 (mGluR5) and consequently one of the hallmarks of FXS is thought to be exaggerated mGluR5 signaling in the absence of FMRP. Traditionally, mGluR5 is thought to transmit extracellular signals to the cytoplasm from its position on the cell surface. However, the O’Malley Lab has shown that up to 90% of mGluR5 is intracellular, located on either the endoplasmic reticulum or nuclear membrane. mGluR5 is a glutamate-activated, G-protein-coupled receptor that plays an important role in neuronal development, synaptic plasticity, learning, and memory. We have shown that active intracellular mGluR5 generates unique cellular responses in striatal neurons. Other signaling pathways downstream of mGluR5 activation implicate the mammalian target of rapamycin (mTOR) cascade, which controls initiation of cap-dependent translation, and eukaryotic elongation factor 2 (eEF2), which modulates the elongation step of protein synthesis. Previously, these pathways were only thought to become activated by cell surface receptors. My research focused on postsynaptic density protein 95 (PSD-95), an important mTOR, MEK-ERK, and FMRP target that serves as a scaffolding protein at postsynaptic sites. Our results show that PSD-95 is upregulated by intracellular but not cell surface mGluR5 in striatal neurons. The mGluR5-induced upregulation of PSD-95 is MEK-ERK and translation-dependent but PI3K-Akt-mTOR-S6K and transcription-independent. The upregulation of PSD-95 is also dependent on a major FMRP phosphatase, protein phosphatase (PP2A) activity. In summary, these studies suggest a major role for intracellular mGluR5 in the regulation of synaptic plasticity mediated by PSD-95, and might lead to novel strategies for disorders such as fragile X syndrome, anxiety, addiction, and Parkinson disease.
Isoflurane Post-conditioning as a Possible Treatment for Delayed Cerebral Ischemia following Subarachnoid Hemorrhage

Michael Harries

Mentor: Greg Zipfel

Delayed cerebral ischemia (DCI) occurs in approximately 30% of subarachnoid hemorrhage (SAH) survivors. This disease can cause debilitating cerebral damage to patients even after a successful post-stroke operation. Currently, the precise causes of DCI are unknown and there is no known treatment. However, DCI is generally observed 72 hours after operation, leaving a window of time for a post-SAH conditioning intervention with an exposure to an anesthetic known to have positive post-conditioning effects.

In this study, my experiments examined the effects of Isoflurane post-conditioning exposure (Iso-PostC) on the incidence of DCI after the induction of SAH in a mice model. I hypothesized that exposing mice to a sub-lethal stimulus of Isoflurane after SAH would result in improved neurological outcomes through a decrease in vasospasm, microthrombi, and apoptotic neurons.

I completed all experiments on three cohorts of mice (sham, SAH, SAH + Iso-PostC treatment). Brain tissue was perfused with ROX SE fluorescent dye following sacrifice, imaged and the diameter of the medial collateral artery was measured to determine the effect of treatment on vasospasm. Following brain imaging, tissues were sectioned for staining. DAB staining with fibrinogen primary antibody was completed to assess the effect of treatment on microthrombi. Cresyl violet and deoxynucleotidyl transferase dUTP nick end labeling (TUNEL) staining was completed to assess the effect of treatment on neuronal cell death and apoptosis specifically. The relationship between Iso-PostC treatment, vasodiameter measurements and microthrombi counts suggests that Isoflurane exposure acts pleiotropically in a way that holds potential for future therapeutic use.
Biology

PRETERM BLOOD GAS AND GLUCOSE IN RELATION TO NEUROLOGICAL OUTCOMES IN THE PRETERM INFANT

Matthew Haslam

Mentor: Terrie Inder

Premature infants often experience complicated cardiorespiratory courses with difficulty in the regulation of blood gas and glucose levels. Severely abnormal levels of carbon dioxide or glucose have been associated with adverse neurological outcome, including increased incidence of seizure and intraventricular hemorrhage. The aim of this study was to more precisely define how carbon dioxide levels or blood glucose concentrations correlate with neurologic outcome in preterm infants. Data were collected for 136 infants ≤ 30 weeks gestational age admitted to St. Louis Children’s Hospital from May 2007 to Jan 2010. Recordings of pH, bicarbonate, the levels of carbon dioxide, oxygen and glucose were collected and stratified according to abnormal values. The level of hemodynamic abnormality was analyzed in relation to the presence of electrographic seizures, brain injury on cranial ultrasound and/or MRI, and neurodevelopmental outcome at 2 years of age using the BSID-III. Multivariate regression modeling, controlled for clinical risk factors, showed that increased incidence and severity of cerebellar hemorrhage was associated with abnormally high levels of both carbon dioxide and glucose. Additionally, cerebellar volume was decreased in infants with hypercapnic scores above 10 points and those with fluctuations of pCO₂ >25 mmHg in a 12-hour period. Adverse developmental outcome at 2 years of age was associated with increased number of days on which an episode of abnormality occurred. These three findings suggest abnormally high carbon dioxide or glucose levels are related to adverse outcome, localized particularly in the cerebellum. There may also be subtle associations between hemodynamic perturbations and increased incidence of adverse long-term outcome. Due to the retrospective design of the study causality cannot be established, but the associations found here further emphasizes the importance of this area of research.
Elucidating the Identity and Function of Volatile Organic Compounds (VOCs) Emitted by the Malaria Parasite, Plasmodium falciparum

Megan Kelly

Mentor: Audrey Odom

Malaria is a serious global health issue that is endemic to most of the developing world, affecting nearly 500 million people and causing 1 million child deaths each year. It is a disease caused by the apicomplexan parasite, Plasmodium falciparum, and transmitted through the mosquito vector, Anopheles gambiae. Due to widespread parasite resistance to almost all available anti-malarials, new drugs and new drug targets are desperately needed. The malaria parasite exhibits many behaviors that are most likely coordinated via extracellular chemical communication, but the mechanisms and specific agents that allow this communication are almost entirely unknown. We hypothesized that these chemical agents are volatile organic compounds (VOCs) and thus would be found in the air surrounding the parasite culture. We then probed headspace gas above the media in search of malaria-specific VOCs.

Using solid phase micro-extraction (SPME) and gas chromatography-mass spectroscopy (GC-MS) analysis, the composition of the headspace gas (air conditioned by P. falciparum culture) was determined. Two monoterpene isoprenoids were found to be present in malaria headspace gas alone. However, when further trials were conducted, we found that the sensitivity of SPME was so high that these terpenes were being detected in controls from the ambient levels in the air. In order to continue our investigation of malaria-specific metabolites, we used a Folch extraction method and analyzed the non-polar extracts via GC-MS and LC-MS. The same monoterpenes from SPME methods were found to be malaria-specific in these extracts. Monoterpenes are odorants that have signaling roles bacteria, plants, and fungi. These roles include quorum sensing as well as inter-species communication, such as the attraction of arthropods. To test the possibility of inter-species communication, our receptors. They were found to increase two receptors 8-fold from normal activity. We are working to determine if these compounds elicit quorum-sensing effects, and are performing high-throughput functional analysis of previously uncharacterized Plasmodium genes to identify the Plasmodium falciparum terpene synthase.
Malaria is a disease that remains a serious problem for millions in underdeveloped regions, and present day efforts are focused on treatment and eradication of malaria worldwide. *Plasmodium falciparum* is the specific malaria species of our research because of its significance in causing the most deaths in infected individuals. One direction of research focuses on proteases that the malaria parasite uses for a wide range of essential roles, including host cell invasion, egress, and degradation of hemoglobin. In this study, we investigated the function of the putative metalloprotease PF3D7_1009500. Based on gene sequence homology, we hypothesized that this metalloprotease is involved in de-SUMOylation, which has functional relevance during the parasite’s development in the host red blood cell (RBC). To study the role of this protein we pursued genetic and biochemical approaches. One method attempted was gene knockout to study the loss of function in the null mutant strain versus wild type via double crossover recombination followed by drug selection. Parasites have been transfected with the knockout vectors and we are awaiting results to see possible phenotypic change. Such will indicate that the peptidases play an active role in the parasite’s growth in the RBC. The second method was to examine protease function through recombinant expression of these proteins. The coding sequences for the protein of interest was cloned into expression vectors then transformed into and expressed in *E. coli*. We have developed a protocol for purifying the recombinant protein and efforts are underway to characterize its proteolytic activity and substrate specificity. It is expected these studies will give further insight into *P. falciparum* biology and may aid in drug design to combat the disease.
The Effect of Visitor Group Size on Stereotypic Behavior and Use of Available Space by Captive Asian Elephants (Elephas maximus)

Kavitha Krishnan

Mentor: Stan Braude

Like many other species, Asian elephants exhibit stereotypic behaviors in many captive settings. These behaviors are unvarying and repetitive and serve no obvious purpose to the elephant. Previous work has shown that stereotypy is associated with age, enclosure setting, and environmental enrichment. However, no studies have looked at how crowd size affects the quantity of stereotypic behavior exhibited by Asian elephants. The current study examined use of total enclosure space and the effect of human crowd size on the frequency of stereotypic behavior by Asian elephants at the Saint Louis Zoo. I conducted 80 hours of scanned sampling and focal observation at the Saint Louis Zoo. I found lower rates of stereotypic behavior when there were more visitors present. However, many of the elephants spent the majority of their time in the back of the enclosure, farthest from the human crowds. These results are different from the growing body of research about crowd size effects on captive primate populations. Positive and negative effects of crowd sizes seem to be species specific. These findings suggest that although elephants choose to avoid humans, humans may still serve as a potential source of environmental enrichment that could ultimately reduce the prevalence of stereotypic behavior in the captive setting.
The Effects of rcTBI on Tau Transcription in a Human Tau Mouse Model

Hal Lewis

Mentor: David Brody

Many athletes that have been subjected to multiple concussions over an extended period of time have developed progressive neurological deterioration known as chronic traumatic encephalopathy (CTE). CTE is associated with memory disturbances, behavioral changes, Parkinsonism, and depression. CTE is characterized by extensive tau, a microtubule associated protein, pathology localized around blood vessels and the depths of the sulci. In CTE and other tauopathies, it is thought that tau function is compromised due to tau hyperphosphorylation, which lowers the binding affinity of tau to microtubules. Humans express six tau isoforms from the splicing of exons 2, 3, and 10. Isoforms are classified as either having 3 or 4 carboxyl terminal microtubule binding repeats (R) depending on the inclusion or exclusion of exon 10. There is equimolar 3R and 4R tau isoforms in normal humans yet it is interesting to note 4R isoforms have greater affinity for microtubules than 3R isoforms. It is possible that the disruption of the 4R/3R ratio is responsible for negative outcomes and pathology in people with CTE and other tauopathies. In this experiment, we looked at transcription, which is upstream of post-translational modifications such as hyperphosphorylation, to see if the cause of disease can be linked to gene expression. We subjected 2- and 8-month-old male htau mice, (n=3 and 2 respectively) which contain all elements of the human tau transgene, to a 24-hour repetitive concussive traumatic brain injury (rcTBI) model. Using qPCR, RTPCR, and gel electrophoresis, we analyzed the total and 4R tau expression and 4R and 3R isoform levels at 2 months. We analyzed total tau staining at 2 and 8 months.

We found that injury did not change the expression of tau or the levels of 4R and 3R isoforms in this model. Therefore, it is possible that gene transcription after injury has no effect on the development of CTE, thus further resources should be invested in analyzing how the post-translational modifications of tau result in disease.
Glaucoma is an age-related ocular disease that damages peripheral vision, which is necessary for safe driving and traffic vigilance. The purpose of this study is to determine the extent that glaucoma affects driving performance and evaluate factors associated with unsafe driving. Using the gold standard of an on-road driving test (ORDT), we compared the driving performance of patients with moderate or advanced glaucoma to normal age-matched controls.

The sample consisted of 22 elder patients (age 55+) with moderate to advanced glaucoma, and 38 age-matched subjects with no ocular disease. Through visual, cognitive and motor tests, participants were clinically assessed for off-road functioning related to the complex task of driving. The main outcome variables for driving ability was a score of pass, marginal pass, or fail on the 12-mile modified Washington University Road Test (mWURT) and a tally of the number of at-fault critical interventions.

Eleven patients (50%) scored a marginal pass or fail on the ORDT compared to 8 (21%) normal controls. Therefore, patients with moderate or advanced glaucoma were 3.8 times more likely to receive a marginal pass or fail than normal controls. Participant age, cognitive and motor ability, and traffic knowledge were significantly (p < 0.05) correlated to a marginal pass or fail score. In addition, 7 (32%) glaucoma patients required 1 or more at-fault critical interventions compared to 6 (16%) normal participants.

In this sample, older drivers with moderate or advanced glaucoma performed worse overall and had a higher proportion of at-fault critical interventions on the on-road driving test than normal age-matched controls. A combination of visual and cognitive factors were associated with poor driving performance, indicating that driving is a complex multifactorial process that needs to be better understood in the elderly and vision impaired. Fostering a safe driving environment where patients are not deterred to participate (out of fear of losing licensure) is needed to obtain a larger sample size and prevent selection bias in subsequent follow-up investigations.
Multiple sclerosis (MS) is a progressive, inflammatory, demyelinating disease of the central nervous system (CNS). MS affects nearly two million people worldwide and is the most significant cause of neurologic disability in young adults. Oligodendrocyte precursor cells (OPCs) responsible for remyelination of damaged myelin sheaths have been detected in MS lesions, but decrease over the course of disease. Animal models of remyelination have revealed roles for inflammatory mediators, including cytokines and chemokines and their effect on growth factors impacting survival, recruitment, proliferation and maturation of OPCs. In the murine model, CXCL10, an interferon gamma inducible (IFN-γ) cytokine present in MS lesions, is shown to exert apoptotic effects by binding to CXCR3, a G-protein coupled receptor present in OPCs. Tumor necrosis factor (TNF-α) is a cytokine that has been shown to play a range of roles from stimulating proliferation to effecting apoptosis. It binds two receptors, TNFR1 and TNFR2. TNF-α is shown to exert its protective mechanisms by binding to TNFR1 on cultured embryonic OPCs, leading to downstream downregulation of cell surface CXCR3 expression. Reduction of apoptosis is seen in embryonic OPCs treated with TNF-α prior to apoptosis-inducing CXCL10 treatment. Gaining a better understanding of the mechanism through which TNF-α protects cells from CXCL10 induced death contributes to research into the mechanisms of demyelination and remyelination in the CNS.
RBCs remove harmful oxidants from the circulation, particularly during physiologic stress (typical in transfusion patients). We hypothesized that increased storage time will reduce this RBC antioxidant capacity, rendering stored RBCs (upon transfusion) more vulnerable to oxidant stress. To validate this theory, we explored GSH and NADPH recycling capacity in RBCs of different storage age, exposing the cells over a time course to two different oxidant generating probes; either 1) diamide (a non-radical producing oxidant probe) or 2) hypoxanthine/xanthine oxidase (and enzyme generating system that produces superoxide). These experiments confirmed that with increased storage age, GSSG and NADP+ recycling capacity are significantly reduced, and as a result, RBCs are more vulnerable to oxidant stress. We therefore speculate that when old RBCs with weak oxidant defense are transfused into patients, they will quickly be removed from the host body by the spleen as a result of damage to the cell from oxidant exposure. This may play a role in reducing the efficacy of the transfusion.

Studies are planned to explore the mechanism behind this phenomenon with the ultimate goal of improving blood storage techniques.
In the GluK2 kainate receptor subunit, RNA editing at the 590 amino acid position, located near the apex of the reentrant pore loop, controls a wide range of channel properties, including ion selectivity, unitary current amplitude, and susceptibility to inhibition by polyamines and cis-unsaturated fatty acids. Additionally, in the GluA2 AMPA receptor subunit, editing at a homologous position influences both the subunit assembly into tetramers and its regulation by supplementary subunits. The mechanism by which these different aspects of channel function are all affected by a single pore loop amino acid substitution from Q to R remains poorly understood. Several lines of evidence, however, suggest that an interaction between the pore helix (M2) and proximate portions of the transmembrane inner (M3) and outer (M1) helices may be involved. We have used double mutant cycle analyses to test for energetic coupling between the 590 site of GluK2, now referred to as the Q/R site residue, and amino acid side chains along the M3 helix. Our results demonstrate an interaction between the Q/R site and several locations along the M3 helix in addition to distinctively strong coupling to substitution of the L614 site, which is located at the level of the central cavity of the channel. At this L614 position, replacement of the leucine with smaller side chains completely and selectively eliminates the inhibitory effect of fatty acids on the gating of edited channels, converting strong inhibition of wild type GluK2(R) to nearly ten-fold potentiation of edited GluK2(R) L614A.
The Roles of JNK 1-3 and MKK4 in a DLK-Mediated Axon Degeneration Pathway

Derek Blake Miller

Mentors: Elisabetta Babetto and Aaron DiAntonio

Degeneration of the axon, the central projection of the neuron that facilitates neuronal communication, is a common mechanism that underlies a wide range of diseases, from glaucoma to Parkinson’s disease. A potential pathway involved in this process is one where dual leucine kinase (DLK), a mitogen-activated protein kinase kinase kinase (MAP3K), acts through a MAP2K to activate c-jun N-terminal kinase (JNK), a MAPK. Previous work has shown that DLK-deficient axons have delayed degeneration after an insult such as axotomy compared to wild-type controls. Inhibiting all c-jun N-terminal kinases (JNKs) at the time of axotomy has also been shown to delay axon degeneration, both results that are consistent with a DLK-dependent axon degeneration pathway. The details of which MAP2Ks and which subsequent JNK isoforms are activated downstream of DLK, however, is not yet known.

To determine this, I infected cultured dorsal root ganglion cells (DRGs) from mice embryos with shRNAs for the different JNK isoforms and monitored their degeneration via microscope imaging at several time points after axotomy. Of the shRNAs tested, shRNAs against JNK2 repeatedly protected axons against degeneration. qPCR also confirmed that JNK2 mRNA levels were effectively knocked down for each shJNK2 construct that protected. shRNAs for JNK1 and JNK3, however, failed to individually protect axons even when the percent of transcript remaining was quite low. Interestingly, simultaneous application of shRNAs targeting all JNKs had a protective effect was greater than that of shJNK2 alone. Subsequent testing revealed that JNK1 and JNK3 have redundant roles in a pathway parallel to JNK2 and account for the additional protective effect of pan-JNK knockdown. Dissecting the MAP2K tier of the pathway, shRNAs that knocked down the MAP2K MKK4 delayed axon degradation after axotomy whereas shRNAs effectively targeting MKK7 did not. These results suggest that MKK4 is the predominant MAP2K acting downstream of DLK that then activates JNK2, perhaps with some redundant regulation by JNK1 and JNK3, in an axon degeneration pathway.
Stem cells in the germ line of the *Caenorhabditis elegans* hermaphrodite differentiate into sperm in the L4 larval stage, and subsequently switch to oogenesis in the adult stage. The transmembrane receptor TRA-2 is a major regulator of the sex determination pathway in the germ line. *tra-2(q122)* is a gain of function allele for this receptor and results in feminization of the germ line stem cells. A previous mutagenesis conducted on *tra-2(q122)* homozygotes identified *oz8*, a dominant allele of an unknown gene that was mapped to chromosome IV. *oz8* suppresses the *tra-2(q122)* phenotype; the germ lines of individuals homozygous for *tra-2(q122)* and heterozygous for *oz8* appear normal and the animals are fertile. *oz8* homozygotes display the Mog phenotype regardless of *tra-2* status, producing a vast excess of sperm, the opposite of the *tra-2(q122)* phenotype. Knocking out *oz8* in a *tra-2(q122)* background, which should occur at high frequency, is expected to result in revertants that are female. To identify the gene defined by *oz8*, I mutagenized a stock of individuals homozygous for *tra-2(q122)* and heterozygous for *oz8*, screening for females in the progeny of the mutagenized stock. I have isolated, balanced, and frozen fourteen mutants we believe carry a loss of function allele for *oz8*. We conducted a mapping experiment to narrow the location of the reverting mutation on chromosome IV and extracted genomic DNA from two different mutant strains. We are awaiting sequencing data to identify *oz8*’s locus, at which point further investigation may reveal its role in sex determination in the *C. elegans* germ line.
ERK-Mediated Regulation of Amyloid-Beta Production in a Mouse Model of Alzheimer’s Disease

Pamela Peters

Mentor: John Cirrito

Amyloid-beta (Aβ) plaques are a hallmark of Alzheimer’s disease (AD) pathology. Aβ plaques form when the typically soluble Aβ peptide reaches a critically high concentration, causing it to form toxic aggregates. Aβ is generated when the enzymes β-secretase and γ-secretase cleave the amyloid precursor protein (APP). When APP is cleaved instead by α-secretase instead of β-secretase, no Aβ is produced.

Synaptic activity is a key regulator of Aβ levels in the brain extracellular fluid. When neurons depolarize and there is high synaptic activity, Aβ is generated at the presynaptic terminal. However, high levels of a specific type of activity, such as by NMDA receptors, has been shown to decrease Aβ levels by activation of an extracellular-regulated kinase (ERK) mediated pathway, which favors the α-secretase cleavage of APP. To lower Aβ levels, ERK may phosphorylate DNA to alter transcription and thus protein levels, or it may phosphorylate proteins directly to alter their function. Thus, NMDA-R can both increase and decrease ISF Aβ levels depending on whether the presynaptic pathway or signaling pathway is predominant.

Our goal is to understand how ERK regulates Aβ formation. We accomplished this by treating wild type mice with an NMDA-R antagonist CPP, thus lowering NMDA-R and ERK activation in the experimental group. Previous data showed that CPP treatment lowered α-secretase activity and did not change β-secretase activity, although we were not able to replicate a significant decrease in α-secretase activity. Nonetheless, changes in α-secretase activity and Aβ levels that have been previously demonstrated after NMDA-R antagonist treatment indicate that ERK causes a modification or change in protein levels of an enzyme that cleaves APP. We found no significant change in levels of the ERK, phosphorylated ERK (pERK), α-secretases (ADAM10, ADAM17), β-secretase (BACE1), and key components of the γ-secretase complex (PS1, nicastrin). Since protein levels did not change, we propose that ERK phosphorylates proteins directly. We continue to test modifications, primarily phosphorylation, of these target proteins to further understand how ERK may act to lower Aβ levels.
Mice Use Stereo Olfactory Detection to Process Directional Odor Cues
Matthew Pieters

Mentor: Timothy E. Holy

The mammalian olfactory system is a largely understudied area of science that contains important phenomena that are poorly understood. One such phenomenon is the possibility of stereo olfaction, the localization of odor direction by comparison of input to two distinct detectors. This study investigates whether mice can detect odor direction by comparing odor inputs between the nostrils. We hypothesized that the location of the odor source could be resolved by simultaneously comparing inhaled air within the two nostrils. In order to rule out the possibility that the animals could detect the odor source by moving their noses back and forth, the animals’ heads were fixed to the testing chamber by a restraining bar. Water deprived mice were trained to identify odor direction with a lick, and in turn received a water reward. Mice were tested in the lick-o-meter machine, which directionally puffed smells at either the left or right side of the subjects’ noses. After controlling for auditory, tactile, and intrinsic testing cues, we found that bilateral odor cues were sufficient for odor localization in mice. In another experiment, mice had their left and right nostrils sewn shut in sequence to disrupt bilateral sampling. When the left nostril was sewn shut, mice stopped licking during both rewarding and non-rewarding odor directions. When the right nostril was sewn shut, mice licked during both rewarding and non-rewarding odor directions. This result indicated that bilateral odor cues were necessary for odor localization. Future investigations will require more physical manipulation of olfactory structures, such as forming a lesion on the anterior olfactory nucleus, to determine the role of each structure on stereo olfaction.
Investigating Dispersal Dynamics and Population Connectivity of the Caribbean Spiny Lobster (Panulirus argus) in the Caribbean and Sargasso Seas: A Test of Sweepstakes Reproductive Success

Jeremy Pivor

Mentor: Eleanor Pardini

The world’s marine ecosystems are under significant stress. Understanding population connectivity is important for effective management as it influences population dynamics, structure, and diversity. The Caribbean spiny lobster (Panulirus argus) is a highly economically important fishery widely distributed across the Central Atlantic Ocean. Long-range dispersal of the long-lived planktonic larvae and consequent complex and variable recruitment patterns has generated persistent difficulties in prediction of recruitment and design of effective management strategies. Similar to other highly-fecund and highly abundant marine species, P. argus has lower genetic diversity than expected from abundance and census population size. In addition, preliminary research of P. argus collected from the Caribbean and Sargasso Seas revealed spatial patchiness and genetic differentiation among larval cohorts. One explanation may be the Sweepstakes Reproductive Success (SRS) hypothesis, which poses that a small proportion of adults account for the bulk of reproductive success and recruitment, owing to chance matching of reproductive activity with suitable oceanographic conditions conducive to larval dispersal, development, and settlement. In particular, SRS predicts less genetic diversity in larval cohorts compared to adult spawning stocks. In this study we investigated the population genetics of one of the largest data sets to date of Caribbean Spiny Lobster larvae. Analysis of life stage structure and genetic diversity of larvae of P. argus collected over the past twenty years from the Caribbean Sea and Sargasso Sea has revealed relative mixing of the larval cohorts representative of the adult population structure. Time/space patterns of population genetic diversity revealed no significant difference thus suggesting no SRS. This implies long-range dispersal and extensive mixing of larval cohorts prior to settlement, and provides new understanding to inform management and policy strategies for this important fishery.
An Exploration Into the Role of Human CLCA1 Proteins in Inflammatory Airway Disease

David Randolph

Mentor: Thomas Brett

Chronic Obstructive Pulmonary Diseases (COPD) such as Asthma, Emphysema, and Chronic Bronchitis show signs and symptoms that are expressed to varying degrees of severity among afflicted individuals. Prior research done on mice has shown that mucous cell metaplasia is affected by Calcium-Activated-Chloride-Channels (CLCA proteins). It could be hyperactivity of these channels that leads to the development of mucous cell metaplasia in COPD patients. It was previously believed that CLCA proteins are integral membrane proteins, but more recent evidence posits the theory that these are secreted signaling molecules that could be dysfunctional in a diseased state. Therefore, a solved structure of CLCA is needed to both compare to hypotheses and elicit more information about the precise role and methodology behind the relationship between CLCA and COPD.

Protein crystallography procedures, such as cloning vectors, hanging drop method, etc., will be used to crystallize the protein. Once protein crystals have been optimized, x-ray diffraction will be used to determine the atomic locations of the various molecules and amino acids that makeup the protein. This will give us the structure and suggest information of the mechanism behind the CLCA protein function.
Effect of Blocking GABA-A Receptors on the Response of Cerebellar Ventral Paraflocculus Purkinje Cells

Lynn Ren

Mentor: Pablo Blazquez

The cerebellar cortex plays an essential role in fine motor control, yet we know remarkably little about the computations it performs. Cerebellar cortex anatomy consists of three layers: the input or granular layer, the output or Purkinje cell layer, and the outermost or molecular layer. Between the input and output layer, information reaches local circuit neurons, mostly GABAergic interneurons, that perform signal transformations not well-understood yet. In this study, we use the oculomotor system of the macaque monkey as our model system for studying these signal transformations. Preliminary data obtained by our lab suggested that inhibition shapes the directional preference of Purkinje cells during saccade eye movements. To further test this hypothesis, we used gabazine (a GABA-A antagonist) to block inhibition while simultaneously recording from VPFL Purkinje cells in the macaque monkey (while performing oculomotor tasks) using multi-barreled electrodes. Our goal was to infer the role of inhibitory interneurons in shaping the output response by comparing VPFL Purkinje cell responses before, during, and after gabazine injections. We found four classes of Purkinje cell responses to visually guided saccades before drug application: 1) neurons that respond with an increase in firing rate during saccades in any direction; 2) neurons that respond with a decrease in firing rate during saccades in any direction; 3) neurons that responded with an increase in firing rate during saccades in a given direction and with a decrease in spikes in the opposite direction; and 4) neurons that do not change their firing rate during saccades. After drug application (gabazine), most Purkinje cells responded with an increase in firing rate during saccades regardless of the saccade direction. These results agree with the results obtained from our preliminary data, suggesting that inhibitory interneurons play a role in shaping Purkinje cell directional preferences during visually guided saccades.
Biology

Attention Deployment and Emotion Regulation in Preschoolers: An Eye-Tracking Study

Rivfka Shenoy

Mentor: Michael Gaffrey

The study of emotion regulation (ER) can help explain how people can live peaceably together, work well under stressful situations, and even predict how children will perform in academic environments. ER follows a rapidly developing course from infancy to adulthood. ER has been defined as a set of processes that alter (e.g., increase, maintain, or decrease) one’s response to emotionally evocative stimuli or circumstances. Understanding the developmental trajectory of emotion regulation has been a topic of significant interest since previous research suggests that the successful development of ER is a highly important predictor of future socioemotional functioning and academic success.

The objective of this study was to examine the use of attentional deployment in preschoolers through measuring pupil dilation during a period of increasing cognitive demand and analyzing the differential effect of task difficulty in the presence of an emotionally evocative stimulus. The study included the analysis of eighteen 4- to 6-year-old children performing a Line Task Paradigm (LTP) that required children to determine whether two lines on either side of emotional faces (fearful, neutral and sad) match. Behavioral measures of the child’s emotion regulation were also collected from parent reports.

This study found that children at this age group were able to successfully regulate their emotions in order to perform a cognitive task based on significant differences in pupil dilation between hard and easy trials when considering sad faces. Furthermore this difference was correlated with children’s scores on a parent-report measure of emotion regulation. At 4-6 years of age preschoolers exhibit physiological arousal suggestive of emotion regulation during a difficult cognitive task. Future research is needed to understand the developmental trajectory of this phenomenon.
Analysis of Recovery in a Post-stroke Population

Charlotte M. Srnka

Mentor: Catherine Lang

This Brain Recovery Core Project study examines change in the domains of physical function, cognition, communication, and participation in daily life in participants at 6 and 12 months post-stroke. Racial disparities in recovery and reported access to care are also investigated. Based on current literature, we hypothesized that participants will experience improvement between 6 and 12 months in all domains except physical function. We also hypothesized that African-American participants would experience less recovery in at least one domain and report less access to care than Caucasian participants.

Data were collected on participants with a primary diagnosis of stroke admitted to The Rehabilitation Institute of St. Louis from 2010 to 2012 who were contacted at 6 and 12 months post-stroke. Participants completed a survey that included the Stroke Impact Scale (SIS), Modified Rankin Scale (MRS), Reintegration to Normal Living Index (RNL Index), Functional Ambulation Category (FAC), a depression screen (SIS Mood and Emotions and PHQ-9), and questions about return to work and return to driving. One hundred two participants were analyzed. Paired sample t-tests showed no significant difference between 6- and 12-month time points for any variable. A two-way ANOVA with participant race as the dependent factor showed that African-American participants experienced less change between the 6- and 12-month time points than Caucasian participants on the FAC (p = .008), and fewer African Americans returned to work (p = .010). For disparities in access to care, a chi-square with race as a dependent factor showed African-American participants were less likely than Caucasian participants to report receiving outpatient rehabilitation (p = .041).

In summary, there was no significant change in functional status for cognition, communication, physical function, and participation in daily activities domains between 6 and 12 months post-stroke. Lastly, there were small racial disparities in recovery and reported access to care.
Coevolution of Sensory Systems: Comparing the Role of Visual and Electroreceptive Systems in Social Communication Behavior of Weakly Electric Fish

Jennifer Stevens

Mentor: Bruce Carlson

Mormyrid fish use electricity to communicate, and they process electric signals in the EL brain region. In some species, EL is smaller and undivided, but in others, it is enlarged and divided into ELa (anterior) and ELp (posterior). Several species with ELa/ELp likely use temporal aspects of electric signals for species recognition, but the sensory modalities used for species recognition in EL fish are unknown.

We hypothesized that EL species rely more on vision for communication and thus have an enhanced visual system as compared to ELa/ELp mormyrids. To test this, I compared the visual system across species. I surveyed species descriptions in the literature and found that EL species have larger eyes than ELa/ELp species on average. I also measured the volume of the optic tectum, a brain region involved in visual processing. EL fish have larger optic tecta than ELa/ELp mormyrids. To ascertain whether behavior correlated to anatomy, I spun stripes around a circular fish tank and counted number of laps swum by the fish to determine what types of visual stimuli elicited behavioral responses. A response greater than that to a solid control suggested the fish could see the stimulus. I varied stripe width to measure visual acuity, and contrast between stripes to measure contrast sensitivity. Although all species tested showed similar contrast sensitivity, EL species have better visual acuity. These data support the hypothesis that EL mormyrids have an enhanced visual system as compared to ELa/ELp fish.

I found that the closest outgroup to mormyrids has small eyes, similar to ELa/ELp fish, while further outgroups have intermediate eyes and visual acuity, so the ancestral state for mormyrids is likely a simpler visual system. EL fish perhaps evolved to rely more on vision while ELa/ELp fish depend more on electrosensation for social communication. Coevolution of sensory systems in mormyrids thus suggests that different sensory systems can have similar potential for communication.
Effect of Divalent Cations on the Sodium-Dependent Potassium Channel Slo 2.2

Qi Sun

Mentor: Larry Salkoff

The SLO family channels are high conductance potassium channels that are gated by voltage and intracellular ions. Two integral members of this family, the Slo2.1 and Slo2.2 (Slack), are different in that the former is activated by calcium and the latter by sodium. The SLO family channels are important in neurobiological research due to their common expression in the brain in humans and C. elegans. The activating effect of divalent ions on Slo1 is well documented, but their effect on Slack channel is largely unstudied. Interestingly, all of the divalent ions that were reported to activate Slo1 channels inhibit Slack channels by reducing channel activity. The main goal of this project is to examine and understand the effects of several divalent cations on the Slack channel.

Previous research has shown that high sodium is needed to activate the Slack channels. It was originally proposed that this channel was an emergency conductance only active during hypoxia. This is because when cells experience low oxygen, ATP will be in low supply. This will affect the activity of the ATP-activated sodium potassium pump and resulting in more sodium inside the cell. With high intracellular sodium, the Slack channel opens.

However, our experiments showed that this is not correct. During hypoxia, there is also high concentration of intracellular divalent cations. By implementing the inside-out patch clamp technique on human embryonic kidney cells, we were able to examine the degree of inhibition due to each individual divalent cation at different concentrations. Among the divalent cations studied, the relative effectiveness in reducing channel activity was Zn\(^{2+}\) > Cd\(^{2+}\) > Ni\(^{2+}\) >> Ca\(^{2+}\) > Mg\(^{2+}\). Zn\(^{2+}\). The effect of divalent ions on Slack was not by blocking the pore; there was no evidence of voltage dependence of the inhibition and the conductance of the channel remains constant. Interestingly, barium cation which had been reported to block Slo1 channels also inhibited Slack channels but, unlike all other divalents, had an obvious pore-blocking effect and showed an increasing block at more positive membrane potentials.
MLL1 in Retinal Development

Ray Suzuki

Mentor: Shiming Chen

MLL family members have been shown to regulate HOX gene expression in development and maintenance. MLL1 is necessary for postnatal neurogenesis in the subventricular zone of the brain. It is currently unknown how histone methyltransferases and demethylases regulate neuronal differentiation in the retina. We have decided to investigate the role of Mll1 in the maintenance of photoreceptors and the development of retinal cell types. Mll1<sup>flox</sup> mice were bred to Crx-Cre mice to conditionally knock out (CKO) Mll in developing photoreceptors. Additionally, Mll1<sup>flox</sup> mice were bred to Rho-Cre and Cone-Cre transgenic mice to conditionally knock out Mll1 in differentiated rods and cones, respectively. Expression of Mll1 was analyzed using qRT-PCR and in situ hybridization. Histology assays were used to detect morphological changes. The changes in retinal cell types analyzed using immunohistochemistry (IHC). Electron microscopy (EM) was used to visualize the synapses between the photoreceptors and the inner retinal neurons. Electroretinogram was used to detect functional defects.

We have found that Mll1 is expressed in all cell types of the mouse retina during development. To our surprise, Crx-Cre line expressed Cre recombinase in all retinal layers in superior-inferior gradient. As a result, Mll1 CKO retina shows thinning of all neuronal layers corresponding to the Cre expression pattern. IHC and EM assays further defected aberrant synaptic connections between photoreceptors and inner neurons. Consistent with these morphological defects, Mll1 CKO mice have decreased retinal function in response to light, indicating malfunction of both rod/cone photoreceptors and inner neurons. Finally, knocking out Mll1 in differentiated rods/cones showed no detectable defects in retina morphology and function.

MLL1 is necessary for development of retina structure and function but not essential for the maintenance of photoreceptor cells. Further study must be done in order to determine the cellular and molecular mechanisms that contribute to the phenotype we observed during retinal development.
Autophagy is Rapidly Induced in Dopaminergic Neurons by the Parkinsonian Mimetic MPP⁺
Eric Tsai

Mentor: Karen O’Malley

Parkinson’s Disease (PD) is a debilitating neurodegenerative disorder in which patients experience the four primary motor symptoms of resting tremors, bradykinesia, rigidity, and postural instability. These four motor symptoms are caused by the rapid retrograde degeneration of dopaminergic (DA) cells in the substantia nigra pars compacta, ultimately leading to substantially reduced DA transmission to the striatum. The loss of DA cells in the nigrostriatal path can be mimicked in mice using the environmental toxin MPP⁺ (1-methyl-4-phenylpyridinium). A variety of potential mechanisms have been proposed to attempt to explain the progressive DA cell death seen in PD patients, including oxidative stress and misfolded proteins. These various cell death pathways have all ultimately been linked to a process known as autophagy. Autophagy is a cellular mechanism that is used for the bulk degradation of cytoplasmic contents. It serves as both a constitutively active cellular recycling pathway and a response to stressors such as starvation or organelle damage. The purpose of this study is to characterize the role that autophagy is playing in the rapid neurodegeneration that is seen in PD patients and attempt to correlate it the O’Malley lab’s previous studies on the effects of MPP⁺ on mitochondria. Using the mouse model, we sought to investigate the temporal progression of autophagy over a specific time period during MPP⁺-induced DA cell death and determine whether or not autophagy occurs after the mitochondrial membrane depolarization that has been seen to accompany MPP⁺ treatment. Midbrain cells from mice were transfected with fluorescently labeled LC3 and treated with MPP⁺ for different lengths of time. We show that following treatment of midbrain cells with MPP⁺, there is a sharp increase in autophagosomal structures in DA but not non-DA neurons. This increase seems to imply that autophagy is most likely playing an early neuroprotective role during MPP⁺-induced DA cell death. By further studying and refining the timing of mitochondrial damage and autophagosomal maturation following MPP⁺ treatment, we hope to achieve a better and more complete understanding of the neurodegeneration that occurs in PD and the role that is being played by autophagy.
Changes in Resting Metabolic Rates Enabled Brain Size Diversification in African Weakly Electric Fish

Robert S. Wang

Mentor: Bruce A. Carlson

Much research has been done on the benefits conferred by larger brains, but relatively little attention has paid to the evolutionary mechanisms behind encephalization. Neural tissue is energetically expensive; our brains comprise 2% of our body mass but 20% of our total metabolic oxygen consumption. There are two hypotheses for how the energetic demands of increasing brain mass have been met: the increased energy budget hypothesis suggests that larger-brained species have increased overall energetic requirements, while the energy trade-off hypothesis predicts that increases in brain size are accompanied by reductions in energetically costly behaviors or tissues. I tested these hypotheses in a family of African weakly electric fish (Mormyridae) notable for their unique electrosensory systems and large, metabolically expensive brains. I dissected various mormyrid species and related outgroups to examine the relationships between brain mass and the masses of other organs, and designed a respirometry experiment to measure these fishes’ resting oxygen consumption rates. My experiments revealed both increasing and decreasing encephalization in mormyrids, and I found that changes in brain mass did not involve tradeoffs with other tissues but instead were accompanied by changes in metabolic rates. A previous study comparing one mormyrid species to more distant outgroups found a tradeoff between brain and gut mass, but my data support the energy budget hypothesis of brain evolution instead. Together, these results suggest that the mechanisms behind brain size evolution may differ depending on scales over which we observe these changes.
Cilia are organelles with roles in host defense, cell sensing and signaling. The complex nature of cilia requires a highly regulated program for assembly and function. Primary ciliary dyskinesia (PCD) is a genetic disorder of motile cilia characterized by impaired ciliary function, resulting in chronic lung disease and infertility. Genetic heterogeneity of this syndrome has limited the diagnosis in many individuals, while the pursuit of pathophysiologic mechanisms has taught us more about proper cilia assembly. Our PCD study group has identified two novel genes, \textit{LRRC6} and \textit{CCDC65}, whose mutated forms are associated with clinical features of PCD. We hypothesized that both LRRC6 and CCDC65 are required for the assembly of cilia. We characterized the expression and function of these proteins through analysis of related cilia structure proteins and genetic silencing of \textit{LRRC6} and \textit{CCDC65} in normal human airway epithelial cells. Mutation in \textit{LRRC6} was associated with ciliary dynein arm defects and immotile cilia. In contrast, mutation in \textit{CCDC65} was not associated with clear structural abnormalities. Both LRRC6 and CCDC65 localized to the cytoplasm of ciliated cells. The cytoplasmic localization of both proteins suggests they are required for cilia assembly rather than cilia structural stability or motility. \textit{LRRC6} silencing in human epithelial cells resulted in cilia with reduced or absent beat frequency, similar to the phenotype observed in PCD subjects. The absence of inner and outer dynein arms and mislocalization of LRRC6 in silenced cells further suggested that LRRC6 plays a role in dynein arm assembly and cilia component trafficking. In contrast, \textit{CCDC65} silencing resulted in cilia that were hyperkinetic. Interestingly, our data showed a decrease in CCDC65 expression in \textit{LRRC6} silenced cells, suggesting that the two proteins may be interdependent. These studies suggest that LRRC6 and CCDC65 contribute to the ciliogenesis pre-assembly pathway.
Characterization of Genes in *Drosophila melanogaster* Involved in Actin Cone Formation during Spermatogenesis

* Bryan Webb

**Mentor: Kathy Miller**

Actin is an important protein that assembles and disassembles to form many of the cytoskeletal structures that mediate cellular actions and processes from vesicle transport to the movement of the entire cell in all types of eukaryotic cells. Despite the prevalence and importance of actin structures in cell physiology, the role of actin structures as well as the mechanisms and proteins governing its long term stability and reorganization responsible for these cell structures and processes to work properly has yet to be fully understood. In order to further understand processes that require the complex actin formations, spermatid individualization in *Drosophila* was used as a model. A specialized actin structure important for cellular remodeling during sperm development was studied. Spermatids start as syncytia but eventually divide into individual sperm. In order to facilitate the individualization of the spermatids, highly ordered structures called actin cones form at the base of the condensed sperm nuclei after elaboration of the axoneme and then move down the axoneme to remodel the membrane and remove cytoplasmic organelles and other molecules unneeded in the final spermatid. In order to further elucidate the identities and roles of proteins involved in this process, we screened a pre-existing collection of male sterile mutants for those with defects during spermatid individualization that suggested the proteins encoded by the genes were important for regulating actin assembly, disassembly or organization during individualization. Candidate genes were identified using whole genome sequencing, comparing the mutants to each other and a reference genome. We characterize here via complementation testing with characterized deletions that uncover each candidate gene, fertility assays and fluorescent microscopy of dissected testis and staining for the actin structures, the defects and potential genes responsible in two mutant lines, Z2-0538 and Z2-5563. We also use expression of RNAi during sperm development to help determine the gene causing the phenotype. While we have yet to identify the responsible gene for the phenotype in Z2-5563, the list of possible responsible genes has been narrowed to two in the case of Z2-0538. These results set the stage for further studies of how the various factors work together to build and maintain the appropriate actin structures for this differentiation process. Because actin and associated proteins are very conserved and actin structures have important roles in all eukaryotic cells, our results should have general application to many different cell types and processes.
Parkinsonism-Mimic, 1-methyl-4-phenylpyridinium (MPP⁺), Induces Rapid Parkin Translocation to Damaged Mitochondria in Dopaminergic Neurons

Huchuan Xia

Mentor: Karen O’Malley

Parkinson’s disease (PD) affects about one million people in the US and is caused by the loss of dopaminergic (DA) neurons in the substantia nigra. Understanding the neuronal and axonal degeneration mechanisms of these DA neurons is critical for developing potential therapeutic interventions. Recently evidence has suggested that mitochondrial damage is the initiating event of these degeneration mechanisms and that PD-linked genes such as Parkin might be involved in regulating mitochondrial health. Peripheral model studies have suggested that Parkin is translocated to damaged mitochondria and then triggers mitophagy, a process by which the damaged organelle is destroyed. However, the role of Parkin in bona fide DA neurons remains unknown. Here we report that CCCP and MPP⁺, both of which damage mitochondria by depolarizing the membrane potential, induced Parkin translocation to mitochondria in mesencephalic neurons in a temporally distinct fashion. MPP⁺ led to rapid Parkin translocation that was specific to DA neurons, whereas CCCP-induced Parkin translocation took almost 24 hours. Addition of lysosome inhibitors increased the level of Parkin translocation and its effect was additive to CCCP. These findings suggest that Parkin does not respond to just depolarization; rather, other signals must also be involved. These results not only provide more evidence to Parkin’s role in preserving mitochondrial dynamics in DA neurons, but also point to a convergence of environmental risk factors and genetic mutations associated with PD that lead to abnormalities of energy metabolism, oxidative stress and protein degradation.
Temporal Responses of Aquatic Invertebrate Communities to a Rotenone Disturbance

Muxi Yang

Mentor: Kevin Smith

Anthropogenic disturbances such as habitat destruction and pesticide usage can have detrimental effects on the species diversity of ecological systems. The species diversity of a system is not only affected by the immediate effect of a disturbance event, but also by the long-term recovery process of the system. This project aims to address the gap in our understanding of recovery of species diversity at multiple spatial scales, as well as recovery of community structure by examining both the short-term effect of disturbance and longer-term recovery from disturbance in an aquatic system in Missouri, USA. In this study the disturbance was application of rotenone, a commonly used piscicide that is also toxic to many aquatic invertebrates. We measured zooplankton and macroinvertebrate species richness and abundance prior and post rotenone application in six control ponds and six treatment ponds at Washington University’s Tyson Research Center. In zooplankton species, rotenone caused statistically significant decrease in local species richness both one week post-disturbance and one month post-disturbance. Regional species richness showed no significant change due to rotenone disturbance, indicating that rotenone caused no regional extinctions. Post rotenone disturbance, beta diversity increased for the treatment ponds, which suggested that the loss of local zooplankton diversity was stochastic rather than deterministic. Across taxa, cladocerans showed the greatest decrease in species richness one week post-disturbance, demonstrating that they were most sensitive to rotenone disturbance among all taxa. The species richness of copepods showed statistically significant decreases only one month post-disturbance. In the time frame of our study, neither species richness nor abundance of the majority of zooplankton species recovered at either local or regional spatial scales. Only rotifers showed marginally significant recovery of local diversity one month post-disturbance. However, in macroinvertebrates, rotenone showed deterministic effects that caused disproportional decrease in local and regional diversity, resulting in community homogeneity. In the same time frame, both local and regional diversity of macroinvertebrates recovered to pre-disturbance levels.
Investigation of Maternal Genotype Effects in Autism by Genome-Wide Association Study

Han Yuan

Mentor: Joseph Dougherty

Like most psychiatric disorders, autism spectrum disorders have both a genetic and an environmental component. While previous studies have clearly demonstrated the contribution of in utero (prenatal) environment on autism risk, little attention has been paid to the maternal genome. Based on a recent sibling study, we hypothesized that these environmental effects could also come from the maternal genome.

We examined the possibility of maternal genotype effects by looking for common variants (single nucleotide polymorphisms, or SNPs) in the maternal genome associated with increased risk of autism in children. We performed case/control genome-wide association study (GWAS) based on a logistic model using mothers of probands as cases and either fathers of probands or normal females as controls. Autism Genetic Resource Exchange (AGRE) and Illumina Genotype Control Database (iCon) were used as our discovery cohort (n=1616). The same analysis was then replicated on Simon Simplex Collection (SSC) and Study of Addiction: Genetics and Environment (SAGE) datasets (n=2732).

We didn’t identify any SNP that reached genome-wide significance (p<10^-8) and thus ruled out the possibility of common variant of large effect. However, there was evidence for the possibility of a large number of alleles of effective size marginally below our power to detect. This suggested that maternal genetic effect of autism may be the result of multiple loci each carrying a small effect and a polygenic model may be more informative in future studies. Also, we may take maternal-fetal genotype interaction and imprinting into account in future investigation of maternal effects on autism risk.
A Systematic Survey of Notch Activation in Adult Tissues and Stem Cells

Andrew Zhang

Mentor: Raphael Kopan

The evolutionarily conserved Notch signaling pathway has significant roles in the development and maintenance of multiple tissues in metazoan species. However, due to the lack of good reagents, a systematic survey of its activation and role in adult tissues, particularly adult stem cells, is lacking. Here we aim to systematically map the fate of cells that activate two of the most important Notch paralogs, Notch1 and Notch2, in adult tissues, including adult stem cell compartments, using two newly established tamoxifen-inducible, activation-dependent Notch reporter lines, Notch1-CreERT2 and Notch2-CreERT2. We adopted the “pulse-chase” strategy by labeling the cells and then following their fates. We found that Notch2 labeling persists a couple of months after tamoxifen induction in all lineages in the gut, which generally has a turn-over rate of 3-5 days (except paneth cells), suggesting that Notch2 is activated in the gut stem cells. Similarly, we observed Notch2 labeling in adult neural and muscle stem cells. For Notch1, we observed its labeling in skin, muscle and perhaps neural stem cells. In addition, for both Notch1 and Notch2, we found scattered labeled cells in various other organs, suggesting a possible role in the maintenance of these terminally differentiated cells in the adult stage. Our study warrants future functional study of Notch1 and Notch2 in these labeled cells.
NIK Stabilization Leads to Increased Bone Resorption in vitro via Cytoskeletal Changes in the Osteoclast

Hanci Zhang

Mentor: Deborah Novack

The NF-κB inducing kinase (NIK) is a central regulator of the alternative NF-κB nuclear signaling pathway, and its activity promotes both osteoclastogenesis and bone resorption. While the downstream gene targets of NIK-mediated signaling in relation to cell differentiation have been described, the mechanisms by which NIK and alternative NF-κB signaling influence osteoclast function are unclear. To more precisely understand the effects of alternative NF-κB, this study examined the impact of a constitutively active NIK mutant on bone resorption. In histomorphometric analyses of osteoclasts grown on hydroxyapatite matrix, enhanced NIK activity resulted in a significant increase in inorganic mineral resorption, likely due to enhanced acid secretion. While gene expression assays did not indicate a significant increase in the transcription of the osteoclast V-ATPase proton pump, transcriptional and protein analyses did suggest higher levels of the Rac1 and DOCK5 cytoskeletal regulators in osteoclasts with stabilized NIK mutant. Although more study is needed, it is likely that NIK and the alternative NF-κB pathway enhances bone resorption by stimulating cytoskeletal remodeling. By better understanding the mechanisms by which alternative NF-κB signaling impacts osteoclast function, our findings aim to guide future treatments for bone disease.
Nociceptin/Orphanin FQ Opioid Receptor (NOPR) Intracellular Trafficking and JNK Signaling Require c-terminal S363

Nancy Zhang

Mentor: Michael Bruchas

Nociceptin/Orphanin FQ opioid receptor (NOPR) is the least understood opioid receptor and plays a key role in pain modulation, opiate tolerance, and responsiveness to stress and anxiety. It has been reported that c-terminal phosphorylation at serine (S), threonine (T), and tyrosine (Y) residues are required for μ and κ opioid receptor internalization, desensitization, arrestin recruitment, and mitogen-activated protein kinase phosphorylation (pMAPK). To determine the molecular mechanisms for NOPR internalization, desensitization, and pMAPK, we mutated c-terminal residues of human NOPR. We generated alanine mutations at S363, T362/S363, T362/S363/T365, and S337/346/351. Using wild type and mutant YFP-tagged NOP receptors expressed in HEK293 cells, we visualized and compared nociceptin-induced internalization.

NOPR-YFP internalized within 15-30 minutes following treatment while NOPR-S363A significantly blocked internalization. In addition, we determined the time course and concentration-dependence of NOPR-YFP-mediated pMAPK. Nociceptin caused robust increases in pERK and pJNK cascades. NOPR-YFP-induced pERK peaked at 10 minutes following treatment and pJNK peaked at 30 minutes. NOPR-S363A showed markedly reduced pJNK levels. We further determined that NOPR-YFP internalization is blocked via arrestin3 and GRK3 shRNAs and that NOPR-S363A internalization and pJNK can be rescued via expression of a dominant positive arrestin3 (DP-Arr3). These data implicate GRK/arrestin in NOPR MAPK signaling and highlight the potential for the development of functionally selective NOPR-ligands.
Beyond the Border:
A Comparative Approach to Women’s Fiction about Migration between Morocco and Spain

Alina Cerisse Cohen

Mentor: Tabea Linhard

In this study, I argue for a comparative perspective in literary study that unites works from different national and linguistic traditions. In analyzing three contemporary novels written by women about migration between Morocco and Spain, I propose that feminist, post-colonial and narrative theories serve to best elucidate similarities and differences within the texts. A comparison of textual structures and themes in Laila Lalami’s Hope and Other Dangerous Pursuits (2005), Najat El Hachmi’s L’ultimo patriarca (2008) and Esther Bendahan’s Déjalo, ya volveremos (Leave It, We’ll Return) (2006) revealed three divergent perspectives on the same topic. The novels, written in English, Catalan, and Spanish, respectively, problematize cross-cultural understanding, the integration of immigrants into new communities, family relationships, religion, and forms of language acquisition. Through comparing three different narrative voices, a more comprehensive understanding of the literary portrayal of migrations between two countries with a complex and troubled past emerges. An examination of the relationship between Morocco and Spain, from Spain’s Moorish past to its colonial influence in Morocco, also aids in this study. This thesis is an effort to reveal the limits of defining novels based on national and linguistic origin and constructing rigid literary canons. As the world becomes increasingly globalized, a comparative approach which links fictions across the globe is the most productive manner to study contemporary literature.
Localized Subcritical and Widespread Convection in the Venusian Crust

Diana L. Goeller

Mentor: Slava Solomatov

Two-dimensional numerical simulations of infinite Prandtl number convection in temperature-dependent viscosity fluids reflecting a range of Arrhenius rheologies applicable to the Venusian crust demonstrate the possibility of both localized subcritical and widespread (supercritical) convection for grain sizes within the expected range. This finding is in stark contrast with previous assumptions that the extremely dry Venusian lithosphere does not convect. Stable localized subcritical and widespread convection are simulated in regions of mild to extreme lithospheric thinning and crustal thickening which are correlated with the highest topographical features. Crustal convection may play a role in the formation of these features. A dependence of localized convective cell magnitude on the Rayleigh number $Ra$ is also observed, which may offer a new way to gain insight on the shallow internal structure and rheology of terrestrial bodies. Additionally, localized subcritical and physically constrained widespread convection may help planetary scientists to understand the formation and longevity of localized planetary features, including the crustal dichotomy and Tharsis region of Mars and the asymmetric pattern of volcanism on Mercury, and may offer a mechanism for localized subduction and plate tectonics.
The discovery of Fe, Mg, and Al clays on Mars using VNIR spectroscopy from orbit indicates past low temperature/pressure hydrothermal alteration and weathering of basaltic rocks. Laboratory analysis of Mars-analog rocks from similar settings on Earth was used to build the ChemCam sample library for Mars Science Laboratory, permitting for more accurate compositional analysis of Martian samples, improved linkages between VNIR’s mineralogic and ChemCam’s elemental data, and improved recognition of different environmental settings for aqueous alteration. VNIR spectroscopy was used to analyze a suite of altered basaltic rocks from San Carlos, AZ. Continuum shape and absorption features were found to vary, depending on the environment and extent of alteration. Relatively unaltered rocks had electronic absorptions related to ferrous iron. The strength of the 1.9-μm H₂O absorption correlated with the degree of aqueous alteration. Samples with strong 1.9-μm absorptions often exhibited absorption bands at 1.4, 2.2, and 2.3 μm indicating the presence of clay minerals and/or features at 0.5-0.8 μm indicative of ferric iron oxides. Diagnostic absorption features and continuum slopes were used to identify a representative subset of rocks from each suite for further characterization with electron microprobe and bulk chemical analysis. Bulk chemical analysis indicates that alteration was isochemical, with little variation in most of the major oxides. Compositional imaging and spot analyses along sample edges and in the interiors of rock sections with the microprobe revealed distinct alteration textures and phases, pointing to possible weathering pathways involving oxidation of iron. Bivariate plots of major oxides both from bulk chemical analysis and microprobe measurements also revealed distinct trends in alkali depletion and iron enrichment compared to silica.
Hyperspectral images from the Mars Reconnaissance Orbiter (MRO) Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) contain an abundance of geologic information that can be obscured as a result of scattering and absorption by aerosols and gases in the atmosphere. CRISM scene FRT0001D86B, covering Cape York, Endeavor Crater, Mars, was acquired with a set of five emission phase function (EPF) images taken of the same site at different emergence angles for study of the atmosphere and separation of atmospheric and surface signals. DISORT radiative transfer code is used to model the atmosphere and surface for this scene at VNIR wavelengths with variable optical depths of dust ($\tau_{\text{dust}}$) and a Hapke function with a two-term Henyey-Greenstein single particle phase function. Parameters for the single particle phase function are asymmetry factor and forward fraction, which together define directional scattering of light by the surface. Combinations of $\tau_{\text{dust}}$, asymmetry factor, and forward fraction are tested with EPF and central scene single scattering albedo spectral retrievals, which converge when atmospheric effects have been successfully removed. A chi-squared statistic is computed for spectra from overlapping pixels in the central scene and EPFs at every wavelength. Minimized chi-squared values are seen in the case where $\tau_{\text{dust}} = 0.6$; optimal combinations of asymmetry factor and forward fraction vary with wavelength, but all of these cases fall near an empirically defined region shown in Mars surface photometry work of Jeffrey R. Johnson et al. These asymmetry and forward fraction values are fit with a polynomial curve to define a wavelength-dependent single particle phase function for the scene. Using this function, higher forward fractions work better for higher single scattering albedos, implying that brighter surfaces are more forward scattering. Single scattering albedos derived from this model can be used to retrieve mineral abundances from spectral analysis or spectra can be recast to laboratory instrument geometries.
The Compton-Belkovich Volcanic Complex (CBVC) is a 25 x 35 km feature on the lunar farside marked by elevated topography, relatively high albedo, high thorium concentration, and high silica content. Morphologies indicate that the complex is volcanic in origin and compositions indicate that it represents rare silicic lunar volcanism. Constraining the timing of silicic volcanism at the complex is necessary to better understand the development of evolved magmas and when they were active on the lunar surface. Lunar Reconnaissance Orbiter Camera images reveal the surface morphology of the complex and surrounding areas, including small volcanic domes, and irregular depressions interpreted as collapse features associated with volcanic effusion. We employ image analysis and crater size-frequency distribution (CSFD) measurements on several locations within the complex and at surrounding impact craters, Hayn (97 km diameter) and Compton (160 km diameter), to relatively and absolutely date the regional resurfacing events. From morphologic and superposition relationships, the CBVC appears to be younger than Compton Crater but older than Hayn Crater. Using CSFD measurements, we establish a chronology dating regional background resurfacing and the earliest possible onset of CBVC volcanism to ~3.8 Ga, the impact of Compton Crater to 3.6 Ga, the latest likely resurfacing by volcanism at the CBVC to 3.4 Ga, and the impact of Hayn Crater at just under 2 Ga. We constrain volcanic activity at the CBVC to 3.8-3.4 Ga. Additionally, we examine the utility of CSFD measurements on small craters (down to 10 m in diameter) using measurements of all craters on images with spatial resolution as low as 0.5 m per pixel. We find the most consistent results to be obtained using craters larger than 300 m in diameter in the CSFD analysis. The size-frequency distributions of craters less than 300 m diameter appear to have been affected by approach to an equilibrium distribution and are not useful in determining the age of the complex.
Choices in Two-Person Interactions: The Effect of Amount and Social Distance on Offers in the Dictator and Ultimatum Games

Christopher Bechler

Mentor: Leonard Green

Proposers in the Dictator Game and the Ultimatum Game often do not act as normative economic theory predicts. Offers are frequently higher than what would be considered income maximizing. The present study investigates two effects on the amount offered by the proposer. The first is whether the initial amount provided to the proposer systematically affects the amount offered (a magnitude effect). The second is whether the social distance between the proposer and responder influences the amount offered (the social distance effect). Three amounts ($10, $3,000, and $250,000) at each of three social distances (2, 20, and 100) are studied under the Dictator Game and the Ultimatum Game. The amount offered is consistently higher under the Ultimatum Game, and the proportion of the amount offered decreases both as the size of the initial endowment increases and as the social distance between proposer and responder increases. The pattern of findings is not differentially affected by demographic factors, including gender, age, education, income, ethnicity, race, religion, political ideology, political affiliation, geographic region, or city size, with the exception of a gender difference in the Dictator Game. Offers made to relatives are higher than those made to non-relatives at a social distance of 2 for the Dictator Game, but are not significantly different for the Ultimatum Game. These results extend the generality of findings with two-person economic games and argue for the importance of amount and social distance in understanding why people fail to conform to normative economic predictions.
Prices and Availability of Healthy Foods across St. Louis

Madeleine Daepp

Mentor: Bob Parks

A number of recent policy interventions have focused on “food deserts,” areas where inhabitants have limited access to nutritious foods, as causal factors in the United States’ obesity epidemic. Yet in the city of St. Louis, many areas with high concentrations of high-risk, low-income households do not qualify as food deserts. I survey grocery and convenience stores in areas with differing levels of median household incomes to examine the state of food access in these regions. Although I do not find evidence of a correlation between the prices of healthy foods and median household income, availability of healthy items is significantly more limited in areas with low median household incomes. This result suggests that reliance on the food desert measure will not adequately address the problem of variable food access in St. Louis.
Social security can serve as a tool to transfer wealth across generations and relieve the over-accumulation of capital. In this paper, I try to explore the capability of the social security system to deal with demographic and production shocks. Using a modified OLG model with uncertain life expectancy and production, I derive the optimum under different preferences of the government. I find that if the government is Utilitarian, the optimal PAYG contribution rate should be a positive concave function of capital labor ratio. If the government is Rawlsian, a small adjustment in PAYG contribution rate can make a significant improvement in the consumption of the worst-off generation.
Does Firing the CEO Improve the Company’s Performance in the Long Run?

Yifan Zhu

Mentor: Bruce Petersen

This paper investigates whether firing the CEO of a publicly traded firm improves or harms long-run stock performance. I employ a matched sample design where every company with an involuntary CEO replacement is matched with a company without a CEO replacement in the same 4-digit SIC industry. The regression results show a negative and statistically insignificant relationship between CEO firing and stock return. While the lower returns for firms replacing their CEO is insignificant, the magnitude is substantial, suggesting that the board should handle CEO replacements with extra caution.
The Influence of Culture on Education and Applied Behavior Analysis in the United States and Denmark

Zoe Tabachnick

Mentor: Thomas W. Allen

The present study aims to examine whether cultural divergences are reflected in evaluation and implementation of Applied Behavioral Analysis programs. The United States is characterized as vertically individualistic, in that hierarchical rank and competition is encouraged, whereas Denmark is characterized as horizontally individualistic, in that homogeneity and equality are cultivated. Each culture’s educational practices reflect these identities: Danish schools tend to emphasize social competency and communal activities, and American schools tend to emphasize academic achievement and competition. Applied Behavior Analysis is a therapeutic intervention commonly implemented with children with autism spectrum disorders that employs educational techniques. Three American and three Danish ABA practitioners evaluated three cases of children with autism who are seeking ABA therapy. Practitioners answered questions about priorities and techniques of intervention. Although the sample size was too small to provide conclusive evidence, responses elevate interest in further examining the relationship between cultural influence and therapeutic practice. The discussion of the findings focuses on the value of consistency between therapeutic interventions and cultural practices.
The Affliction of Loneliness: The Revision Process of Tennessee Williams
Leah Roth Barsanti

Mentor: Julia Walker

The overarching focus of my thesis is Williams’ revisions and the ways in which he used these revisions as a means to attempt to communicate with his audiences and, in doing so, overcome his feelings of loneliness. I argue that loneliness is something that plagued Williams throughout his life, that loneliness was what drove the playwright to revise as extensively as he did, and that loneliness is also what drove him increasingly toward drama—which offers a communal experience that prose writing doesn’t—throughout his career. I go on to explore the ways in which issues of craft and theme helped Williams to better communicate his subjective feelings of loneliness and the ways in which the collaborative nature of playwriting can damage the vision of a playwright by undermining the “thing” which he is trying to communicate.
Programmatic Resistance: Theory and the Artist in Contemporary Academic Fiction

David Lamb

Mentor: William Maxwell

Recognizing academic fiction as an important genre of contemporary American literature, this thesis examines university-related obstacles to contemporary literary production and the strategies academic fiction invites for overcoming them. In particular, I focus on strategies of authorial reflexivity and engagements with literary theory in three influential works of academic fiction written by prominent contemporary authors: “Westward the Course of Empire Takes Its Way” (1989) by David Foster Wallace, Blue Angel (2001) by Francine Prose, and Galatea 2.2 (1995) by Richard Powers. I propose that these strategies and engagements form a kind of alternative writing program in an era fraught with two major academic obstacles to the production of serious literary art: namely, the difficulty of communicating authorial intentions to critics who have internalized the idea of “the death of the author,” and the clash between the aging ideal of artistic autonomy and many living writers’ real reliance on academic institutions for financial support.
“She Felt So Afraid of Dying”:
Health, Illness, and Narrative Structure
in Wuthering Heights, The Tenant of Wildfell Hall, and Jane Eyre
Katherine Marcal

Mentor: William McKelvy

Because of the Victorian Era’s historical connection to the birth of clinical medicine and psychiatry, the literature of the time was uniquely positioned to offer insight into questions of body, mind, consciousness, and morality that arose during the development of these sciences. Vaguely overlapping and indefinably linked, mental and physical illness threatened nineteenth-century domesticity, gender roles, and social structures dependent on conformity. The Brontë sisters, privileged by their historical circumstances and resulting awareness of pre-biomedical health care, enable entry to a world shaped by conflicting uncertainty and enlightenment. In their novels, the Brontës use physical and mental illness as a means of emphasizing and distorting established social structures and gender roles. Illness serves as an opportunity for alternate, socially “diseased” voices to emerge as potentially valid sources of development and enlightenment. Patients and practitioners navigate the obstacles of illness through an exchange of information, compassion, and power. In Wuthering Heights, the conventional correlation between health and morality is overturned, mirroring a similar destruction of established class structures. The Tenant of Wildfell Hall uses illness to delineate gender roles and highlight the inherent inequities of a patriarchal society; illness is embedded in the fabric of society itself and, ultimately, the structure of the novel itself. Finally, Jane Eyre encapsulates female aberrance in a single case of severe mental illness, suggesting that women must necessarily conform to rigid standards and suppress any trace of deviance in order to successfully attain domestic bliss. In each novel, illness shapes the narrative and creates competing voices possessing various levels of health, reliability, and awareness. Unbound by modern diagnostic criteria and the total professionalization of medicine, the Brontës’ novels suggest a universal human experience of mortality that carries into the modern world.
English

Complexities of Womanhood: Gendered Existence in William Faulkner’s Novels

Lydeah Grayce Negro

Mentor: William Maxwell

When Jason in William Faulkner’s novel *The Sound and the Fury* proclaims “Once a bitch always a bitch, what I say,” how much of this idiom does Faulkner’s work promote? Feminist analysis offers important insight into some of the most character-intensive of William Faulkner’s novels: *The Sound and the Fury* (1929), *As I Lay Dying* (1930), and *Absalom, Absalom!* (1936). His novels portray women struggling with issues of sexuality, reproductive rights, and most importantly, family. Faulkner manages to present several portraits of women confronting these issues, igniting conversation about the evolving status of the female body, mind, and spirit. Critics conclude that his canon portrays women as either subjugated or powerful, sexually in control or sexually abused, heard or forgotten. With this confusion among experts, I sought to humbly answer the question: how does Faulkner’s work actually portray the female experience?

Through Faulkner, I discovered that the female experience is never wholly in opposition to the male experience, nor is it ever wholly in conjunction with it. Instead, both gendered existences work simultaneously against and with each other, producing something much more accurate to the true experience of being male or female. Through many different portrayals of existence, of experiences, of trauma, of pain, of love, and of communication, William Faulkner strives to encapsulate the slippery substance that is truth of experience, specifically gendered experience. As Faulkner explains best himself “I think that no one individual can look at truth. It blinds you. You look at it and you see one phase of it. Someone else looks at it and sees a slightly awry phase of it. But taken all together, the truth is in what they saw though nobody saw the truth intact.” Through three of his most prominent novels, William Faulkner creates characters whose gendered experiences together strive to create “the truth intact.”
Psychologists and sociologists have studied the nature of family and individual identities cross-culturally, defining differences in cultural values like collectivism and individualism. Literature and literary theory have also dealt with these cultural differences and the anxiety surrounding identity formation, family identity, and sexuality. The family seems to occupy a uniquely problematic role in postcolonial literature. These issues are apparent in the novels’ portrayal of dysfunctional identity formation and the repeated occurrences of incest. *One Hundred Years of Solitude* and *The God of Small Things* are two excellent examples of postcolonial literature that address family troubles, collectivism, identity, and incest. I chose to discuss these two novels because the families in both texts are so central to the plot and to the characters’ identities. Incest is a key theme in both novels and demonstrates the problematic family relationships as well as the attempted solution to fragmentation and isolation. Incest is also a way in which Roy and Marquéz demonstrate and then condemn the false promises of a collectivist society that promote segregation and rigidity. Other postcolonial texts that I have come across that deal with incest in some form include Bapsi Sidwha’s *Cracking India* and Salman Rushdie’s *Midnight’s Children*. I will examine these issues in my thesis by combining perspectives from the fields of psychology, sociology, and literature to understand what is at stake in the radical representations of sexuality and identity these novels offer.
“What if Society Allows Humanities Studies to Fade?”: Examining Dystopian Visions in Fact and Fiction

Melanie Walsh

Mentor: Vincent Sherry

In 2011, National Endowment for the Humanities Chairman Jim Leach asked: “What if society allows humanities studies to fade in significance?” This question has been asked in a dozen variations in classrooms and universities across the globe. All of these questions seem to converge, however, with the same rhetoric of panic and fear, imagining a future where the humanities are extinct. Martha Nussbaum, in *Not for Profit: Why Democracy Needs the Humanities*, voices an urgent call to arms in just this way. She portrays the humanities in strict financial competition with science and technology and in dire jeopardy. If the humanities die out, she warns, the greater foundation of global democracy will be poised to crumble. These alarmist claims strongly resemble visions from the dystopian literary tradition—resembling novels like *1984*, *Brave New World*, and *Fahrenheit 451*, which specifically imagine the endangering or extinction of the humanities. I argue these visions have been unconsciously inherited by thinkers like Leach and Nussbaum. Through the lens of *Never Let Me Go*, *Brave New World*, and *Fahrenheit 451*, I hope to show that these alarmist claims actually misread the original dystopian texts—and that the original texts call for greater introspection from the humanities and a better cooperation with science and technology. I hope to ultimately shed light on how the humanities might best survive in a world that is increasingly dominated by science and technology.
Examining the Effects of Community Reduction and Acidification on Patterns of Extinction and Local and Regional Biodiversity of a Protozoan System

Vanessa R. Hensley

Mentor: Kevin G. Smith

Biodiversity is important for ecosystem health and function which in turn benefits many human activities such as farming, ecotourism and medicine development. Despite its importance, biodiversity is declining on a global scale and extinction levels are exceeding background rates. With several species under threat, it is crucial to understand not only why these extinctions are occurring but how these extinctions are affecting community structure and diversity over a range of spatial scales if there is any hope to slow or stop the current extinction crisis.

This study focuses on two disturbance events, community reduction and acidification, and their effects on local and regional diversity of a protozoan system. Through local and regional diversity measurements, species occupancy analyses and a null model of stochastic extinction, this study reveals two disturbances that lead to a reduction in both local and regional diversity and differ significantly from the biodiversity levels predicted by a null model of stochastic extinction. The selectivity of each extinction event and the associated increase in biodiversity loss given the magnitude of each disturbance provides a more complete explanation of these extinction events and sets the stage for future research on the understanding and characterization of mass extinction events. The results of this study should guide future conservation efforts to reduce the current rate of extinction and prevent the loss of biodiversity on a variety of spatial scales.
A central goal of ecology is to understand the processes that influence community assembly, which has important implications for the maintenance of biodiversity. Habitat filtering is a key process, and indicates that a given habitat selects for individuals with similar survival strategies. Limiting similarity, another process, proposes that competition may exclude species with similar strategies. Plant functional traits can be measured and used to study various processes of community assembly. While plant functional traits have been studied extensively as a way to learn more about community assembly, there are gaps in our knowledge of 1) how traits vary across multiple environmental gradients and 2) how trait-environment relationships vary across different functional groups (e.g., canopy vs. understory species). In this study, we examined relationships between community weighted means (CWMs) of five plant functional traits (leaf size, maximum DBH, seed mass, specific leaf area and wood density) across soil resource gradients (aluminum, nitrogen, phosphorus, pH and potassium) in a 12-ha oak-hickory forest dynamics plot at the Tyson Research Center, Missouri. If habitat filtering was important, we anticipated that trait values would be associated with environmental gradients. To test the hypothesis that CWM-soil relationships differ across functional groups, we performed separate analysis for all species combined, canopy species, and understory species. We found varying support for habitat filtering as well as limiting similarity, as only some traits were strongly correlated with soil gradients. In addition, CWM-soil relationships between canopy and understory species indicated that these different functional groups assemble differently. Our results indicate that studying functional groups separately can yield different results than studying them together, demonstrating the importance of analyzing functional groups separately. Furthermore, this study reveals that habitat filtering is an important process in the assembly of this forest, but that limiting similarity may also play a role.

Aaron Senser

Mentors: Philip Sewell and Richard Chapman

Space, the final frontier. Throughout history, this infinite abyss has captured the imaginations of writers, scientists, and explorers around the world. It’s no wonder that the science fiction genre has been well represented within the popular film and fiction canon. The mystery of what’s beyond our Earth calls up nostalgic memories of childhood wonder, the desire to reach beyond one’s limitations for something just out of reach. Likewise, cinema acts as a projection of the human mind, displaying our “dreams” upon a screen for an audience to marvel at. For children, film acts as one their first portals into not only new worlds, but also an introduction to cultural tropes and understandings about life.

For my thesis, I have written a Hollywood-style screenplay that attempts to act as both a form of entertainment and a reminiscence of juvenile conceptions of exploring the undetermined and entering maturity. Rather than relying on today’s exceedingly common use of pop culture and gross-out humor, I have strived to create a piece that can be appreciated by any age, in any era. It is a reflection on what it means to be a hero and how we connect to others when our standard methods of communication are increasingly mixed. My goal was to create a story that shows, for children and adults alike, that even when the future is dark, nothing is impossible.
Germany’s remarkable recovery from the devastation of World War II was characterized by booming consumerism, industrial growth, and a general improvement in the quality of life for German citizens. The economic revival of the 1950s and ’60s was so astounding that it quickly earned the moniker *Wirtschaftswunder*, or Economic Miracle. Many ordinary Germans enjoyed a rapid return to prosperity; however, contemporary authors tended to depict the rebuilding efforts with surprising pessimism. In this thesis, I trace the roots of these misgivings by studying the works of three prominent writers: Friedrich Dürrenmatt, Wolfgang Koeppen, and Heinrich Böll. The selection of texts is meant to provide a meaningful cross-section of writing formats and author perspectives from a period rich in literary activity. By analyzing specific symbols and motifs related to the *Wirtschaftswunder*, I attempt to discern which areas of German society, in both the public and private spheres, these writers found problematic in the postwar context. Together, these works convey a palpable sense of dread regarding the onset of a new, money-driven era in German history: their texts abound with dystopian imagery, allusions to fascism, and political and ethical corruption. With over fifty years of hindsight, their criticisms of contemporary Germany and their fears for its future provide a unique insight into how one of the most emphatic economic turnarounds in modern history impacted German identity.
The Tokyo War Crimes Trial prosecuted the top-level Japanese military and government officials for war crimes after World War II. It was both a problematic and important event in the development of international law. Following the example of the Nuremberg Trial, the Allied Powers created an international war crimes tribunal at the Tokyo Trial that was revolutionary in its scope and ambition. Like Nuremberg, the Charter of the Tokyo Trial included two crimes that had never before been prosecuted by a war crimes tribunal—“crimes against peace” and “crimes against humanity.” These crimes were controversial however, as they were considered to be “ex-post facto,” meaning they did not have valid legal precedent under international law at the time. This was particularly true for crimes against peace, the inclusion of which elicited much dissent from Japanese officials and scholars, including from former General and Prime Minister Tojo Hideki, and from members of the Tokyo Tribunal itself. The inclusion of these crimes inspired the charge of “victors’ justice” against the trial. The Allied Powers (especially the Americans) were accused of applying their own rules of right and wrong on the Japanese defendants without regard for established international law. The refusal to indict Emperor Hirohito, the lack of prosecution for the American use of the atom bomb, the inconsistent treatment of rape by the prosecution, and the failure to include the charge of experimentation of biological weapons on civilians and Allied prisoners of war were all Allied actions that weakened the legacy of the trial and supported the assertion of “victors’ justice.” While a valid claim, this thesis attempts to move beyond the idea of “victors’ justice,” examining the importance the Tokyo Trial held for future international war crimes tribunals and for establishing a comprehensive historical narrative of the actions of the Japanese military during the war and in the events leading up to it.
History


Adam Ezrapour

Mentor: Krister Knapp

Although numerous historians have studied the relationship between the United States and Pakistan, none have examined this relationship primarily through Pakistan’s historic use of militant proxy organizations to wage its foreign policy. This study, which combines a wide array of both American and South Asian primary and secondary sources, argues that Pakistan began using jihadist groups as a means of maintaining pressure on India in Kashmir, after it became clear that Pakistan could not maintain parity with its eastern neighbor through conventional military means. The initial successes of these militant groups in Afghanistan cemented the role of these groups as a useful foreign policy tool among Pakistani policymakers. However, after decades of arming and funding these groups, in the wake of September 11, 2001, Pakistan discovered that it could no longer control these increasingly radicalized organizations, some of whom would begin to wage jihad against the Pakistani state itself, after it declared its allegiance to the United States in the war on terror.

From the American perspective, Pakistan’s use of militant proxies was largely ignored until it began to directly effect American interests in Afghanistan. The United States aggressively supported the mujahideen fighters in their quest to evict the Soviets from Afghanistan. However, after the Soviets departed, the US began to view these militants as terrorists who threatened regional stability. The American invasion of Afghanistan in 2001 has dramatically strained relations between Pakistan and the United States, as militant groups, operating from Pakistan, continue to attack coalition forces in Afghanistan. However, despite the dangers they pose, Pakistan still refuses to fully cut ties to these groups, as it views them as essential in any future conflict with India.
History

Edge of an Empire:
Religion, Politics, and the Basilica of San Vitale in Ravenna, Italy

Elena Gittleman

Mentor: Mark Pegg

The Basilica of San Vitale is widely regarded as one of the most important East Roman churches outside of Istanbul. Began by a Catholic Bishop while the city was under Ostrogothic Arian rule, and completed after Justinian’s reconquest of the city, the church and its mosaic program provide a fascinating insight into a world at a crossroad. Many scholars have done a great amount of work on the imperial panels depicting Justinian and Theodora, and the narrative portions of the mosaic program, yet have widely ignored the details of plants, animals, birds, and water that make up the largest portion of the interior mosaics. It is believed that the mosaics were mostly designed and constructed before Emperor Justinian gained control of the city, yet the most famous of all of the mosaics are the two Imperial panels depicting himself and Theodora. No other changes were made to the existing mosaic program. And yet, the mosaics all work together to embody contemporary theological and political ideas that worked to strengthen Justinian’s power over the city.

This thesis re-examines the mosaic program of San Vitale, paying special attention to the connection between the nature imagery, the Old Testament narratives, and the imperial panel portraits. Additionally, the patronage of the church by a private citizen and not by the Emperor leads to questions of purpose and of Ravenna’s place in the new Empire. My analysis of the mosaic program is grounded in literary, theological, political and historical sources. This thesis explores how the Basilica of San Vitale at once encapsulated the historical and theological concepts of Justinian’s empire, and revealed a glimpse into the past and future fate of the city of Ravenna and of the East Roman Empire.
The Destroyer of Worlds: America’s Response to Nuclear Weapons in South Asia

Benjamin Kallen

Mentor: Krister Knapp

The purpose of this thesis is to examine how America has oriented its foreign policy to handle nuclear weapons proliferation in India and Pakistan. Although there are varying arguments about how these weapons factored into the decision-making process of the United States for this region, no general consensus exists. Some scholars theorize that the primary driver behind America’s actions in South Asia was the Cold War and efforts to contain Soviet expansion. Others claim that America never really considered the region to be that integral in its Cold War calculations, and that nuclear proliferation played a bigger part. This thesis examines primary documents, spanning the period between 1947 and the present, as well as secondary sources in an effort to more fully understand this issue. This thesis argues that while Cold War interests did play an instrumental role in America’s policy-making towards South Asia, this was largely limited to the 1950s. Beginning in the early 1960s, the United States started showing more concern over nuclear weapons proliferation in South Asia, and by the middle of the next decade this concern had translated into policy. Except for a brief revisiting of Cold War strategy during the Reagan Administration, proliferation issues would continue to form the bedrock of American policy toward both Pakistan and India up to the present. No other weapons technology has affected war as dramatically as nuclear weapons have. As such, they warrant significant study. While the United States and Soviet Union reduced their nuclear stockpiles, other states increased their nuclear weaponry or continued developing them. Rogue nations or individuals acquired them for monetary gain or terrorism. By analyzing the past effects on international relations of nuclear weapons, it may be easier to predict their future diplomatic impact. Understanding the root causes of the turmoil in South Asia may be key to better formulating policies that will help to make the subcontinent more stable and secure.
The United States experienced vast social, political, and economic changes after the Civil War. This thesis examines ways in which American identity and individual attachment to the American polity were reconstructed as the United States expanded its physical and psychological boundaries into a continental and overseas Empire. It analyzes American cultural productions, specifically dime novels and debates in Congress, in order to understand popular representations of Empire from the Indian Campaigns in the late 1870s to the aftermath of the Spanish-American War. It is concerned with how individuals and groups were constructed as either falling within or without conceptions of American identity and Empire. The role of the Army in American Empire, and its symbolic importance in a time when it was in relative disarray, is examined alongside its relationship to Native Americans. Native Americans were a key group in the formulation of American identity, encompassing the ever-changing line between foreign and domestic. Both dime novels with their fictional portrayals, and Congress through the Dawes Act, attempted to spatially and temporally define where Native Americans conceptually and officially belonged in the burgeoning American Empire. The varying ideas of how Empire was envisioned—and the tensions inherent in these formulations between nation and individual, foreign and domestic, military and civilian—became increasingly confused even as the United States reached the supposed locus classicus of American Empire, the Spanish-American War. This thesis argues that these contradictions, which threatened to tear apart Empire, are embodied in dime novels and congressional debates that foregrounded the role of the individual as the United States moved from Civil War era nationalism to the bureaucratic structures of imperialism.
“Electric Shock Is Simply Something You Don’t Go Around Talking about at Cocktail Parties”: The Fractured Political Narrative of Thomas F. Eagleton

Hannah Rae Lustman

Mentor: Iver Bernstein

Thomas F. Eagleton was a three-term United States Senator for the state of Missouri from 1968 to 1986. Eagleton rose quickly through Missouri state government and was elected Saint Louis Circuit Attorney, Attorney General, and Lieutenant Governor after one term in each position. However, Eagleton is best known for an infamous bid for the Vice-Presidency as running mate of South Dakota Senator George McGovern in 1972. When media sources discovered that Eagleton had been treated for depression with electroconvulsive therapy, negative reaction would eventually be the motivation for his removal from the ticket just eighteen days after his nomination. However, the representation of Eagleton’s mental illness and its influence on his political career were much more complex than its revelation in 1972, and analyzing how he navigated the relationship between his private life as a mental health patient and public life as a prominent politician is the subject of this thesis.

This thesis provides a richer understanding of Eagleton’s life as both a man struggling with mental illness and one with rising political power (especially as he is frequently mentioned when presidential candidates choose running mates). The balance between public and private life was never the result of a strict boundary separating his struggles with Bipolar II disorder and his life as a politician. Although 1972 was the first time accurate information was disseminated about his treatment, a relationship was present for many years between his disease and his public life. This thesis is ultimately an exploration of how Thomas Eagleton’s politics resonated with some of the issues he confronted privately, as well as how the symptoms of his Bipolar II disorder and his representation of his mental illness influenced his political career in Missouri and the United States Senate.
Gervase of Tilbury, marshal of Arles, wrote a book of history, geography, and of the
marvelous called the Otia Imperialia for Otto IV, Holy Roman Emperor around 1215.
The Otia Imperialia, more than anything, packaged the marvelous with a Christian
ribbon. It was a masterpiece of medieval scholarship, unique in its scope and breadth,
focusing on the marvelous and a scientific approach to history writing.

The early thirteenth century was a time of great political, social, and scholarly
shifts in Latin Christendom. The Church was solidifying its power not just as a moral
and religious authority, but as a political authority as well. The Holy Roman Empire
was engaged in a civil war and Pope Innocent III proclaimed an internal crusade
against Christian heretics in the lands of the count of Toulouse. During the same
period, Latin Christian intellectuals were making great strides in the development of
historical writing. This thesis is a study of the Otia Imperialia and how Gervase of
Tilbury omnivorously encompassed this social and religious change in an encyclopedic
and innovative history.
**History**

**Going East:**
**The Evolution of the Medieval Travel Account, 1253–1356**

*Jeffrey Shevach*

*Mentor: Mark Pegg*

The most famous of the medieval European travel accounts is the record of Marco Polo and his family’s journey to Asia, known as the *Livres de merveilles du monde*. Though the *Livres*, renowned for its fantastic nature and enormous scope, is the most famous work of the genre, it is only one of a multitude of travel accounts written by pilgrims who left the bounds of Latin Christendom and passed into Eastern Asia. While many travel accounts have been analyzed and used for various purposes, there is not much literature focused on the development of the travel account as a genre during the Middle Ages. This study aims to track this development over the course of a century, from the middle of the thirteenth century to the middle of the fourteenth century, to extract information on how Latin Christendom was transforming and how Latin Christians changed the way they saw the world. It will also try to determine the reasons for the evolving style of narration in the genre and how this period of one hundred years helped mold the model for succeeding Latin Christian travel accounts. This analysis will use Latin Christian travel accounts from the mid-thirteenth century through the mid-fourteenth century, primarily focusing on the travel accounts written by William of Rubruck, Marco Polo and Sir John Mandeville, but will also utilize contemporary sources from Asia in order to provide a broader context in verifying the claims made by the authors of the travel accounts and in understanding how Christianity affected the traveler’s perception of the world outside the physical bounds of Latin Christendom.
Ja sóc aquí: 
THE CONSTRUCTION OF CATALAN CULTURE DURING THE TRANSITION TO DEMOCRACY

Alina Sigmond

Mentor: Mark Pegg

In 1979 Catalonia was recognized as an autonomous region within Spain for the second time in the twentieth century. Four years into the newly founded Spanish democracy after the death of General Francisco Franco, Catalan culture confronted issues of cultural identity, especially where culture intersected with politics. My thesis analyses this cultural construction of modern Catalonia and its affect upon the Catalan people. I examine language, street movements, and the Catalan government. Each topic unravels a bit of Catalan culture: the language in defining the people; street movements in determining how the people came together; and the government to show how Catalonia was officially represented.

I find that during the Transition to Democracy, Catalans, especially those in power, chose to reclaim their culture by reinventing it. After nearly forty years of repression under Franco’s dictatorship, the rediscovery and reinvention of this culture in the 1970s entailed a more powerful and ultimately more useful phenomenon—an incredible consensus and mandate from the Generalitat that Catalans had a unique collective identity that needed protecting and promoting during this fragile time.

By 1979 Catalonia was in a vital socio-political position where its culture and collective identity was being questioned, shaped and used by people and politicians in and out of Catalonia. The Transition marked a change in how their northwest region of Spain would be considered. It is what fundamentally altered and created modern-day Catalonia.
When Pruitt-Igoe was demolished in 1972, the high-rise public housing project in North Saint Louis was arguably the most infamous public housing project in America. Its failure has been attributed to many factors, including the isolation and extreme poverty of the residents; however, the most common explanation is the modernist design of the buildings. DeSoto Carr, the site of Pruitt-Igoe, was not always destined for twentieth-century modernism. Initially proposed by planner Harland Bartholomew in 1947, the dilapidated site was to be redesigned according to the theories of nineteenth-century planners and social reformers. By the time the project was constructed in 1954, Saint Louis City officials had decided to incorporate the nineteenth-century design concepts proposed by Bartholomew and head architect Minoru Yamasaki with twentieth-century modernism. Even though many of the public policies that influenced modernist construction broke from early public housing design, Saint Louis officials aimed to manipulate the built environment to reform the lower and working-class and to ameliorate poverty, a primary goal of nineteenth-century reformers. This thesis examines the collision of the two philosophies—nineteenth-century planning and reform movements with twentieth-century modernism—that shaped the design and situation of the buildings, as well as the optimistic rhetoric at groundbreaking, the disillusionment with mid-twentieth century urban policies, and ultimately, the spectacular downfall of Pruitt-Igoe.
“Breaking” News: How New Media Dismantled Broadcast Television News

Julia A. Kellman

Mentor: Matthew Brown

News in the Post-Network Era is produced by a business model under which only the news that sells is fit to tell. The standards that define what qualifies as newsworthy have been reduced and replaced the legacy of reputable journalism from the Broadcast Network Era. Under a profit-driven media environment, serious, unappealing, or complicated issues simply do not receive adequate coverage. Dry but indispensable details about weighty, complicated issues, like the economic ramifications of pending political decisions, do not hold attention when the siren’s song of a car chase or sex scandal beckons from the next channel. In proper journalistic vetting of those heavy, abstruse issues, there are no adrenaline-producing car chases, shocking sex scenes, ominous music, laugh tracks, special effects or other incitement to excite viewers. But it is exactly those issues that require the thoughtful presentation and scrutiny by the media to facilitate public discourse. It seems that without regulation and enforcement, media owners in the private sector will not prioritize high-caliber journalism over more profitable, attention-grabbing methods of content production.

In this thesis I first characterize the Broadcast Network Era and investigate the economic systems that produced traditional broadcast television news. Then, to explore how those systems have changed to produce our current news environment, I examine how consumers have adopted new technology and the ramifications of new media consumption practices. I analyze how the advertising industry, the media industry, and particularly, the broadcast television news industry have adjusted their practices to accommodate new media consumption practices. My examination of the economic relationship between the media industry, the advertising industry, and the commodification of news produces salient indications of journalism’s subordination to business interests. My conclusions extract the larger repercussions of rampant commercialism in broadcast television news and suggest recommendations to remedy the situation.
Active, Disorienting, and Transitional:
The Aesthetic of Boredom in the Multimedia Works of Nam June Paik (1932–2006)

Eugene Kwon

Mentor: Lutz Koepnick

The term boredom has a long and complex history. Boredom has been a topic of interest for both critical theorists and artists from various disciplines since antiquity. In the 1960s, the meaning of the term boredom took on new significance as several art critics employed the term “boredom” to describe contemporary artworks. One artist from this period did not hesitate to describe his artworks as boring: Nam June Paik (1932–2006), a multimedia artist known for his avant-garde installations, sculptures, videos, and films. In my study, I argue that an aesthetic of boredom underlies certain works by Paik that employ particular artistic strategies, inducing a constant shift between physical, spatial, and temporal boundaries.

Taking a chronological approach, my study focuses on three seminal works by Paik: Zen for Film (1964, film/installation), Global Groove (1973, video), and The More the Better (1988, video/sculpture). In my first chapter, I argue that Paik’s minimalist work Zen for Film puts the viewer in an ambiguous viewing position, allowing the viewer to establish multiple relationships with the installation site that induce an aesthetic of what I call “active boredom.” Then, I turn to Paik’s Global Groove, arguing that its aesthetic of “disorienting boredom” embraces elements of both structure and fragmentation. Finally, in my third chapter, I examine the multiple sets of aesthetic and ideological tension generated by Paik’s The More the Better within the historical context of South Korea’s political transition in 1988—these sets of tension constitute an aesthetic of “transitional boredom.”

An aesthetic of boredom promises to provide a new understanding of today’s contemporary artworks, including literary works, films, and videos. My study aims to achieve the following two goals: the development of a distinct aesthetic of boredom, and a new understanding of Paik’s interdisciplinary works through the lens of such an aesthetic category.
Outer space has never been defined in international law. The territory above Earth, divided into zones based upon their aeronautic uses, falls into three categories: airspace, outer space, and near space. Airspace is the realm of airplanes and all manner of atmospherically powered flight; it is governed by international aviation law, a system based on the concept of absolute state sovereignty. Outer space is the domain of space stations, satellites, and the beyond; it is governed by international space law, a regime founded on the principle that outer space is free from all claims of national sovereignty. Neither field has explicitly defined where airspace and outer space begin or end, which is why near space exists, a no-man’s land in between where the only visitors are space objects in transit. It is unclear which set of laws apply in near space, a problem exacerbated by the sharp ideological differences at the cores of aviation and space law. In this thesis, I argue that the international community of nations must agree upon an exact demarcation between these two realms, as leaving the border between airspace and outer space undefined is dangerous for the development of outer space as a whole.

My analysis shows the histories of both aviation law and space law, demonstrating how and why their two contrasting approaches came to be. I explain why this gap in international law is dangerous, in terms of technological advancements shrinking near space, the dangers of space actors operating in an ambiguous legal environment, and the hindrance this issue is for the development of space law. I finally propose an explicit border between airspace and outer space, and explain why addressing this gap in international law is necessary to ensure the egalitarian goals set for outer space.
Reading the Real Biblioteca del Escorial: Dangerous Books, Readers, and Populations

Sophia Blea Núñez

Mentor: Stephanie L. Kirk

Amid the imperial politics, censorship, and inconsistent religious discrimination in sixteenth- and seventeenth-century Spain, the royal and religious Escorial library’s acceptance of Hebrew, Arabic, and forbidden books initially appears anomalous. However, I contend that textual incorporation and exclusion within the library both contrasts with and parallels the relationships to corresponding populations and readers. The symbolic and practical significance of the Esorial’s collections make the library a unique lens onto Early Modern Spanish history and culture. Given the shared nomenclature of cuerpos that describes both books and bodies, and the convergence of diverse cuerpos in the Real Biblioteca del Escorial, I dedicate chapters to the practices and cuerpos of readers; the human cuerpos of royals, monks, converts, and others present in or evoked by the Escorial; and the incorporation of cuerpos of potentially-dangerous books into the library. To do so, I combine studies on book history with scholarship on the political and cultural contexts of Spain’s treatment of Muslims, Jews, and their converted descendants. Furthermore, I examine published and archival Inquisition licenses, catalogues, constitutions, descriptions, histories, and letters regarding the Escorial library in the sixteenth and seventeenth centuries, paying particular attention to the treatment of suspect books and their readers. I suggest that keeping “dangerous” books in this library expressed power over the conquered, showed royal pride and prestige through a universal and valuable library, and minimized the risks that the books present by isolating them from all but trustworthy readers in the Escorial. Indeed, although the library was ostensibly open to “all men of letters who wished to come and read,” in the words of Philip II, I find that only those most trusted readers enjoyed an unusual, potentially dangerous, freedom of reading at the Escorial.
FUTURISM AND THE FEMININE: UNDERSTANDING FUTURIST GENDER DYNAMICS BETWEEN RHETORIC AND THEORY

Donald Steinburk

Mentor: Anca Parvulescu

One of the earliest twentieth-century avant-garde art movements, Italian Futurism impacted the worlds of European art and politics with their bold ideas and revolutionary claims. Led by the poet F.T. Marinetti, the Italian Futurists praised speed, violence, and the power of the machine while also calling for the “contempt for woman,” bringing questions of sex and gender to the forefront of the Futurist project. Paradoxically, the Futurists simultaneously embraced bombastic anti-feminist rhetoric and argued for the primary concerns of first-wave feminists throughout their manifestos, attracting many women to the movement. The Futurists were among the first to distinguish sex from gender, detaching the concept of “woman” from its strict biological basis. In this thesis, I argue that between the bombastic rhetoric and the more sophisticated theory of gender that the Futurists developed, Futurism exploded the “woman question” through their novel deployment of the masculine and feminine as categories of analysis, though their rhetorical and theoretical excesses prevent them from being considered a feminist movement.

My analysis of the Italian Futurists’ gender theory draws from close readings of key Futurist texts. I begin by examining Marinetti’s foundational writings on gender and his engagement with female Futurists and feminist activists. I then concentrate on Marinetti’s Let’s Murder the Moonlight! and interrogate the fantasy of total subjectivity that the Futurists propose in the clash between masculinity and femininity. Finally, I focus on Marinetti’s novel Mafarka the Futurist to investigate the role eros plays in mediating relations between the sexes.

This study of the intersection of simplistic rhetoric and more nuanced theory raises questions that can be applied to the misogynistic contradictions common to the other historical avant-gardes. This thesis is an effort to decouple rhetoric from theory to uncover hidden theoretical complexity without losing sight of the real consequences of these rhetorical excesses.
The South Caucasus at a Crossroads: Armenia and Azerbaijan’s Rocky Regional Relations

Katherine Ayanian

Mentor: James Wertsch

The fragile 1994 Nagorno-Karabakh War ceasefire agreement between Armenia and Azerbaijan is at high risk of breaking. If violence between Armenia and Azerbaijan were to resume, another war could have detrimental ramifications far beyond this region nestled between Europe and Central Asia. The Armenians and Azerbaijanis, two of the largest ethnic groups in the diverse South Caucasus, have not always been at odds, in fact, many members of both ethnic groups have engaged in warm and lasting business ventures and friendships. Nevertheless, since Armenian and Azerbaijani independence from the Soviet Union in the early 1990s, national identities have emerged in both countries that encourage internal unity at the expense of regional partnerships with the other state. The Armenian and Azerbaijani dispute over control of the Nagorno-Karabakh territory has hindered diplomatic relations between the two young states. Skirmishes along the closed Armenia-Azerbaijan border are a regular occurrence and if the international community does not increase efforts to intervene and mediate the hostile relations between the two governments, all-out war could erupt for the second time in the past two decades. And this time, it would be much more deadly. Azerbaijan has invested large sums of oil revenues in enhancing their military capabilities so that their military is now considerably stronger than that of Armenia. As the three most influential regional actors, Russia, Turkey and Iran all have some vested interests in maintaining the tenuous status quo. Thus to solve this conflict, it is imperative that mediation efforts give Armenians, Azerbaijanis and residents of Nagorno-Karabakh each a seat at the negotiating table. Representatives from all three territories must collaborate to improve relations between Armenia and Azerbaijan so that someday that can be strong regional partners.
Since the division of the Korean Peninsula there has been a steady exodus of North Korean refugees entering South Korea. This journey is politicized, as politics influence the decision of refugees to migrate as well as how they are treated. Despite the presence of government initiatives designed to aid refugees in their adjustment to life in the South, the North Korean refugee community as a whole remains marginalized and struggles to adjust. Yet there are a few refugees who have been quite successful even by South Korean standards. This research is designed to answer the question: which refugees are succeeding, or doing better than government assistance alone would enable them to do, in the South Korean economy? After assessing how health, education, and discrimination hinder refugees who were affluent in North Korea disproportionately less than their counterparts, I hypothesize that being a part of the North Korean elite is a necessary but not sufficient condition for succeeding in the South. Using a case study comprised of individual refugees I test this hypothesis and conclude that former North Korean elite that are succeeding in the South but not just because they are disproportionately hindered by barriers to adjustment, but rather because through their investment in human capital before their defection they developed skills that enabled them to succeed in the South Korean economy.
Health and Sub-Saharan Migrants in Morocco: Recent Changes and Future Trends in Healthcare Access and Immigration Policy

Sylvie Doppelt

Mentor: Carolyn Sargent

This thesis explores the progression of immigration policy in Morocco, currently transitioning from a country of transit to a destination country, and its impact on sub-Saharan migrants residing there. I assess migrants’ treatment and situation in Morocco through the lens of health and healthcare access, an area largely unexplored in past studies. Assessment of Morocco’s current economic struggles, pressure from the European Union to curb northern migration, and inadequate healthcare for its own citizens led me to conclude that Morocco, though politically stable, does not now have the economic or social capacity to effectively receive irregular, vulnerable migrants at the current rate. However, the Moroccan state’s systematic neglect of migrants and policy reform denies them access to citizenship, labor, education, and healthcare, which pose distinct challenges to decent living and good health outcomes. While studying abroad in Rabat, Morocco, I interviewed six NGOs and approximately twenty sub-Saharan irregular migrants, asylum seekers, and refugees to gain insight into the extent to which migrants are able to access healthcare services in the country. Relying on extensive research on immigration trends and policy in Morocco, my work further explores the divergence between policy and practice by including first-hand accounts from migrants and NGO staff. The Arab Spring and ensuing movement throughout the MENA region makes other Arab populations and other incoming groups worth studying in the future. My work, therefore, should serve not as a parting commentary, but rather an example of a marginalized people in a region that, whether ready for it or not, is becoming a permanent stopping ground for immigrants and refugees from across Africa.
The island of Lamu is located on the northern coast of Kenya. Its small size, a mere 24 square miles, and its geographic isolation belie its relationship to and interactions with other communities. Lamu society’s interactions with other communities have contributed to the island’s unique ability to easily adapt and modify various features of other cultures and societies. Wedding celebrations reveal Lamu society’s adaptability and dynamism. In this thesis, I argue that Lamu wedding celebrations are constantly incorporating new features and discarding old ones to reflect the social, religious and political perspectives of the time. I researched Lamu weddings from the second half of the 20th century to the beginning of the 21st century to try to understand how weddings have changed over time. My research relied heavily on the oral histories of Lamu women. Their ages ranged from 25 to 88 years, and they represent three generations of women. I decided to focus on women rather than both men and women in this study because women are the backbone of Lamu weddings. They are involved in essentially every aspect of the wedding preparations, and the numerous roles that they play throughout weddings make them a more telling group to focus on. Their anecdotes demonstrate the impact that a variety of factors, such education, globalization and religion, have had on wedding customs. Although this study is anchored in Lamu, it reveals some of the ways in which the core customs of a society respond and adapt to new and outside influences, and how societies balance tradition and change.
The Enigma of “National Interest”: Understanding Russian Decision-Making in Kosovo and Georgia

Erin Humphries

Mentor: James Wertsch

During the NATO Intervention in Kosovo in 1999, Russia decried the violation of Serbian sovereignty and territorial integrity without UN authorization. But in South Ossetia nine years later it unilaterally intervened and violated Georgian sovereignty and territorial integrity. How can a country that was so staunchly supportive of the inviolability of one state take what appears to be precisely the opposite position with another less than a decade later? Through an exploration and application of Mearsheimer’s Offensive Realism theory, Wendt’s Constructivist theory, and national narratives, this paper seeks to understand Russian motivation for its involvement in both Kosovo and Georgia with a particular focus on the Russian relationship with NATO and the West.
Identity Crisis: The Fundamental Question of European Sentiment in Defining, Legitimizing, and Perpetuating the European Union

Diana Jack

Mentor: Matthew Gabel

The European Union is an unprecedented example of globalized and multicultural government whose limbs now reach far into political, cultural, economic, and social issues. Accordingly, the EU today looks and acts much more like a nation-state than it did when it began. It suffers, however, from a citizenry that is less interested in supranational, EU-level politics and culture than in its own national life, a discrepancy that hinders the EU’s progress. I argue in this thesis that the discrepancy between loyalties stems from a lack of familiarity among and identification as “Europeans,” and that the EU could work to foster these elements of a strong supranational identity. To that end, I define models for national identity and identity building, and argue that those models could be harnessed to propagate a European identity. Next, I determine the extent to which the European Union has assumed nation-state characteristics, and assess the existing level of attachment to and interest in the project among its citizens. Finally I propose a number of paths for strengthening and perpetuating “Europeanness.” The creation of a stronger supranational identity would secure citizens’ support, ease the present workings of the European Union, and perpetuate the project’s future goals.
(Traditional) Gender Constructs in Chile: Perpetuation by the Church and the State, and Sociological Effects

Angelica Maria Juarbe Santaliz

Mentor: Kedron Thomas

This paper will analyze the construction of gender roles in contemporary Chile, their purposeful maintenance through policies of the state and the church, and the sociological effects of these (traditional) concepts of gender. First, I discuss a general understanding of (traditional) gender roles in Latin America insofar as society’s conceptions of male and female gender roles. To better understand the hypermasculine qualities that surround Latin American understandings of masculine identity, I discuss the concept of machismo in greater depth. Of particular interest are the theories that surround the history of machismo, theories which while useful in understanding machismo’s past, do not fully explain its presence in contemporary Latin America. Next, I analyze the state and the Catholic Church as the two institutions which have contributed to the maintenance of (traditional) gender roles in Chile. I focus on the history of Chile dating back to the dictatorship, and analyze the reproductive health polices, the role of torture in establishing the state’s control of the female body, and private and public spheres. Further, I explain how the Servicio National de la Mujer, SERNAM, acts today as the symbol of the state’s interest in gender roles. Lastly, I analyze the ways that society has been impacted by these (traditional) concepts. I discuss the impact of (traditional) gender roles on the family in terms of fatherhood, on women entering the labor market, and on intimate partner and sexual violence because of the ways machismo has played an important role in defining concepts of gender roles.
The Afghan Taliban, since the group’s formation in 1994, have been a major force in the enduring violence and instability in Afghanistan. Although the Afghan Taliban regime was toppled by the United States in 2001, the group evolved and currently leads the insurgency that threatens the future of Afghanistan. Despite their importance in what is now the longest war in United States history, the Afghan Taliban remain mysterious and understudied. The aim of this thesis is to analyze the evolution of the Afghan Taliban over the past two decades and determine what role the group will play in the future of Afghanistan. To accomplish this, I examined countless news articles, field reports, and existing books on the Afghan Taliban in order to identify and track any changes and potential trends that could inform my analysis. What I discovered is that the past decade of combat with the militaries of the United States and its allies has transformed the Afghan Taliban into an increasingly complex entity. The ideology and goals of the Afghan Taliban remain primarily unchanged, but their combat tactics have increased in both sophistication and brutality. This means that the outlook for Afghanistan is no more promising than it was ten years ago, and the evolved Afghan Taliban are a primary reason why. It is the conclusion of this thesis that the Afghan Taliban pose an immediate threat to the future stability of Afghanistan, and that the threat will only increase upon the withdrawal of United States military forces at the end of 2014. It is my hope that the findings of this thesis may serve as a primer for individuals who are concerned about the unsettled situation in Afghanistan and want to learn more about the present condition of the Afghan Taliban.
International and Area Studies

Being-in-the-World:
Accessing Female Embodiment through a Cultural Phenomenology of Childbirth

Pia Marcus

Mentor: Carolyn Sargent

The embodied experience of childbirth is both individually unique as well as culturally specific. Thus, a cultural phenomenology of childbirth provides access into the embodied experience of woman as potentially transcendent of bodily boundaries—of internality and externality, of body and self, of self and other. This paper explores Western philosophical notions of human experience. Beginning with Cartesian Dualism, I proceed to collapse this concept of our lived as experience as mind separate from body through discussions of phenomenology and embodiment theory that propose a notion of lived experience as a thinking and feeling body open to the world. This philosophical and theoretical framework applied to childbirth ultimately reveals the social and shared reality of lived experience.
As of the past few years, the war on drugs has become an increasingly volatile security issue for Mexico. Drug-related deaths since ex-President Felipe Calderón undertook a militarized anti-drug strategy now total over 50,000 in number. With a problem so extensive, one begins to wonder, how might this be affecting Mexican society as a whole? My specific objective here is to try to observe potential negative economic effects of drug violence by making use of a synthetic control state statistical method first seen in Abadie and Gardeazabal’s 2003 article “The Economic Costs of Conflict: A Case Study of the Basque Country.” The purpose of such a study is not to reduce the consequences of violence to economics, for no decrease in growth could outweigh the human costs of Mexico’s situation. Rather, it is to see how violence can have ripple effects with consequences for the well-being of society at large and also to frame the issue in a way that can resonate with policymakers. I ultimately find some evidence that drug-related violence may be negatively affecting growth in violent Mexican states, but the results are somewhat mixed. Thus, I examine whether violence might not be damaging Mexico’s economy quite like we would expect in light of previous case studies on the economic costs of violence. In addition to my synthetic state study, I also undertake a comprehensive examination of the current situation that the Mexican government faces in order to see what is causing the increase in drug violence and what newly elected President Enrique Peña Nieto can do to curtail the number of victims.
To achieve universal electricity access, the Brazilian government initiated the *Luz Para Todos* (Light for All) electrification program in 2003. The objective of *Luz Para Todos* was not only to provide full electricity access to the rural population in Brazil, but also to improve the overall quality of life in rural areas. The state of Bahia contained the largest rural population in Brazil and has historically lagged behind national averages of human development indicators. Recent energy development literature has identified the significance of isolating the effect of electrification on development indicators, such as income, education, and infrastructure, in order to determine if large-scale electrification interventions like *Luz Para Todos* achieve their intended impact. This thesis assessed if increased electricity access was correlated with rural development in Bahia in 2010, following the completion of the first phase of *Luz Para Todos*. An econometrics approach was used to analyze data from the Brazilian Institute of Geography and Statistics (IBGE) on access to electricity and infrastructure, income, and education levels for 414 of Bahia’s municipalities. Results suggest that access to electricity could be associated with infrastructure, income, and education, as it was positively correlated with access to water supply, access to trash disposal, and household income and negatively correlated with illiteracy. These findings support the role of electricity access through *Luz Para Todos* as a means to further rural development in Bahia.
Rainbow Street: Heritage, Cosmopolitanism, and Urban Space in Amman, Jordan

Jessica Page

Mentors: Lois Beck and Robert Canfield

In this article I examine Rainbow Street in Amman, Jordan, a heritage-based urban regeneration project sponsored by the Greater Amman Municipality (GAM) beginning in 2005. The street’s architects aimed to highlight Amman’s architectural and social heritage and create a public, pedestrian space accessible to Ammanis of all socio-economic backgrounds. Rainbow Street represents efforts of GAM and Ammanis to brand Amman as a historical, cosmopolitan, global city. Amman, established as the capital of the Hashemite Kingdom of Jordan in 1921, has since become home to diverse peoples—Palestinian, Iraqi, Syrian, and Libyan refugees; Egyptian, South Asian, and Filipino migrant laborers; and rural migrants. Jordan’s stability in relation to other countries in the region has attracted growing numbers of tourists, scholars, and entrepreneurs to the city and country. Government and foreign agencies are forging a distinctive identity for Amman, a city positioned between long-established urban centers such as Cairo and Damascus and newer oil-rich capitals such as Dubai and Doha. Rainbow Street stands in contrast to neoliberal, market-oriented urban development projects in Amman such as hotels, business towers, and shopping centers that create spaces for international investors and elite consumers rather than the ordinary people of Amman. Rainbow Street is both a translocal and Ammani space, and presents ordinary Ammanis, those without structural positions of power, the opportunity to demonstrate their knowledge of cultural cosmopolitan codes of global urban centers without consumption. The ordinary Ammanis who frequent Rainbow Street are the center of popular discussion (news articles, entertainment forms) revealing their influence in shaping Amman’s urban life. Their presence on Rainbow Street challenges GAM’s control over Amman’s urban image. I use textual analysis, street observations, participant observation, and informal interviews to analyze how Rainbow Street enables ordinary Ammanis to be active participants who shape Amman’s public, urban character and international image.
In my senior honors thesis I explore the relationship between the United States and Latin America and how this history led to the establishment of foreign health aid programs, international institutions, and ideologies that promote the allocation of resources for development to Latin American countries. I begin my paper by describing several key historical events that shape the dynamic of the relationship between Latin America and the United States as one of interventionism, whether direct or indirect. The ideology of humanitarianism is central to the current logic behind health and development programs. Subsequently, I look at the case of Guatemala and how the United States has shaped the recent history of this country and helped create the great disparities that exist there today. I question the effectiveness of several US-sponsored maternal health programs in the department of Sololá, Guatemala. I then examine the broader health care environment in Guatemala and the effects of and reasons behind the proliferation of small nongovernmental organizations. I conclude by posing several questions about the effectiveness of foreign health aid. I argue that more attention to the local is necessary in order for health aid to be effective. However, is this focus possible in a world dominated by the economic interests of multinational corporations and the idea that biomedical care is superior? Is it possible to work within this dominant system to bring more attention to the local and, thus, provide more effective health care? I believe that it is essential to continue to question the authoritative ideologies and the institutions that support them in order to improve the health of marginalized populations. However, it may also be necessary to work within these prominent frameworks due to the associated resources.
The Fabrics of Memory: Sites of Violence, Collective Memory, and the Jewish Narrative in Palma, Mallorca

Sarah Roth

Mentor: Tabea Linhard

In the wake of dictatorship, cultural revival and cultural memory gain poignant political significance. “What should be remembered?” becomes a question of human rights, and “What should be commemorated?” a question of justice. In this thesis, I look at the xuete narrative in Palma, Mallorca, in which the politics of commemoration have surged to the political stage in the wake of a number of political and economic changes over the course of the last half-century.

In the years following Francisco Franco’s death in 1975, Spain transitioned to democracy, and the politics of religious and linguistic identity moved to the front of the collective political imagination. A group of historically segregated Mallorcans—whose ancestors were dubbed, xuete, derived from the mallorquín word for pig, and similar to the peninsular term marrano—moved to the political stage as government archives were opened to the academic public. In 1986, the Israeli government and the Spanish government worked to establish an Institute for Balearic-Israeli Relations. Architects began to draft memorials to commemorate violence against the xuetes. A small Jewish community almost entirely consisting of “re-converted” xuetes formed and began to flourish. Yet no memorial was ever built—largely at the behest of xuete descendants.

The central research questions I would like to address by examining this case study are: how does the built fabric of a city reflect the collective memory of its occupants? Can the built environment reveal the ways in which a community copes with, represents, and codifies histories of systemic violence?
Evolutions in Class Visibility, Morality, and Representation in Chilean Teleseries: From Military Regime to Current Moment

Sadie Smeck

Mentor: Ignacio Sánchez Prado

This work begins by exploring the concepts of class and class-consciousness as they are represented in the Chilean teleserie *Pobre Rico* (2012–13), examining elements of class-marked aesthetics, linguistics, and spaces in Santiago as these are manifested in the television program. The work will question how these representations relate to national, urban realities, and problematize the manner in which they at times reflect, exaggerate, and/or misrepresent particular attitudes, dynamics, and realities of class stratification in present-day, urban Chilean society. The work then examines how representations of class in Chilean television and media have evolved in the past three decades, since the final years of General Augusto Pinochet’s military regime (1973–90). This study progresses through three “phases” of teleseries, from the end of the military regime through two decades of democratic transition, examining a parallel transition and thematic opening with respect to class representation in fictional television shows. All programs analyzed in this study aired on Chile’s national network, TVN, which underwent congressionally mandated reform following the end of the dictatorship.
Crafting Identities: Indigenous Artisans and the Politics of the Handicraft Industry

Katharine Sullivan

Mentor: Kedron Thomas

This study seeks to investigate the relationships among indigenous artisans, the indigenous craft industry, non-indigenous craft buyers, and three indigenous communities (two of which are Mapuche and one of which is Quechua). By interviewing public officials, business owners, and indigenous artisans in two Mapuche communities, I attempt to gauge the motives and methods of handicraft buyers and sellers, as well as institutions that regulate the handicraft industry, in San Martín de los Andes and Otavalo. In my interviews with Mapuche artisans, I sought to understand how community members adapt to and control the presence of visitors in their communities, how they construct their identities through the crafts that they sell, and how they are affected by the actions and assumptions of the mass tourism industry in San Martín de los Andes. In addition, I conducted extensive document-based research on the Quechua communities near Otavalo in Ecuador, which are famous for their textiles and will serve as useful points of comparison for my data on Mapuche crafts. I found that, although cooperation and respect between state institutions and indigenous artisans are growing, the objectives and interests of the two groups are still quite different; thus, the institutions assert their asymmetrical power over the artisans when it is necessary to protect their interests. Although it has the potential to exacerbate this imbalance of power, the indigenous craft industry can also be used by the communities as an economic and cultural tool to produce and revitalize distinctly indigenous identities and to distinguish Mapuche and Quechua ways of life from the dominant culture. By asserting their influence over sectors of the tourism industry, the indigenous communities gain control and agency over how they present themselves to the rest of the world.
Too Cute for Words:  
An Investigation of the Aegyo Speech Style and Its Pertinence to Identity, Gender, and Sexuality within South Korea

Shelby Strong

Mentor: Brett Kessler

Aegyo is a Korean term for a type of charming, cute behavior and may refer to both linguistic and nonlinguistic, nonverbal behavior. The first part of this paper argues that the aegyo speech style is objectively recognizable because it is marked by a set of linguistic features. In the first study, to test the hypothesis that there is a significant prosodic difference between aegyo and non-aegyo speech an experiment was conducted where subjects read aloud passages in Korean that were constructed to elicit contrastive speech performances. The subjects’ performance was expected to exhibit more or less aegyo depending on the context information embedded in the passages. It was found that there was a significant difference between the mean pitch of aegyo and non-aegyo utterances for three of the five subjects who participated in the experiment. In a second study, 25 aegyo utterances and 25 non-aegyo utterances collected from media clips were transcribed to investigate whether other linguistic features in addition to pitch mark aegyo. It was found that nasalization of vowels and repetition of sounds or words within utterances significantly differed depending on whether an utterance was produced within a non-aegyo or aegyo context. The second part of the thesis argues that aegyo reflects the ideology that social categories like gender are biologically determined because the language used to describe aegyo forces speakers to refer to aegyo as something that people intrinsically have or do not have as opposed to something that people convey through performance. This paper argues that depending on the context performances of aegyo by adults may be interpreted as challenging or affirming social norms due to the fact that aegyo indexes qualities associated with childhood.
Lie Groups blend the idea of a group and a manifold. They are used all over science and engineering to describe systems that possess continuous symmetries. For example, they are used in physics to describe the interactions between fundamental particles. We use many mathematical tools to study Lie groups, including the exponential map generalized to Lie groups, representation theory, and characters. We discuss several important results including Schur’s Lemma, the canonical decomposition of representations into irreducible submodules, and the Theorem of Peter and Weyl.
This thesis develops a potential simulation-based approach to solve maximum expected utility (MEU) portfolio allocation problems between investment and consumption. In general, MEU requires computation of expected utility over the decision variables, and optimization subject to boundary conditions. The traditional way to solve a MEU problem is gradient-based, which is highly dependent on the analytical properties of the utility functions and boundary conditions. However, in portfolio problems, the expected utility is generally not analytical available. In addition, the complexity of the boundary conditions is another problem that makes the traditional gradient-based method not feasible. A simulation-based method avoids the calculation of derivatives and also allows for functional optimization. This paper introduces an algorithm that combines Markov Chain Monte Carlo (MCMC) with the insights of simulated annealing and evolutionary Monte Carlo. It can exploit conjugate utility functions and latent variables in the relevant predictive density for efficient simulation.
We review the history of elliptic curves and show that it is possible to form a group law using the points on an elliptic curve over some field $L$. We review various methods for computing the order of this group when $L$ is finite, including the complex multiplication method. We then define and examine the properties of elliptic pairs, lists, and cycles, which are related to the notions of amicable pairs and aliquot cycles for elliptic curves, defined by Silverman and Stange. We then use the properties of elliptic pairs to prove that aliquot cycles of length greater than two exist for elliptic curves with complex multiplication, contrary to an assertion of Silverman and Stange, proving that such cycles only occur for elliptic curves of $j$-invariant equal to zero, and they always have length six. We explore the connection between elliptic pairs and several other conjectures, and propose limitations on the lengths of elliptic lists.
Shellability is a property of simplicial complexes that indicates whether the complex can be built up in a “nice” way from its constituent facets. Shellability has been found to have some interesting implications in unexpected places. Specifically, it relates to the order complex associated with the subgroup lattice (which is by definition a partially ordered set), with the partial order relation being set inclusion. The order complex associated with a partially ordered set (poset) is the simplicial complex created when the elements of the poset are considered vertices, and the totally ordered subsets are considered faces. It has been shown that a finite group is solvable if and only if the order complex associated with its subgroup lattice is shellable. It is therefore of interest to consider the implications of shellability as applied to other types of mathematical structures, such as Lie algebras. As of yet, little is known about the implications of shellability as applied to Lie algebras, and there are few known examples of nonshellable Lie algebras. To that end, we demonstrate the nonshellability of a small (dimension 6) Lie algebra. To strengthen the correspondence with the result in group theory, the Lie algebra has been chosen to be simple and the underlying field is $\mathbb{Z}_2$. 

Mentor: John Shareshian
Functional Magnetic Resonance Imaging (fMRI) is a procedure that measures brain activity by detecting associated changes in blood flow. Anesthesiologists are interested in learning the change in brain functional activity within networks linking different cortical areas under different sevoflurane concentrations by studying resting-state fMRI data. In this thesis, we perform a mixed effects vector autoregressive model analysis for such data to analyze the connectivity between different regions of interest (ROIs). This model captures the condition-specific connectivity (fixed effect), subject-specific connectivity (random effect), and run-specific connectivity nested within conditions (random effect). In our analysis, we used a simplified version of the original model in SAS based on efficiency and feasibility. Our results show that the number of significant effective connectivity effects decreases as the anesthetic concentration gets higher. And at the highest concentration level in the experiment, no cross-ROI connectivity remains significant.
I argue that the recently observed failure of American higher education to cultivate the “full human and intellectual capacity” of today’s college students is the result of its neglect of the unconscious anxiety and guilt that all students carry with them into the classroom. Relying heavily on Paulo Freire’s seminal work, *Pedagogy of the Oppressed* (1972), as well as the psychoanalytic theory of Erich Fromm, I contend that within all students is an innate need to develop their agency and become autonomous human beings, but that current pedagogical practices act against this need, thereby causing students unconscious pain which renders them passive and ineffective in their learning. However, in order to reform the pedagogical practices of the professoriate so that they may successfully guide students in their development, students—who represent the future generation of professors—must first come to terms with the unconscious demons which guide their behavior and keep them from acknowledging their own autonomy. For it is only by being able to acknowledge their own autonomy that professors will be able to acknowledge and successfully develop the autonomy of their students. I therefore conclude that undergraduate education must focus on developing practical methods by which students and professors can engage in the psychoanalytic process of self-affirmation by making the unconscious conscious.
The Ancient Greek philosopher Epicurus claimed that our goal in life is to attain pleasure, and that the greatest pleasure is the complete absence of pain. In this thesis, I use Neo-Epicurean argument in order to defend Epicurean ethics from three prominent objections. The first objection is that the greatest pleasure is not the complete absence of pain. The second objection is that the Epicureans are wrong to value the virtues and friendship as a mere means to pleasure. Finally, the third is that the fear of premature death prevents the Epicureans from attaining the complete absence of pain. With regards to the first two objections, the success of this thesis is qualified. In order to defend the claim that the greatest pleasure is the complete absence of pain, I impose two conditions on the definition of the greatest pleasure that Epicurus would not have thought necessary. Furthermore, rather than showing that the Epicureans are right to value the virtues and friendship as a mere means to pleasure, I settle for proving that they are not wrong. Nonetheless, even though this thesis fails to completely refute the most prominent objections against Epicureanism, there is still value to its best possible defense. In particular, modern ethicists have been quick to dismiss Epicureanism as a legitimate way of life. By showing how Epicureanism can respond to its most pressing objections, this thesis restores the credibility of Epicureanism and affirms its relevance to contemporary debates.
Auditory-Visual Speech Perception in Individuals with Dementia of the Alzheimer’s Type

Elizabeth Basow

Mentor: Mitchell Sommers

It is a well-documented finding that auditory-visual speech perception affords better speech comprehension than either auditory or visual information alone. Many older adults, however, have trouble identifying and processing speech, especially in challenging listening conditions. The primary question addressed in this study was whether or not older adults with Dementia of the Alzheimer’s type (DAT), who have known cognitive deficits concerning memory and thinking, have impaired speech perception compared to healthy older adults. Specifically, we investigated whether or not individuals with DAT are able to benefit as much as healthy older adults from adding a visual speech signal. We also investigated whether or not performance differed as a function of word-level processing and consonant-level processing. In our study, participants were asked to identify word and consonant stimuli presented in background noise; each modality was presented in auditory-only, visual-only, and auditory-visual conditions. As expected, performance was highest in the combined AB condition, but this was true for all three groups of participants. Thus, DAT status did not affect visual or auditory-visual speech perception. Additionally, both healthy older adults and individuals with DAT received comparable benefits on measures of visual enhancement and integration efficiency. Finally, there was no correlation found between measures of word- and consonant-level tasks. Taken together, these results imply that the extraction and integration processes mediating speech understand are not affected by the cognitive impairments imposed by DAT. Furthermore, it appears that different mechanisms mediate speech perception for words and consonants, and that these mechanisms are part of a robust speech-processing system that extends to individuals with cognitive difficulties.
According to the control principle, we cannot rightfully judge people’s moralities for factors that are outside the realm of their control. However, the domain of people’s control, that which is immune to luck, is extremely limited. Moral luck scenarios occur when people violate the control principle and morally judge agents based on factors beyond their control. Psychological research on moral luck suggests that agent beliefs, not the outcomes of agent actions, most heavily influence the production of moral judgments relating to those agents. This focus on beliefs might help resist the problem of moral luck, but only if we can provide explanations for why both the justifications for beliefs and the truth-values of beliefs can rationally be considered morally relevant.

I present the hypothesis that, when people treat the truth-values of beliefs as morally relevant, they use them as imperfect yet beneficial indicators of belief justifications. Because of certain inescapable limitations on knowledge and time, this behavior is rational, especially in low impact cases in which the results of moral judgments have minor consequences. This explanation helps support the notion that the reliance on beliefs in producing moral judgments helps resist the problems of moral luck.
The human brain consumes approximately twenty percent of the body’s energy-related resources. Much of these resources are consumed by spontaneous fluctuations in brain activity. Noninvasive neuroimaging techniques such as functional magnetic resonance imaging are useful for observing these spontaneous activity patterns in human brain activity. Even at rest, collections of brain regions show highly correlated activity patterns, forming networks of functionally connected brain regions. These networks are observable across a variety of states, including wakefulness and anesthesia, suggesting that these networks reflect the brain’s functional architecture. Previous work has demonstrated that learning information changes certain aspects of the functional network structure; furthermore, the magnitude of such changes directly correlates with later memory performance. Here, we measured functional connectivity in participants prior to engaging in learning, in order to identify patterns of brain activity related to retention of to-be-remembered information over a delay. We found that the amount of information retained over the delay could be predicted using spontaneous brain activity measured before the participants begin learning to-be-remembered information. Retention was predicted using both network-level properties and synchronous activity between a set of regions we found to be highly related to subsequent memory retention. These results help identify patterns of activity and functional network structure that may characterize individuals who have exceptional memory performance.
An ongoing delineation of systems underlying response to motivational stimuli has helped to establish two primary systems: the Behavioral Inhibition System (BIS), thought to bring about withdrawal, and the Behavioral Activation System (BAS), thought to bring about appetitive motivation. However, only a few studies have addressed these motivational systems in the context of development. While the available studies have provided useful information for establishing early measures of BIS and BAS, they have not yet employed direct tests of psychophysiological responses during the experience of appetitive and aversive outcomes, an approach that has proven to be critical in adult studies of motivated behavior. In large part, examining psychophysiological responses to gain or loss of reward in early development has been stymied by the absence of age appropriate “reward processing” tasks. As a result, the current study sought to develop and validate a reward processing task using measures of psychophysiological arousal and parent-reported BIS/BAS behavior in preschool age children. A recently validated parent-report questionnaire assessing BIS/BAS tendencies in young children was used to measure approach and withdrawal behavior and pupillometry was used to measure a child’s psychophysiological arousal during the gain or loss of reward. Results were significant for an overall greater increase in pupil dilation when children experience a loss, as opposed to a gain, of reward. No significant correlations were found between measures of BIS/BAS and pupil dilation response to either gain or loss of reward. Study findings provide preliminary support for a developmentally informed reward-processing paradigm that was developed and advocate for future reward processing studies in young children to address questions regarding the development of motivated behavior.
Delay Discounting and Deprivation

Prateek Kumar

Mentor: Leonard Green

Delay discounting refers to the decrease in a reward’s subjective value as the wait until its receipt increases. The effect of deprivation on the degree to which people discount the value of delayed outcomes was investigated using real liquid rewards as well as hypothetical monetary and musical rewards. Participants were studied in two experimental sessions, one in which they were deprived of liquids for nine hours and one in which they were not deprived. Differences in deprivation were verified by measurements of urine specific gravity as well as by subjective thirst ratings. An adjusting-amount procedure was used to estimate the subjective values of the rewards at various delays. For all three types of rewards under both deprivation conditions, the decrease in the subjective value of the reward with increases in delay was well described by a hyperboloid discounting function. Liquid deprivation had no effect on the degree of discounting of monetary and song rewards, but decreased the degree of discounting of liquid rewards. These findings are contrary to those from previous studies that report that when substance abusers were deprived of their drug of abuse, they discounted both delayed drug rewards and delayed monetary rewards more steeply than when they were not deprived. The present finding that deprivation led to shallower discounting of the reward that participants were deprived of is reminiscent of the amount effect, in which larger rewards are discounted more shallowly than smaller ones, and suggests that, at least with some types of reward, deprivation increases the value of that reward.
Very little research has been done to investigate the relationship between worry, hope, and sensory loss in the aging population. In order to better understand this field, subjective and objective sensory measures in aging adults were compared with individual tendencies to worry and hope. Fifty-one participants from 55 to 89 years old, including 26 males and 25 females, completed objective hearing and vision testing, along with a questionnaire composed of subjective measures of sensory ability, tendency to worry, tendency to hope, and depression. Results revealed all of the senses to subjectively and objectively correlate with worry, hope, and depression, with the exception of subjective and objective hearing. In addition, subjective measures revealed a clear distinction in perception of vision and hearing as compared with smell, taste, and touch, as participants experienced significantly greater decreases in their vision and hearing when compared with the other three senses. While this study provides an initial understanding of the relationship between worry, hope, and sensory loss in the aging population, there is clearly a need to further investigate hearing as compared to the other four senses when considering an individual’s tendency to worry or hope.
Mindreading and Metarepresentation: Role in the Ontogeny and Expression of Human Language Capacity

Laura Levin

Mentor: Elizabeth Schechter

The skilled and efficient learning and sophisticated expression of human’s language abilities have often been considered distinct from alternative communicative systems in other species. Mindreading, the ability to possess the concept of representation for another person’s or one’s own mental states, is another notable hallmark of human cognition and development. The present paper aims to show that mindreading serves as a necessary, innate pre-adaptation for the complete development and expression of the human language capacity. This paper explores the correlated ontogenetic times of mindreading and language in normally developing children. Here, the normal population is contrasted with individuals with Autism Spectrum Disorder in order to show that mindreading continues to influence language outcomes at every stage of development. These capacities sequentially develop such that failures of specific mindreading mechanisms offer explanations for corresponding language deficits. Empirical research is employed to show that mindreading mechanisms associated with referential intention, joint attention, complex social pretend play, false-belief understanding, figurative language, and empathy play a role in the development of word-mapping, morphological and syntactical structure, indirect utterances, and pragmatic expression. The present findings shed light on the interaction between the human capacities for mindreading and language, information that may be important for understanding human’s communication system. This thesis might illuminate the direction of future research necessary for understanding normal and impaired language expression in humans and communication expression in non-human species.
The Impact of Depression on State Conscientiousness: A Closer Look at What Drives the Vicious Cycle of Depression

Hannah Martin Markell

Mentor: Simine Vazire

The relationship between depression and low global conscientiousness levels is well established. Though several models exist that aim to explain this link (e.g., diathesis-stress model, dynamic predisposition model) none of these models take into account a) state conscientiousness levels or b) the possibility that depression itself may cause lower conscientiousness levels—rather they all focus on how low conscientiousness leads to depression. The current study examined a sample of 93 participants who completed global and Experience Sampling Method (ESM) self reports over the course of six days. The goal was to use global and ESM reports to reveal relationships between personality constructs and depression. Rather than distinguish between clinical and non-clinical depression, I analyzed depression in terms of the broad spectrum of depression, ranging from clinical to non-clinical. The results indicated that depression predicted lower state conscientiousness levels, even when controlling for their self-reported global conscientiousness levels. This finding has implications for both personality assessment and theoretical models of depression. The authors suggest future directions for this research and how it may be applied to theoretical modeling of depression and potential intervention techniques.
As young children become fluent users of their native language, they are also frequently exposed to speakers of unfamiliar languages. Previous studies have examined young children's ability to differentiate between languages and the preferences children exhibit for speakers of familiar languages, but little is known about what children think about communication between unfamiliar-language speakers. We posit that bilingual preschoolers should have an advantage over their monolingual peers when reasoning about communication in unfamiliar languages because of their experience navigating between two linguistic codes. One recent study found a striking difference between monolingual three- and four-year-old children's ability to recognize that an unfamiliar linguistic convention can support meaningful communication. While four-year-old children are capable of understanding that successful communication requires shared knowledge of a language, three-year-old children do not demonstrate this ability. This thesis builds on these findings and examines what bilingual children understand about communication between speakers of both familiar and unfamiliar language conventions. In this study, three- and four-year-old bilingual children participated in a live interaction with one bilingual experimenter and two monolingual actors, one who spoke English and one who spoke Spanish. After being familiarized to the languages the monolingual actors used, the child and bilingual experimenter participated in a game to test their understanding of communicative intention in familiar and foreign languages. The bilingual experimenter asked for an object from one of the actors by using either English or Spanish, and the child was then asked to retrieve the object from the correct actor. The present finding contrast a corpus of empirical evidence suggesting a bilingual advantage in conversational understanding, theory-of-mind, and problem solving. Similar to their monolingual counterparts, bilingual three-year-old children do not appear to understand that successful communication requires that two speakers share knowledge of the language being used.
The aim of this study was to explore the relationship between hippocampal subfield volume and memory in youth with type 1 diabetes (T1DM). While similar studies have been conducted with whole hippocampal volumes, this experiment makes use of new technology that has allowed for automated segmentation of the hippocampus into its individual subfields. T1-weighted scans were obtained on a 1.5 Tesla magnetic resonance imaging (MRI) machine for youth 7-17 years old (n=118), with 80 diabetic subjects and 38 healthy sibling control subjects. Clinical variables including number of hypoglycemic episodes and hyperglycemic measurements were collected. The subjects were administered a verbal list-learning task and a spatial location memory task, both of which had immediate and delayed recall portions. MRI scans were processed using Freesurfer, which automatically segments the brain and provides volumetric estimations. Diabetic subjects were found to have smaller CA1 subfield volumes but larger presubiculum volumes than controls. Diabetic subjects with more than three hypoglycemic episodes had larger average hippocampal volumes, CA2-3 and CA4-DG volumes than other diabetics and controls. In controls, larger average hippocampal volume was associated with better delayed verbal retrieval, and larger CA2-3 subfield volumes were associated with better immediate spatial recall. In diabetic subjects, larger average hippocampal volume was marginally associated with poorer delayed spatial recall, and similar relationships were seen for CA2-3 and CA4-DG volumes and verbal learning. In contrast, larger CA1 volumes were associated with better delayed spatial recall, and larger subiculum volumes were associated with better verbal learning. Together, the results support a picture in which there is some functional specialization amongst the hippocampal subfields, and diabetes affects different subfields and types of memory in different ways.
Individual Differences in Long-Term Memory Ability Revealed with fMRI

Neil K. Savalia

Mentor: Kathleen McDermott

Cognitive ability, especially the ability to absorb newly learned information and preserve it over the long run varies widely across the human population. There is puzzlingly limited experimental evidence on the neural correlates of lasting memory formation and how these actually regulate how and why this faculty differs among individuals in the general population. To study the individual differences in long-term memory (LTM) ability, we employed a data-driven functional magnetic resonance imaging (fMRI) approach. We used a combination of resting-state functional connectivity (rs-fcMRI) and task-evoked MRI to search for a neural signature of long-term memory capability. Through the present investigation, we ask two essential questions regarding biomarkers of lasting memory formation that are present at the level of brain systems: are there differences in neural activity across multiple presentations that contribute to LTM, and does the initial exposure to material itself leave biomarkers representative of their LTM ability? Our results indicate that neural signatures for LTM ability are present and can predict the variations between individuals. Intriguingly, we observe two distinct patterns of brain network activity contributing to LTM ability: suppressions in default mode network activity and modulation of activity in a parietal encoding-retrieval network. In both cases, these findings have clear links to the literature on memory and aging, implicating these brain networks to be dynamically related both to memory formation and vital longevity. This investigation has potential to be fundamentally informative on the population-level variation in LTM as well as help direct future investigations in these rapidly developing fields.
Since their conception in the early 1900s, twin studies have been popular research designs for elucidating heritability of traits and chronic diseases. Yet with the advent of developmental programming as a paradigm in health and adaptation work, their efficacy is called into question. Intrauterine exposures shape developmental trajectories and chronic illness risk, and twins have vastly different *in utero* experiences from singletons. Twins share resources and space, are typically born low birth weight (LBW), and their LBW status can increase their risk of developing metabolic syndrome. Furthermore, large intra-pair differences in twin birth weight can lead to changes in growth and developmental trajectory. Their mothers are at increased risk of experiencing gestational disorders, which predisposes the twins to being born small for gestational age (SGA), a status that can alter their adult body composition. Mothers having certain illnesses and health conditions during pregnancy can alter their fetus’ development and risk for disease, as seen by the cases of obese mothers undergoing biliopancreatic bypass surgery and mothers diagnosed with Type 2 diabetes. Additionally, heritability estimates provided by twin studies often discount gene-environment interactions. These types of interactions have been found to be crucially important in modifying disease risk, as identical twins discordant for Alzheimer’s disease had significantly different epigenetic patterns as evidenced by DNA methylation levels. Even newborn twins showed extreme discrepancies in their epigenomes, and the chorionicity of identical twins impacted their methylation patterns. For twin studies to remain a viable research paradigm, they will need to incorporate developmental programming into their study designs by considering chorionicity and amnioticity, gene-environment interactions, and epigenetics.
Behavioral Variability as a Moderator of Self-Other Agreement in Personality

John Slochower

Mentor: Simine Vazire

In modern psychology, it has become clear that behavior is the result of complex interactions between personality traits and situational variables. Experience-sampling methods (ESM) allow researchers to collect data on participants’ momentary states, enduring dispositions, and situational influences. When used in conjunction with global self- and informant-reports, these methods may reveal patterns of behavior that make it easier for others to accurately identify levels of personality traits. Specifically, behavioral variability was hypothesized to moderate self-other agreement, such that lower levels of variability should lead to greater self-other agreement. However, regression analyses revealed that variability did not have a moderating effect on self-other agreement across the Big 5. Only self-other agreement on Negative Affect experienced a moderation effect. Exploratory analyses were also performed to help characterize individuals with high levels of behavioral variability. Decreased emotional reappraisal and mindfulness scores were correlated with variability, indicating that these subjects have very little control over their experience of emotion. The implications of this finding are discussed with reference to philosophical notions of agency and personal responsibility.
Retrieval from *episodic memory* involves an awareness that one is thinking about one’s own past experience. This awareness generally includes vivid perceptual imagery of time and place. Tulving was the first to label this kind of memory “episodic” and to distinguish it from “semantic” memory. *Semantic memory* transcends the spatial and temporal realms; semantic memory consists of general knowledge about the world. People with isolated episodic memory deficits, a deficit known as episodic amnesia, have difficulty forming and recalling personally experienced memories despite their ability to recall facts about the world. Without these specific and privileged kinds of memories of the past, is a person able to conceive of a past and a future? Philosophers and scientists alike have, implicitly or explicitly, asserted that people with episodic amnesia lack a concept of time. There is an a priori argument that episodic memory is necessary for one to have the concept of the past; it seems unlikely that one could have a concept of something they have never experienced. To test the episodic necessity hypothesis, the present study addresses whether people with episodic amnesia possess semantic knowledge of time indexed to the present. This is carried out by asking five subjects with episodic amnesia a battery of questions on several components of time: 1) concepts of the past, present and future, 2) knowledge of the direction of time, and 3) knowledge of the causal asymmetry of time. The empirical data on temporal concepts from individuals with episodic amnesia suggests that people with episodic memory deficits, even global and lifelong episodic memory deficits nonetheless retain considerable conceptual knowledge of time, proving the episodic necessity hypothesis to be incorrect.
The Study of Autism and Social Cognition: A Neurological and Psychological Lens

Victoria Wesevich

Mentor: Lori Markson

Autism spectrum disorder (ASD) is a disorder of brain development characterized, in varying degrees, by difficulties in social interaction, and verbal and nonverbal communication. The current diagnosis and treatment of ASD does not fully consider the implications of evidence shown through studies in neuroanatomy and social cognition, and therefore offers less helpful information, as exemplified by the instability of initial diagnosis criteria later in childhood. This is likely due to the lack of understanding of the underlying cause of the disorder. At present, data from studies of genetic and brain region abnormalities do not aid in the clinical assessment of ASD because neuroanatomical measures of cortical thickness, activation, and neuronal cell type have failed to give consistent and diagnostically meaningful results. Furthermore, studies of social cognition fall short diagnostically due to a lack of consensus in the field of psychology on the cause of ASD, resulting in significant differences in experimental approaches. This limits more rapid progress towards an accurate and complete understanding of ASD, for example, the way in which a child’s ability to imitate is experimentally tested demonstrates different levels of intention comprehension. Overlooking this is likely why the ASD studies on imitation have been inconclusive. Therefore, for a deficit in imitation to be used as diagnostic criteria for ASD, the specific level of intentionality that etiologically explains the deficit in imitation must be agreed upon to effectively determine the appropriate testing method of imitation. By analyzing currently available data from both fields, it can be concluded that for ASD research to progress the understanding of ASD, an interdisciplinary approach is required. Through support from both neuroanatomical and social cognitive evidence, such research will provide promising data for the diagnosis and intervention for children with ASD, including earlier or more accurate diagnosis and better outcomes in social functioning.
Effects of Stress on Category Learning

Teresa H. Yao

Mentor: Denise Head

Category learning refers to classifying objects or concepts into different categories based on what we observe about the object or concept. Understanding factors that could influence category learning may uncover further insights into situations that involving the use of categorical learning. Two major types of category learning are rule-based (RB) and information-integration (II). Previous studies have shown that RB is associated with a medial temporal lobe-based declarative memory system, while II is associated with a caudate-based procedural memory system. These neural regions underlying RB and II learning overlap with regions associated with stress. Thus, the goal of this study was to investigate how stress influences performance in RB and II tasks. Our prediction was that stress would decrease RB performance and increase II performance. Twenty young adults completed stress questionnaires and a computerized category-learning task, which involved use of both RB and II learning strategies. Correlations between self-reported stress measures and performance measures from the category-learning task were not significant. Analyses after excluding outliers yielded mixed findings. There was a non-significant negative trend for higher chronic stress levels to be associated with faster RB reaction time. Decreases in positive affect were associated with both slowed RB and II reaction time, but increased II accuracy. Because the sample size was very limited and outliers may represent a wider variability in the larger population, no conclusions can be made regarding the relationship between stress and category learning. Thus, perhaps a larger sample size could lead to more robust findings. Additionally, the influence of the prefrontal cortex and working memory are discussed for future research.
Determination of Average Loss Lifetimes for Near-Earth Electrons in Solar Storms

John Blears

Mentors: Michael Liemohn, University of Michigan, and Martin Israel

The rate of electron wave-particle scattering in the near-Earth magnetosphere is investigated using multiple simulations of solar storms from solar cycle 23 (1996–2005). Simulations are created using the Hot Electron and Ion Drift Integrator (HEIDI) model, which analyzes the drifts of keV-energy electrons through the inner magnetosphere and identifies the precipitation of these particles into the upper atmosphere. The loss lifetime formulation used by HEIDI, which represents the rate at which the keV-energy of the electrons is extinguished, predicts unreasonably large loss lifetimes deep in the inner magnetosphere. This discrepancy between the values used by the HEIDI model and those observed by satellite measurement can in part be resolved as a result of this work, which provides evidence for more reasonable loss lifetimes for particles in the inner magnetosphere. This study and future work can be used to improve data-model comparisons of solar storms.
Isospin Symmetry Studies Using 8Cgs and 8BIAS 2p Decay

Walter Buhro

Mentor: Lee Sobotka

We studied the double proton decay of 8C ground state and its isobaric analog (IAS) in 8B. An isobaric analog is a state with the same spin, same isospin T, and mass number A, but a different number of protons and neutrons (isospin projection Tz). This experiment is part of a continuing study of isospin mass multiplets. Mass multiplets are the collection of all possible nuclear states (isospin projections) with the same spin, A, and T. Isospin symmetry depends on nucleons acting as point-like particles. This experiment completed the A = 8, T = 2 mass multiplet. In a previous experiment, the group measured the double proton decay of 12O ground state and 12NIAS. If a mass multiplet has isospin symmetry, then the masses of the nuclei in that multiplet can be calculated with a quadratic polynomial in Tz called the Isobaric Mass Multiplet equation (IMME). The IMME has wide applicability, including predicting the rates of nucleosynthesis reactions that have not been experimentally measured. We measured the 8C and 8B (IAS) reactions in an experiment performed at the National Superconducting Cyclotron Laboratory at Michigan State University. 9C beam was prepared and interacted with a Be target and we measured the charged particles and photons with Si solid state detectors and CsI scintillator detectors. We found that isospin symmetry is broken in the A = 8, T = 2 multiplet and the IMME cannot predict their masses. However the A = 12, T = 2 multiplet was found to exhibit isospin symmetry and their masses are predicted well by the IMME. Isospin symmetry is a very useful tool when it is present, and when isospin symmetry breaks it hints at interesting nuclear structure effects that require further study.
Applications of Extended X-Ray Absorption Fine Structure to the Study of Metallic Glasses

Walter Fu

Mentor: Kenneth Kelton

In this paper, the atomic structure of vitreous Cu46Zr54 at room temperature was studied primarily via extended x-ray absorption fine structure (EXAFS) analysis. The raw data were processed using the program ATHENA, and were then used in conjunction with x-ray diffraction (XRD) to constrain Reverse Monte Carlo simulations of Cu46Zr54. As a proof of concept, the elemental sensitivity of EXAFS permits separation of the partial pair correlation functions and reproduces the results of molecular dynamics (MD) simulations while bypassing the high computational requirements of MD; however, the application of this technique is limited by a number of practical and theoretical factors. The source of these issues will be the subject of further investigations.
This thesis describes a new statistical method that can be used to separately determine the quantum efficiency and gain of a microchannel plate photodetector. This method is employed on an atomic layer deposition coated microchannel plate, before and after the entrance to the microchannel plate pores are activated with cesium ions and a layer of amorphous gallium nitride to determine what impact those procedures have on the plate quantum efficiency and gain. The potential for observing single electron peaks in a low intensity beam incident on the plate is also considered while comparing the pulse height histogram to theoretical expectations.
Elemental characterization of presolar silicate grains has shown that many have higher than expected Fe contents. The pristine nature of most primitive meteorites suggests that much of the Fe is intrinsic to the grains rather than due to secondary alteration. Fe isotopic measurements can provide confirmation of a primary origin and can help constrain nucleosynthetic processes in evolved stars. Our goals in investigating Fe isotopic compositions in presolar silicates are to: 1) demonstrate that using the Cs+ primary beam to extract Fe in FeO- is a viable alternative to measuring Fe+ with the 0- primary beam; 2) determine if the high Fe content of presolar silicates is primary or secondary in origin; 3) see if we can provide constraints on Fe nucleosynthetic processes in evolved stars.
Many proposed frameworks for a unified description of nature include predictions that run directly contrary to our present understanding of the universe. One such prediction that is common among these theories is the existence of Lorentz Invariance Violation (LIV) at extremely high energies. Gamma Ray Bursts (GRBs) combine rapid flux variability with high photon energies and cosmologically significant source distances thus making them ideal testing grounds for LIV. In the interest of increasing the number of GRB light curves from which we can extract lower limits on the LIV energy scale, we propose a novel method of analysis that combines measurements of rapid, statistically significant flux variability with GRB spectral models to set lower limits on this energy scale. The efficacy of our algorithm has not yet been tested using real data. Using Monte Carlo simulations in which the actual value of this energy scale is known, however, we find that our two pass algorithm accurately recovers lower limits on this energy scale in over 98% of trials, even when the energy scale used to generate the simulated data is varied across ten orders of magnitude.
Nucleon pairing is studied with specific considerations directed toward the possible influence on neutron star cooling. We present an in-depth analysis of BCS theory using realistic nuclear potentials and consider the impact short-range correlations can have on the gap. Gap calculations are incorporated into neutron star cooling simulations and the significance of the $3\Pi_2 - 3\Pi_2$ channel in various hadronic cooling models is closely examined. An analysis of the $1\Sigma_0$ gap in neutron matter suggests short-range correlations can drastically alter the magnitude, density range, and temperature dependence of the gap. While the newly constructed $1\Sigma_0$ gap does not significantly alter the nature of neutron star cooling, improved calculations in the $3\Pi_2 - 3\Pi_2$ channel call into question the existence of this gap in neutron stars. Ongoing work focused on incorporating medium polarization effects through second-order self-energy corrections is also briefly discussed.
Is the appointment and empowerment of US presidential “czars” antidemocratic? Although many authors have argued about the constitutionality of the presidential power of appointment, the existing literature has overlooked problems that violations of the doctrine pose for the maintenance of democratic institutions, namely the non-delegation doctrine and the separation of powers. Existing indices for measuring countries’ achieved levels of democracy neglect to include measures of delegation, even though nondelegation is one of the most important limitations on the executive branch. My analysis of two of the most prevalent democracy indices, the Polity IV Project and Freedom House, reveals that both of these indices fail to account for the degree of executive branch delegation of legislative powers, leaving open a loophole through which countries with antidemocratic institutions may still receive scores of “fully democratic.” I have developed a Nondelegation Index, which ought to be included among these measures and which scores countries across three separate sub-scores: 1) the legal limitations against delegation; 2) the actual extent to which delegation is practiced; and 3) the extent to which appointees exercise decision-making powers characteristic of the legislative branch of government. The violation of the non-delegation doctrine through the appointment of presidential czars is inherently antidemocratic and must therefore be seriously considered in measures of democracy.
Selfish Genes, Not Selfish Individuals: Explaining the Salience of Race in Determining Support for Welfare

Neel Desai

Mentor: Frank Lovett

Why is race the most salient factor in determining support for income redistribution, and why do such considerations overwhelm rational pecuniary interests? More specifically, why does individual support for welfare spending increase as the recipiency rate of members of same-race individuals increases, and vice versa? As income inequality expands globally, the importance of these questions looms ever larger. This thesis proposes that racialized attitudes towards income redistribution are a relic of our evolutionary past. Proceeding from the acceptance of evolution by natural selection as the ultimate cause for human behavior and of kin selection as the primary altruistic mechanism at play in welfare, this thesis proposes that the cognitive mechanism for kin selection is a heuristic process in which race and kin are conflated erroneously.
This thesis examines the historical origins and institutional development of the sovereign immunity doctrine as it applies to the United States federal government. The legal doctrine of sovereign immunity prevents citizens from suing their government in its own courts for money damages. A seemingly incongruous feature of a democratic society, this paper accounts for various theories of how governmental immunity from lawsuits became so entrenched in early American law.

The alternative legislative remedies and institutions created to compensate those harmed by governmental breaches of contract and negligence are explored. After a discussion of the limited political science literature on sovereign immunity, legal cases dealing with sovereign immunity from the country’s founding to the present are discussed and original data gathered on the number of private bills is presented. This work incorporates legal history, normative political theory, institutional analysis and American political development to try and explain this phenomenon of the American legal system.
Political Science

Campaign Spending Matters: New Approaches to Capture the True Effect of Incumbent Spending

Alexander Boguslaw Kaufman

Mentor: Guillermo Rosas

There is clear evidence that when candidates who are challenging House and Senate incumbents spend money campaigning they significantly increase their percentage of the overall vote, or vote share. However there is no conclusive evidence that campaign spending by incumbents has the same, or even any, significant effect on the incumbent’s vote share. Some theories have been offered to explain why incumbent spending might really be in ineffective, or as effective, as challenger spending. Many scholars believe that spending does matter but most research has been unable to observe the effects. Scholars agree that past models designed to test the effect of incumbent spending have suffered from specification error and endogeneity problems.

I design and test a new model to capture the effect of incumbent spending on vote share by using data from House and Senate elections between 1980 and 1998. I use a 2SLS model to avoid the endogeneity problem that results from a simultaneous relationship of spending and vote share. To estimate incumbent spending I test novel instruments related to constituency’s income and participation data. My model is also the first to use district level instruments that are not a lagged measure of vote share to estimate spending, the first to test candidate quality controls in a 2SLS regression, and the first to include independent and party coordinated expenditures in spending aggregates. I find evidence that the proposed instruments are methodologically sound and that incumbent spending does affect vote share, almost as much as challenger spending. The effect of including independent and party coordinated expenditures does not significantly affect vote share in the models tested.
Rhetorical Localism: Patterns of Constituent Focus in US Senate Speech

Simon Kwong

Mentor: Randall Calvert

What factors affect the amount of attention to local issues in US Senators’ floor speeches? I examine rhetorical localism, the level of Senators’ focus on constituent concerns through rhetoric, and how it changes in response to factors believed to affect policy representation. I argue that quantitative measures of rhetorical localism will display significant shifts in response to electoral, temporal, and institutional pressures. This study provides a macro-level perspective on trends in representational behavior intensity and compares the use of Senate floor speeches versus press releases. Using floor speeches from 1994 until 2010, I find significant decreases in rhetorical localism for long-serving Senators, as well as a fluctuating pattern that alternates between election and non-election years. I then replicate the analysis on Senate press releases from 2005 to 2007 to provide a comparison of the two mediums, discovering that constraints in time, opportunity, and prestige differentiate floor speeches from press releases.
Jürgen Habermas developed a normative ideal of how citizens should interact with their states by analyzing the deliberative institutions of the eighteenth- and nineteenth-century bourgeois public sphere. The institutions that once facilitated deliberation had disintegrated by the time Habermas wrote. However, scholars have argued that the internet could help realize Habermas’s ideal today. I argue that current online discourse fails to meet the Habermasian ideal. However, I further claim that increased state involvement with online deliberation can enable it to approximate Habermas’s ideal. I thus reject the conventional idea that the public sphere must be separate from the state, and instead claim that the internet enables closer state-public sphere interactions without compromising the independence of the public sphere.
Social Network Support for Weight-Related Behaviors as a Predictor of Percent Overweight and Weight and Shape Concerns among Children Seeking Obesity Treatment

Allison Bischoff

Mentor: Denise Wilfley

Childhood obesity is associated with detrimental physical and psychological consequences, including onset of Type II diabetes and heightened weight and shape concerns, a potent risk factor for development of an eating disorder. Research on adults demonstrated that social networks may engender obesity and its consequences or protect against them, although little is known about the social networks of children and the role of parents versus peers, as these may differentially impact weight status. The current study aims to analyze associations between children’s social networks and their degree of overweight as well as their weight and shape concerns. Specifically, this study addresses how social network support among family and peers for unhealthy eating and unhealthy activity contribute to children’s degree of overweight and weight and shape concerns. Overweight, treatment-seeking children (N=241, BMI>85th percentile) completed baseline interviews on their social networks (Network Support for Healthy Behaviors) and questionnaires on their weight and shape concerns (Eating Disorder Examination Questionnaire-Youth Version). Results indicate that social network support for unhealthy eating was correlated with higher baseline percent overweight (r=0.13, p<.05). Social network support for unhealthy activities was also correlated with higher baseline percent overweight (r=0.13, p<.05). Baseline percent overweight was associated with family support for activity, but was not associated with eating. Baseline percent overweight was not associated with peer support for eating or activity. The study also found that social network support for unhealthy activity was correlated with increased weight concerns and shape concerns (r=0.15, p<.05) (r=0.13, p<.05). This research underscores the importance of evaluating the role of social network support in shaping or maintaining children’s overweight status and their weight and shape concerns. Future research on social networks and how they can be used to facilitate healthy lifestyles in children may yield innovative and wide-reaching solutions to the obesity epidemic for individuals and broader society.
An Examination of the Other-Race Effect Using Direct Manipulation of Race

Lauren Clatch

Mentor: Sandy Hale

Three experiments were conducted to examine the other-race effect (ORE) using race-transformed faces in order to eliminate the role of differences in within-race variability as a confound in the existing ORE literature. The first two experiments of the current study used a standard memory-recognition paradigm to examine the ORE, and the third experiment sought to determine whether the ORE reflects differences in the initial perceptual processing of both same race (SR) and other race (OR) faces. In Experiment 1, one group of Caucasian participants was exposed to original-race Caucasian and African-American faces and another group was exposed to reverse-race faces. Surprisingly, the ORE was not obtained for either group. In Experiment 2, a group of Caucasian participants were exposed to Asian and Caucasian faces that were equivalent in terms of within-race variability because all of the faces were derived from original-race Asian faces that were also counterbalanced to remove all stimulus-specific effects. This experiment did yield an ORE. Lastly, Experiment 3 required participants to view two faces presented side-by-side and make same-different judgments. Evidence from these data sets suggested that SR faces were discriminated more efficiently than OR faces. Taken together, the current experiments suggest that the ORE is not a reflection of previous failures to take within-race variability in the selection of faces. It appears to be a robust phenomenon that can also be observed in the perceptual processing of faces without a memory requirement.
Domestic Dissatisfaction or Dissatisfaction? Gender Differences in a Multilevel Model of Marital Satisfaction Using Prenuptial Marital Expectations after 20 Years

Sarah Garrison

Mentor: Michael Strube

Nearly half of all marriages are predicted to fail. Yet, only 11 longitudinal marriage studies exist, which can examine psychological variables after 20 or more years. Most of these did not properly examine gender differences. Using data from the first (1935) and second (1955) waves of the Kelly Longitudinal Study on marriage and personality (n=599), I found that there was not a significant gender difference in marriage attitudes at time of engagement on marital satisfaction after 20 years. When the predictions were analyzed separately by gender, various attitudes predicted marital satisfaction, suggesting differences in the model. When the dependencies within couples were accounted for, the various attitudes did not significantly predict marital satisfaction, and there were no significant differences in the models between genders. These results suggest that attitudes do not predict marital satisfaction. However, I suggest that more current marriage studies be used to replicate these findings.
Parenting Preschoolers with Disruptive Behavior Disorders: Does Child Gender Matter?
Antonya M. Gonzalez

Mentor: Joan Luby

Parental responses to child behavior early in development can have an important impact on later behavioral outcomes. The current study investigated parental responses to preschool children with Disruptive Behavior Disorders. Children in this population often engage in externalizing and disruptive behavior, which often elicits negative responses from parents. Disruptive Behavior Disorders are less common in girls, and there is a dearth of literature investigating possible child gender differences in parental responses. A number of studies have found that parents react more negatively when girls engage in disruptive behavior, plausibly because it is behavior contrary to societal gender expectations. The current study investigated this dynamic within a population of preschoolers with Disruptive Behavior Disorders. The hypothesis was that parents would show more negative behavior and affect toward disruptive girls than they would toward boys. Fifty-nine parent-child dyads were included in the study, and all children were diagnosed with Attention-Deficit Hyperactivity Disorder, Oppositional Defiant Disorder or Conduct Disorder. Each dyad completed a mildly stressful interaction task where the caregiver filled out paperwork while the child waited eight minutes for a present. The interaction was coded for negative parental responses, such as behavior and affect. No gender differences were found in the majority of parental response variables, possibly because the population of parents who had children with clinical level symptoms may be better acclimated to disruptive behavior in their children. The variable Ambiguous Directions was found to be significantly more common in parent-boy dyads. This finding was consistent with the current literature, which suggests that parents are less explicit and directive in their communication with young boys. In conclusion, the study found evidence for some gender differences in parental responses to early childhood disruptive behavior. However, further research is needed to inform the intersection between parenting, child gender, and Disruptive Behavior Disorders.
Delay discounting refers to the decrease in the subjective value of a reward as the wait until its receipt increases. The current study examined the effect of symbolic information on the delay discounting of directly consumable liquid rewards. At issue was whether the amount effect (i.e., larger delayed rewards are discounted proportionally less steeply than smaller delayed rewards) observed with humans, but not with non-human animals, would be obtained when humans, like the animals, are not provided symbolic information about the delays and amounts. Participants in one group were provided symbolic information about the amount of reward and the delay until its receipt, whereas participants in the non-symbolic group were not provided such information. A significant amount effect was obtained in the symbolic condition, whereas no amount effect was observed in the non-symbolic condition. These findings raise the possibility that the fact that humans discount smaller amounts of delayed reward more steeply than larger amounts, whereas animals do not, may be an artifact of the different procedures typically used with humans and animals and not a species difference, per se.
Do Different Narrative Styles Affect Intervention Films’ Ability In Reducing Schizophrenia Stigmas?

Danni Liu

Mentor: Michael Strube

Prior research found that filmed personal contact could effectively reduce stigma toward mental illness. However most studies only used personal interview (PI) as narrative style for the film. The present study compares the effectiveness of personal interview to first-person documentary (PD) narrative style in reducing stigmatized attitudes toward schizophrenia. Participants were assigned to watch one of four combinations of intervention films: PI and PD, PI and nature documentary, PD and nature documentary, and nature documentary only. Both explicit and implicit attitudes were assessed before and after the experiment, using the explicit attitude scale and Social Distance Scale for measuring explicit attitudes, and the Implicit Association Test for measuring implicit attitudes. Viewing both PI and PD significantly reduced bias in “unpredictability/incompetence” and “poor prognosis” stereotype components, while viewing PI and nature documentary significantly reduced bias in the “unpredictability/incompetence” component. Participants’ willingness to interact with schizophrenia increased significantly regardless of the films they watched. Further research is necessary in identifying specific aspects of the intervention films that are effective in reducing stigma.
Social Loafing in Virtual Teams

Brittany Marcus-Blank

Mentor: Andrew Knight

Virtual teams and computer-mediated communication (CMC) are commonplace in today’s organizations. With the rise of globalization, virtual communication is necessary for teams to collaborate on projects whether across time zones or within the same office building. This instantaneous communication allows employees to work together regardless of geographic location, and it provides huge cost savings for organizations on travel expenses. While there are many benefits of CMC, it is important to be aware of the impact CMC has on productivity gains and losses. Past research has shown the social loafing effect, decreasing one’s effort when working in a collective group to avoid other’s free riding, is present in virtual teams, but there has been no research to date on the social compensation effect, where individuals increase their effort on collective group tasks in order to compensate for underperforming co-workers when the group outcome is valuable, in virtual teams.

This study investigated the effects of group similarity and perceived group-member effort on individual effort, which was assessed through a series of idea-generation tasks. Group similarity was manipulated through an avatar minimal group paradigm manipulation, which was intended to alter participant’s social connection. Group feedback after each trial was used to manipulate participant’s perception of group members’ effort. Results indicated neither significant main effects nor significant interaction effects for group similarity and group-members’ effort. Theoretical and practical explanations for these results are discussed.
The Effects of Metacomprehension on the Read, Recite, Review Study Strategy

Nicole Martin

Mentor: Mark McDaniel

This experiment investigates the effectiveness of metacognitive judgments and the read, recite, review method as a study strategy. The goal of the experiment is to determine whether making judgments of learning (JOLs) can help students more effectively study while using the read, recite, review method in order to maximize their learning. Participants were given an educational text to read and assigned to 1 of 3 study conditions. A read, recite, review (3R) condition was compared to both a read, recite, review condition that made specific metacognitive JOLs (specific meta 3R) and a read, recite, review condition that made general metacognitive JOLs and had access to those judgments during restudy (general meta 3R). Participants were tested over the text after studying and were evaluated on multiple choice, problem solving, and free recall performance. The amount of new information learned during restudy and restudy time allocation were also analyzed. The results showed that making JOLs was not helpful in guiding studying. The general meta 3R condition performed significantly worse than the 3R condition on inference multiple choice questions and marginally worse than the 3R condition on problem solving, free recall, and new information learned. Participants made highly accurate JOLs, yet these judgments did not help them allocate restudy time to the information they did not know; in fact, participants appeared non strategic in their decisions of study time allocation. Overall, students seem to be very inefficient in their studying even when they have a good idea of what information they do not know.
Bipolar organ transplant candidates represent a small yet under-researched portion of the transplant population. We conducted a case series analysis investigating the pre-transplant clinical and behavioral characteristics of these patients as the first phase of an ongoing study examining the behavioral effects of post-transplant corticosteroid treatment on this subgroup. Thirteen patients with accessible and complete data were selected from a group of 28 transplant candidates with bipolar disorder who had been psychologically evaluated at a large Midwestern hospital in the past 25 years. The most commonly experienced manic symptom in these patients was flight of ideas/racing thoughts, and nine of the 13 cases discussed exhibited some comorbid psychiatric symptomology. Although none of these patients displayed manic symptoms current or severe enough to suggest denial of transplant, certain attributes (e.g., history of alcohol abuse and susceptibility to psychological triggers) may potentially indicate higher risk of development of post-surgical mania.
The Role of Emotions in Political Attitudes: Do Negative Feelings toward the Opponent Predict Support for the Favored Candidate?

Jannina Phi

Mentor: Alan Lambert

In this research, we challenge the basic assumption of many political campaigns: that negative emotional reactions toward the opponent can galvanize support for one’s chosen candidate. To investigate this, we surveyed a representative sample of 539 participants on their feelings towards Barack Obama and Mitt Romney in addition to a host of demographic and psychographic variables. Our results indicate that, contrary to popular belief, emotional reactions toward the opponent do not consistently predict support for one’s favored candidate. Of particular note, among Mitt Romney supporters, feelings toward Obama did not at all predict their degree of support for Romney. Likewise, among Barack Obama supporters, feelings toward Romney only weakly predicted support for Obama. These findings may challenge the effectiveness of mud slinging, attack advertisements, and other components of negative campaigns.
Executive Abilities in Children from Families with Inter-partner Violence

Brian Richter

Mentor: Desiree White

In the following study, the researcher was concerned with the relationship between children’s exposure to inter-partner violence and executive abilities, which are metacognitive processes necessary for successfully navigation of the current cultural geography. Specifically, do children exposed to inter-partner violence exhibit poorer executive abilities than children not exposed to inter-partner violence? To answer this question, mothers and their children residing at a shelter for inter-partner violence were administered questionnaires and tests that assessed their executive abilities and, importantly, their executive abilities in daily life. Though no questionnaires or tests were given to assess the children’s exposure to inter-partner violence, it was assumed that the children who participated had been exposed to, or, at the very least, had been aware of inter-partner violence because they were residing at a shelter for inter-partner violence. The results demonstrate that executive abilities, specifically the behavioral regulation processes, were poorer in a population of children who had been exposed to inter-partner violence than the population used to normalize the tests. This result has practical implications for treatment and for shelter programming.
Surviving on My Own: 
Does Ostracism Influence Attention to 
Fitness-Relevant Stimuli?

Angela L. Senne

Mentor: Randall Larsen

Previous research has suggested that socially excluded individuals are more attentive than included individuals to cues of social acceptance but not to cues of social rejection. The present study aimed, in part, to replicate these results but also to extend the literature on the effects of social exclusion by looking not just at attention to social stimuli but also at attention to non-social, evolutionary fitness-relevant stimuli. Because social groups helped provide crucial survival benefits throughout human evolution (such as increased ability to obtain high-quality food resources and increased ability to detect and defend against predators), humans may have evolved a disposition to be more attentive to such fitness-relevant cues as the presence of food items or of threatening animals when ostracized from a social group than when included in the group. To test this, I manipulated ostracism using Cyberball, a virtual ball-toss game in which some participants were randomly assigned to be excluded for most of the game. Participants then completed a series of visual search tasks measuring detection speeds for social and non-social fitness-relevant stimuli. Notably, the present study failed to replicate previous findings of increased attentiveness to cues of social acceptance for socially excluded versus socially included individuals. Furthermore, the results did not support the hypothesis that socially excluded participants would be more attentive than socially included participants to non-social fitness-relevant stimuli as there was no difference in reaction times between those who were included and those who were excluded. Ultimately, more research is needed to determine what, if any, effect ostracism has on attention to evolutionary fitness-relevant stimuli.
The Effects of Gender Expression on Implicit Attitudes toward Homosexuality

Brittany Tokasey

Mentor: Diana Hill

Despite increased positivity in explicit reports of attitudes toward gay individuals, discrimination based on sexual orientation still occurs. For this reason, it is important to examine not only the attitudes toward homosexuality that people are willing to express but also those that they hold implicitly. The present research adds to the literature by taking into account that the wide variety of gender expression, regardless of sex, within the gay community may also influence people’s implicit attitudes. Using pictures of males and females who varied in how feminine or masculine they appeared, six types of same-sex couples (feminine female/feminine female, masculine female/masculine female, feminine male/feminine male, masculine male/masculine male, feminine female/masculine female, and masculine male/feminine male) and one type of opposite-sex couple (masculine male/feminine female) were constructed. Participants were shown, or primed with, a photograph of one of those couples before seeing a pleasant or unpleasant target picture. The time that it took for them to categorize the target pictures should reveal their implicit attitudes toward the pictures they were primed with. All seven types of couples elicited positive implicit attitudes. The only two cases where these results did not reach significance were for the feminine male/feminine male and opposite-sex couples. These patterns indicate that, in general, being in a romantic relationship invokes positive implicit attitudes in others. Implications and future directions are discussed.
The Effects of Child Sexual Abuse on Risky Sexual Behavior among African-American Women

Claire Tourjee

Mentor: Laura Otto-Salaj, University of Wisconsin, Milwaukee

Child sexual abuse (CSA) is an offense that occurs worldwide and has far-reaching effects. While much research exists on the effects of sexual abuse in Caucasian women, little research exists on the effects in African-American women. The purpose of this study is to further the research in the area of childhood sexual abuse as a possible precursor to risky sexual behavior among African-American women. Most studies have sought to investigate predictors of HIV risk, and have used models of behavior that do not consider power in relationships between women and their partners. My substudy, which was inspired from its parent study—Etiology of Sexual Risk, Substance Abuse, and Trauma: A Bioecological Systems Model—looks specifically at how child sexual abuse and other factors (sex roles, sexual relationship power, and victimization) affect future risky sexual behavior. Several associations were found through structural equation modeling (SEM) analysis: past history of childhood sexual abuse predicted traditional gender role attitudes (sex roles), sex roles significantly predicted sexual relationship power, and sexual relationship power significantly predicted recent victimization. Interventions aimed at helping CSA survivors change their traditional gender role attitudes are needed. Future implications are discussed as well.
The Effect of Social Anxiety on Academic Anxiety

Melissa Turkel

Mentor: Thomas Rodebaugh

Much evidence supports the notion that social anxiety causes impairment in many domains of life, such as romantic relationships, friendships, work, and physical health. Few studies, however, have examined the effect social anxiety has in school, particularly for college students. The purpose of the study was to investigate the effect of social anxiety on academic anxiety and to determine if the effect would be isolated to highly socially evaluative academic situations.

One hundred five participants completed self-report measures assessing social anxiety and anxiety-provoking classroom experiences. Measures included the Social Interaction Anxiety Scale and the Social Phobia Scale, and the Liebowitz Social Anxiety Scale, modified with author-generated items and items from the Anxiety Disorder Interview Schedule. The modified LSAS was divided into academic situations high in social evaluation (e.g., giving an oral report) and low in social evaluation (e.g., taking a test). Participants also wrote about an academic situation that elicited anxiety. They completed affect and anxiety measures before and after the task. Multiple regression was used for prediction of LSAS-M and affect responses by social anxiety, neuroticism, and depression.

Social anxiety, but not depression and neuroticism, predicted fear and avoidance of both total academic situations (part r=.61, p<.001) and situations with low social evaluation (part r=.41, p<.001), as well as pre-writing task negative affect (part r=.30, p=.004). Social anxiety, as well as depression and neuroticism, also predicted fear and avoidance of highly evaluative situations (part r=.68, p<.001), pre-writing task state anxiety (part r=.22, p=.04), and post-writing task negative affect (part r=.36, p<.001).

Overall, social anxiety was significantly related to academic anxiety. Depression and neuroticism, however, were also predictors. These findings imply a possible global academic anxiety for individuals with elevated social anxiety, regardless of the social nature of the academic task.
The Neoliberal Paradigm: Cultural Production and the “Death of the Author” in Mexico

Ariel Wind

Mentor: Ignacio Sánchez Prado

This study centers around cultural production under neoliberalism in Mexico by following the development of three cultural products—a novel, a play, and a movie—to see how their extra-literary trajectories (production, reception, distribution) dialogue with the messages they wish to send (or tacitly send) through their content. This content, I develop, is in part molded by the social and economic forces outside the work itself. The thesis involves such theory as Diana Taylor’s vision of “academic activism,” Walter Benjamin’s posits on theater as spectacle, Pierre Bourdieu’s idea of “cultural capital,” Michel Foucault’s theory of subjects under the State, and Judith Butler’s concept of “disidentification” as guiding forces.

The three works Entre (Pancho) Villa y una mujer desnuda, Año bisiesto, and Los esclavos are analyzed within the two epistemes of a) what message(s) are communicated when one includes the “problem” of the author in the analysis and how the choice to include the author interacts with the economic structure of the period, and b) what is conveyed when one considers the work from a poststructural perspective, as a work that is located in a specific socioeconomic context. How do cultural works conform to and reinforce the extant neoliberal paradigm? Is it possible that a new discourse that is figuratively born from such analysis could have a direct impact on the (re)organization of the State and its neoliberal (re)productive systems? Ultimately, I explore if the cultural products, in their historical contexts, suggest future implications for the use of art/cultural “texts” in society, and look to the paradigms of open source and Edward Said’s the “public intellectual” to rearticulate the figurative place of contemporary Mexican cultural production.
Paradigma neoliberal: Producción cultural y la “muerte del autor” en México

Ariel Wind

Esta tesis se centra en la producción cultural bajo el neoliberalismo en México por seguir el desarrollo de tres productos culturales—una novela, una pieza teatral y una película—para ver cómo sus trayectorias extra-literarias (las de la producción, recepción, y circulación) dialogan con los mensajes que intentan proliferar (o proliferan de facto) a través del contenido. Este contenido literario, propongo, está impactado en parte por las fuerzas económicas y sociales en el exterior del texto en sí. Esta tesis usa como base teórica los conceptos de “academic activism” de Diana Taylor, el teatro como espectáculo de Walter Benjamin, el “capital cultural” de Pierre Bourdieu, el Sujeto en el Estado de Michel Foucault, y la “disidentificación” de Judith Butler.

Las tres obras Entre (Pancho) Villa y una mujer desnuda, Año bisiesto y Los esclavos se analizan a través de las epistemes de a) cuáles mensajes se comunican cuando se incluye el “problema” del autor en el análisis, y cómo interactúa la inclusión del autor con la estructura económica del periodo, y b) qué se expresa cuando se considera la obra desde una perspectiva posestructuralista, como una obra que se ubica en un contexto histórico específico. ¿Cómo refuerzan y conforman las obras culturales al paradigma neoliberal? ¿Es posible que un nuevo discurso que crece de tal análisis pueda tener un impacto directo en la (re)organización del Estado y sus sistemas neoliberales de (re)producción? Últimamente, exploro si los productos culturales, en sus contextos históricos, sugieren implicaciones potenciales para el uso de los “textos” artísticos, y echo una mirada a los paradigmas del “código abierto” y el concepto de Edward Said del “public intellectual” para rearticual la ubicación figurativa de la producción cultural mexicana.
In 1899, the state of Illinois established the first juvenile court, which institutionalized the separation of child delinquents from adult criminals and heavily involved governments in the process of caring for “wayward” youth. This thesis provides a historical analysis of cities’ efforts prior to the Juvenile Court Act to deal with youth who were seen as both troubled and troublesome to the larger society. It will then discuss the city of Chicago as a case study, uncovering and exploring the history of the Audy Home, Chicago’s Juvenile Detention Home. The Audy Home was the detention center housing children awaiting court adjudication. The study discusses the significant problems the Audy Home faced, including abuse of children within the home, the lack of funding, and overpopulation. This thesis seeks to put a human face on the children who lived in the Audy Home since its founding. Who were the children that society deemed troubled and in need of control and legal supervision? Though the answer is complicated, it becomes clear that in far too many cases children in custody of the state had committed nothing more than the crime of being born into poverty. Today, as city officials attempt to close the Audy Home, the study concludes with Chicago’s attempts to place troubled children into smaller group homes, monitored confinements, and other community based programs.
Waiting for the Wrecking Ball: Eminent Domain, Unrealized Redevelopment, and Equity in US City Planning

Allison S. Reed

Mentor: Carol Camp Yeakey

In 2005, the Supreme Court’s *Kelo v. New London* decision affirmed government’s right to delegate the power of eminent domain to private real estate developers, so long as landowners are justly compensated. *Kelo*, one of the most controversial Court rulings since *Roe v. Wade*, ignited broad public and scholarly debate. The conversations, though, rarely address the fact that redevelopment projects often fall apart and never materialize. What impact do threatened eminent domain and failed projects have on a redevelopment area? How do stakeholders deal with such failures? To answer these questions, this thesis uses two case studies: the New London, Connecticut, project from the *Kelo* case, and the Hadley Township redevelopment area in Richmond Heights, Missouri. In addition to secondary literature, legal history, and data from the US Government Accountability Office’s report on eminent domain, this study draws on newspaper articles and other primary sources. Informal interviews, archival documents, and meeting minutes supplement the Hadley case study. In both cases, major developers failed to reach completion of projects. Knowing that they may be bought out or forced out, even conscientious landowners have less motivation to invest time or money into their properties. Such neglect exacerbates the problems redevelopment was meant to reverse, such as vacancies, dilapidation, and falling property values. The uncertainty also heightens personal and communal stress, conflict, and anxiety—issues especially challenging for elderly, long-term residents. While there is no way to eliminate all of the risks inherent in today’s public-private redevelopment projects, more can be done to distribute the risks equitably and to make sure that all stakeholders—especially the most vulnerable—are informed about the choices they must make.
Female criminal defense attorneys face unique challenges in the course of their work, while striving for the respect and opportunities for career advancement awarded to their male colleagues. They must navigate, and overcome, patriarchal attitudes and other expressions of systematic discrimination and sexism, while dealing with the emotional toils that stem from the troubling nature of many criminal cases. Little existing research explores how these struggles manifest in their professional duties, and in their personal lives. My study analyzes the origins and implications of female defenders’ unique struggles, and explores how these struggles manifest both in their private lives and public roles. This qualitative study utilizes data from ten interviews with nine female criminal defense attorneys who represent a wide range of ethnic backgrounds and years of experience working in both public and private criminal defense. Law school, courtroom expectations, and the culture of law offices condition women defenders to adopt stereotypically masculine behaviors, including crude humor, resiliency, “thick skin,” the replacement of sadness with evocation of anger, and the creation of distance from cases and clients. Defenders attempt to separate their personal beliefs from their professional duties in order to provide an objective, strategic defense for their client, and to protect their own emotional wellbeing. However, despite attempts to separate their personal ideologies and professional identities, female defenders develop attachments to clients, become impassioned about social justice and criminal justice reforms, and allow casework to influence how they interact with friends, strangers, and even how they raise their children. I conclude that the work of female criminal defense attorneys, by combating the “bullying” patriarchal criminal justice system, promotes feminist goals. The compassionate perspective of many female defenders that humans must not be mistreated or deprived rights because of isolated traits, like gender, or isolated events/actions further aligns with feminist ideals. Further research is needed to identify specific reforms in order to combat hostility and discrimination towards women defenders.
The Intersectional Opportunity: The Shortcomings of the Media Coverage of the Anita Hill and Clarence Thomas Sexual Harassment Hearings

Rosa Heyman

Mentor: Jami Ake

The Anita Hill and Clarence Thomas Senate Judiciary Committee hearings in October 1991 provided a moment to assess our ability to engage in a national conversation about race, sexuality, and sexual harassment. I conducted a content analysis to compare the narratives that emerged in the *New York Times*, the *Washington Times*, and the *Atlanta Daily World* in order to identify the choices that each publication made (whether intentionally or inadvertently) that revealed its understanding of Hill’s social position as a black woman, sexual harassment, and the racial dynamics of the Senate. Kimberlé Crenshaw articulated the methodology of intersectionality in the late 1980s as a way to understand how systems of oppression, such as sexism and racism, work together to influence an individual’s lived experience. Based on this content analysis, I determined that intersectionality had not yet permeated mainstream public consciousness. The absence of a national common sense informed by intersectionality resulted in reporting that perpetuated harmful misconceptions about sexual harassment, minimized the role of race and the existence of racism in our country, and revealed a limited awareness of the consequences of gender, privilege, and power. This analysis of journalism shows that we did not possess the cultural vocabulary at the time of the hearings to understand the intricacies of Hill’s case and her identity. Moreover, my thesis aims to expose that journalism was not capable of synthesizing and conveying race and sexual harassment as dynamic events and social constructions that can serve as barometers for our country’s degree of social progress.
A Novel Protocol for Differentiation of V2a Interneurons from Mouse Embryonic Stem Cells

Jessica Butts

Mentor: Shelly Sakiyama-Elbert

Spinal cord injury (SCI) is a traumatic event that can cause life-long impairment. Prior studies suggest a potential role for spinal interneurons in regeneration and motor recovery following SCI. The V2a interneuron subpopulation originates from the p2 progenitor domain in the ventral half of the developing spinal cord. Development of progenitor domains in the neural tube is dependent on a balance between the concentrations of retinoic acid (RA), a promoter of neural differentiation, and a sonic hedgehog (Shh) gradient from the notochord and floor plate cells in the ventral neural tube. This project focuses on developing an induction protocol to obtain V2a interneurons from mouse embryonic stem cells (mESCs) by varying RA and Shh concentration. Induction conditions were assessed by measuring expression of the transcription factor Chx10, which is uniquely expressed in the developing neural tube by V2a interneurons. mESCs were formed into embryoid bodies (EBs) for two days in suspension culture and plated onto gelatin-coated dishes with specific amounts of RA and purmorphamine (Pur, a Shh agonist) for four days (2-/4+). The effect of RA (0nM – 10μM) and Pur (0 – 2μM) concentration on Chx10 expression was assessed at the end of the 2-/4+ period by immunocytochemistry (ICC) and quantitative real-time polymerase chain reaction (qRT-PCR). Results showed the greatest Chx10 expression at 10nM RA and 1μM Pur. Notch signaling has been shown to influence V2a differentiation from p2 progenitor cells. The effect of the notch signaling inhibitor N-[N-(3,5-difluorophenacetyl-L-alanyl)]-(S)-phenylglycine t-butyl ester (DAPT) concentration (0-5μM, added after 2 days of induction) on Chx10 expression was assessed at the end of the 2-/4+ period. Analysis by qRT-PCR and ICC showed highest Chx10 expression at 5μM DAPT and increased differentiation as assessed by flow cytometry. In summary, appropriate conditions have been identified to obtain 16.8% Chx10 positive V2a interneurons from mESCs in culture.
Characterization of the Physiomechanical Properties of Patterned Electrospun Polycaprolactone Scaffolds for Hernia Repair Applications

Braden Eliason

Mentor: Corey Deeken

Electrospun scaffolds offer a novel platform for the design of increasingly effective and integrative materials for soft tissue repair applications such as hernia repair. However, the physiomechanical properties of such materials remain unproven for this specific application. It is critical that materials utilized for hernia repair possess appropriate initial properties to provide sufficient strength at the repair site to prevent recurrence of the hernia. Thus, the objectives of the present study were to characterize the physiomechanical properties of seven novel electrospun scaffold designs and to determine the suitability of these scaffolds for potential clinical applications such as hernia repair. Previous studies of FDA-approved materials have shown that scaffolds with at least 20N suture retention strength, 20N tear resistance, 50N/cm tensile strength, and 10-30% strain are appropriate for most hernia repair scenarios.
Kinect: Controlling a Rhino XR-4 Robotic Arm

Matthew J. Johnson

Mentor: Ed Richter

Robots are rapidly being integrated into our lives, whether we see them or not. They roam our floors to vacuum our messes, build our automobiles, and even defuse dangerous explosives. Since they are becoming so vital to society, it is imperative that we provide our robotic companions with vision to increase their efficiency and adaptability. In some cases typical two-dimensional cameras provide the necessary information, but sometimes this is not enough. This project was developed as a proof of concept to provide three-dimensional vision to robots, in order to assist in the automation of basic tasks that require both vision and depth. The goal of this proof of concept was to detect an object and provide the position to a robotic arm, which could then move and pick it up with no input from the user. To do this, I created a working method that utilizes a three-dimensional camera in order to accurately control a robotic arm. The Kinect was chosen as the three-dimensional camera due to its availability, relatively low price, and its abundance of pre-existing resources. The Rhino XR-4 robotic arm was chosen on the basis that it was readily available, was already installed, could be easily interfaced with a computer, and has 5 degrees of freedom. The project proved to be very successful in that the goal was proudly accomplished. When an object was placed within a specified given volume, the Kinect provided the three-dimensional position of the object and the Rhino XR-4 robotic arm was able to move and pick it up very accurately. In the future, object detection could be incorporated where priority is given to certain objects to be picked up first in order to further illustrate the benefits of providing three-dimensional vision to robots.
Effect of Various Telomere-Interacting Proteins on Telomere Length in the Telomerase-Negative Tumor Cell Line Saos2

Wilbur Song

Mentor: Qin Yang

Telomeres are protein-nucleic acid complexes that stabilize the ends of linear eukaryotic chromosomes to maintain chromosomal integrity, and are implicated in aging and tumorigenesis. Telomeres progressively shorten due to the end replication problem, and immortalized cells must maintain telomere length either through telomerase activity or alternative lengthening of telomeres. Six proteins in particular are implicated in telomere stability: TRF1, TRF2, TIN2, TPP1, RAP1, and POT1. In addition to these important proteins, several recombination proteins, including GEN1 and SLX4, have been shown to interact with telomeres. In order to observe the individual and cooperative effects of these proteins on telomere length, we performed shRNA-mediated knockdown of each of these proteins in two cell lines: telomerase-negative Saos2 and Saos2 where telomerase was exogenously upregulated. Then, we measured the subsequent change in telomere length by the quantitative fluorescent in situ hybridization assay after two weeks to determine if any significant changes had occurred. We measured both the overall distribution of telomere length and the presence of extremely long telomeres, which occur at a frequency of around 1 per metaphase in Saos2 cells. Our results indicate that for the relatively short time period studied, knockdown of the proteins in question did not affect either measure for either cell line. This suggests that at least on a short time scale, these proteins are not necessary for maintaining telomere length.
Brain Repair via Induced Neural Plasticity

Krista Vedvik

Mentor: Dennis Barbour

Neural plasticity, the rearrangement of neural networks in response to functionally relevant patterns of stimulation, is a well-established phenomenon. Previous work has shown that the functional relationship between two neurons can be altered via closed-loop recording and stimulation. External stimulation triggered by ongoing neuronal activity can induce plasticity-dependent network changes, but most of the current research concerning this spike-dependent stimulation has focused on rewiring of motor cortex circuitry. Achieving reorganization via extrinsic stimulation to functionally related neurons in a healthy brain opens the door for exploration of this technique for correcting disorders of neural circuitry.

Consequently, the short-term goal of this project is to evaluate the changes in existing connections in response to extrinsic activity-dependent stimulation. Observing response patterns of existing local circuits and inducing systematic changes in these established connections facilitates further experiments aimed at correcting neurological deficits. This project aims to show that network rewiring in sensory cortex can occur via exogenous stimulation and, therefore, functional relationships between two sensory neurons can be altered systematically to create new neural network functionality.

We aimed to obtain conclusive in vivo evidence that closed-loop stimulation can change existing neural connections in the rat auditory system. We attempted to promote systematic plastic modifications in the rat auditory cortex using spike-triggered stimulation (STS) by isolating two functionally distinct groups of neurons and stimulating one “target group” at a fixed delay after the other “recording group” fires. We analyzed temporal changes of the correlation coefficient between the activity of the two groups of neurons to elucidate plastic changes due to activity-dependent stimulation.
Hernia repair has traditionally been accomplished using synthetic permanent meshes. More recently, resorbable materials such as biological tissue-based and absorbable polymer scaffolds have been developed. Absorbable polymers are relatively inexpensive and can be fabricated with consistent properties and biocompatibility. The goal of the study was to compare the degradation characteristics of three novel electrospun polymer scaffolds and a commercially-available scaffold using an \textit{in vitro} model.

Three novel scaffolds were fabricated by dissolving 12\% (w/v) polycaprolactone in dichloromethane and N,N-dimethylformamide (4:1). The solution was electrospun with 20kV at 6mL/hr from 26cm above a collector (planar metal, and square and hexagonal grids, each resulting in different fiber structures). The commercially-available Bio-A® (polyglycolic acid and trimethylene carbonate) was also included. Ninety samples from each scaffold type were divided into dishes containing n=10 samples, immersed in PBS (pH 7.4), and incubated (37°C and 5\% CO2). Ten samples of each scaffold type were subjected each week (0-8 weeks) to scanning electron microscopy (SEM), uniaxial tensile testing, and mass and pH measurements.

SEM revealed broken Bio-A® scaffold fibers as early as 4 weeks. Electrospun scaffolds did not display evidence of damaged fibers. The uniaxial tensile strength of Bio-A® scaffolds was reduced from 3.1MPa to 0.04MPa at 3 weeks, and the mass was reduced by 18\% after 8 weeks. Bio-A® scaffolds produced more acidic byproducts (pH reduced from 7.4 to 3.0 at 8 weeks). The tensile strengths, mass, and pH of the electrospun scaffolds did not change significantly.

Bio-A® scaffolds exhibited significant degradation and reduction in tensile strength, mass, and pH. Electrospun scaffolds remained intact and maintained stable tensile strength, mass, and pH. The fiber structure of the electrospun scaffolds did not appear to influence \textit{in vitro} degradation. Future studies will investigate longer incubation periods and/or accelerated degradation solutions.
Radiation therapy uses imaging differently than radiology. In the radiotherapy planning process, anatomy is contoured on computed tomography (CT) imagesets to define organ and tumor borders. Magnetic resonance imaging (MRI) has been shown to identify soft-tissue anatomy better than CT and may aid in anatomical contouring. This study aims to characterize contour reproducibility on MR images of normal abdominal anatomy. We imaged fourteen healthy volunteers with two different sequences each (T2-weighted and BFFE), totaling to 28 imagesets. Seven volunteers were given natural oral contrast (blueberry juice) before imaging to test the effect of contrast on contour reproducibility. Images were exported to clinical planning software and contoured four times. Contoured organs included the liver, stomach, duodenum, pancreas, spleen, bowel, spinal cord and kidneys. We measured overlap by computing the dice coefficient (DC) for each contour and performed significance testing (p<0.05) and multivariate analysis. Variance of DCs was significantly different for the stomach, pancreas, and kidneys between MR sequences and significantly reduced for the pancreas in the presence of contrast. For stomach, pancreas, spinal cord and bowel, the BFFE sequence yielded significantly higher mean DCs. The liver, spleen, and kidneys consistently yielded high DCs while the duodenum and pancreas yielded low values. Sequence and contrast were significant predictors of mean DC at 0.95 and 0.90 level of significance, respectively. MRI-based contouring is reproducible for liver, spleen, and kidneys. The use of BFFE sequence and contrast agent improves contour reproducibility for the stomach, pancreas, spinal cord, and bowel.
Designing a Soft-Modem to Optimize Communication through an Audio A/D

Andrew Cowley

Mentor: Robert Morley

The audio-in channel on mobile devices and computers is used as a means of transmitting digital information in many applications, including Square’s card reader, for instance. This may be done by utilizing the analog to digital converter in the audio-in port to sample an electrical signal carrying digitally encoded data. Using the audio-in to transmit data, as opposed to other ports, is both cheaper and offers more developer flexibility with regards to how the data is encoded. The goal of this research project is to determine what modulation technique provides the fastest data rate through it by designing a “soft-modem.” The bandwidth efficient modulation schemes chosen to test the system were minimum phase shift keying (MSK) and quadrature phase shift keying (QPSK), and were picked due to the results from a research paper. This modem will both improve current performance as well as hopefully lead to the use of data transmission through the audio-in port for new applications. The current progress of the project includes the characterization of the noise present in the communication channel, which allows the calculation of a theoretical maximum bitrate using the Shannon-Hartley Theorem. Every block of the soft-modem system was simulated using LabVIEW, including carrier synchronization, symbol synchronization, modulation, and demodulation for both QPSK and MSK. The logical extension of this project is to use data acquisition hardware, such as the ELVIS II, along with LabVIEW blocks previously mentioned to record and study real data. A comparison of the bit error rates, along with other measured characteristics of the two different types of modulation schemes, may then be used to refine the soft-modem into an efficient communication system.