THANK YOU
The Office of Undergraduate Research would like to thank the following people for their support of the Spring 2013 Undergraduate Research Symposium:

Heidi Kolk
Randall Calvert
Mark Pegg
Jennifer Gallinat
Hannah Paulding
The College of Arts & Sciences

OFFICE OF UNDERGRADUATE RESEARCH
http://ur.wustl.edu
research@artscli.wustl.edu

Joy Kiefer, Director
Kristin Sobotka
Holly Tasker
Jennifer Kohl
American Society of Plant Biologists
Angen Scholars Program
David Thoreau Foundation
Henry Luce Foundation
Howard Hughes Medical Institute
J. Stephen Fossett Fellowship
James and Elizabeth McDonnell Fund for Alzheimer's Research
Jeffrey Modell Foundation
Knight Initiative for Alzheimer's Research
National Institute of General Medical Sciences
National Institute of Health
National Institute of Mental Health
National Institute on Drug Abuse
National Science Foundation
Parkinson’s Disease Foundation
Science Education Alliance
Sea Education Association
Washington University in St. Louis
Amgen Scholars Program

Participants also wish to acknowledge the support of their research mentors, many of whom have contributed funding from their grants to support undergraduate research experiences.

Matthew Lee — My parents, Michaela and Debra Lee
Sangli Loe — Dr. Leonard Green, Dr. Joel Myerson, Mark Povey
Jenna Li — Dr. Shanti Parikh, Dr. Bradley Stemer, Dr. Reem Thomas, Dr. Pete Benson, Jean-Pierre Louvrier, Isreal Reiman, Dr. Anton Beresini, Odillo and Cesia Brantilakis, Bil Callahan, Marcia Costa, Glacbia Rodrigues, Ana Celia Moreira
Hannah Lin — I would like to thank Dr. Librande for overseeing this research and for all your helpful suggestions; Vicki Yom for being such a great mentor and friend; and thanks to my friends and family for all your support!
Kevin Liu — Sara Weston, Dr. Jackson
Landy Liu — I would like to thank Dr. Kline and Dr. Padl for their integral mentorship and guidance.
Max Liu — Allen Doctor, Stephen Rogers
Melany López — I just want to say thank you to Dr. Huettner for his infinite patience and support, but I also want to thank Dr. Jess Woods and Jennifer Kold for their advice and constant support. Thank you all so much!
Hannah Lustman — Special thanks to my family, friends, and my advisor, Dr. Joe Bernstein.
Brittany Marcus-Blank — Professor Andreone Knight
Nathan Mariano — Guillermo Rosas, Ignacio Sanchez-Pardo, andstudabeita Balboduradaped for their help with the project.
Nicole Martin — Dr. Mark McDaniel, Khyeen Nguyen, and the rest of the McDaniel Lab
Joseph McDonald — I would like to thank my Dad for the years of advice and encouraging my creativity while integrating engineering and business.
Daniel Michon — Michael Pol, Michael Sorberg, Peter Cramer, Melissa Waters, Joseph Loewenstein, IPH Class of 2013 and Faculty
Derek Miller — The member of the DiAntonio lab for their advice and generous support.
Karen Mok — Guillermo Rosas (Advisor), Joseph Callen (Second Reader)
Christopher Monahan — Professor Sally for helping me edit and post poems in 1 st for helping me revise my paper
Austin Nov — Dr. Lee Ratner, Dr. George Kiyi, the Rafter Lab
Emary Oak — Dr. Stephen Lofgren, Dr. Nancy Anderson, Dr. Joan Downing, Dr. Gerald Easty, Dr. Erin McGrath, Merle Kling fellow
Jessica Pegg — Dr. Paikhan, Mellon Myers Cohort, Regine Pegg
Justine Parsi — I wish to thank professors Benson, Thomas, and Heilbron for their help, time, and support throughout the thesis-writing process.
Gary Parizher — Thanks to Dr. Tim Scholl, Dr. Ariz Khan, and Dr. Jannet Padiardik for your patience and teaching. Thanks to the Nissim lab for letting me use your compound microscope to take pictures.

SungHo Park — I would like to thank Professor Minna and Mr. Yang for their guidance. Also, I would like to thank the Office of Undergraduate Research at Washington University for supporting my presentation at the 24th ACS National Meeting held in New Orleans.

Pamela Peters — John Cirrito and everyone else in the lab!
Jasmine Phu — Dr. Alan Lambert and the Attitude and Decision Making Lab
Matthew Pieters — I would like to thank the Holy Lab, especially my bench mentor Cam Kang.
Jeremy Pisnor — I would like to thank Erik Zetkler, Linda Smardon-Zetkler, Ann Bublick, Lavoce D’Emilio Bocca, April Standa and Eleanor Pardue for their extensive help, guidance, and advice; and I would like to thank Sea Education Association for their support.
Michael Rauch — Regina Frey, Michael Cahill, Mark McDaniel, Stacey and Steven Rauch, Nat Stecklow
Lynn Rm — Pablo Blanquer Lab
Brian Ritter — Dr. Shane White, Susan Blomdahl, James Reid, Suana Stritt
Allison Schell — Dr. Elizabeth Quinn, Dr. Bradley Stemer and the WHR Kerner Scholarship Committee
Angela Simon — I would like to thank my mentors, Raelle Larsen and Nicholas Holmstrom, for their invaluable support throughout the research process.
Jeffrey Stevahn — My family, friends, and Dr. Mark Pegg.
Alina Sigmond — Mark Pegg, Venus Brou, Jean Carlos Sanchez Ibane
Melly Simon — Caroleen Sargent, Peter Benson and Shami Parikh
Sadie Smock — Ignacio Sanchez-Pardo, Tabes Limhard, Yasmin Oyan (PUC Chile)
Willoo Song — The Yang lab, including Fan Zhang, Chonggui Sun, and Dr. Zhou
Charlotte Senna — I would like to thank Dr. Catherine Lang and Margaretta Bland as well as the entire Lang Laboratory.
Alissa Sturgis — Carys Fritz and Kendall Thomas
Donald Steinbuhler — IPH, Dr. Pervaoacas, Dr. Abie, Dr. Koecknocp
Shelby Strong — Roosevelt conducted this paper for you made possible by the financial support of the Office of Undergraduate Research at Washington University in Saint Louis and the generosity of Dr. Mitchell Sommers who allowed us to use a sound booth in the lab.
Tony Sun — Andrew D. Lust, Andrew M. Tager, Mansoor Ganbar, Robert F. Kiyi, Michael Tsok
Ray Suzuki — Dr. Shining Chen, David Brightman, Juliana McManus, Frank Schettler, Hai Wang, and Chen Lab members.
Ken Tharp — Andrew Surface, Mark Conrad
Brett Toksaye — Dr. Laura Otto-Salaj and Daniel Fuleman
Adam Tombs — Office of Undergraduate Research, Jim Buckley
Eric Trau — Dr. Karen O’Malley, Jong Sook Kim-Han, Steve Harmon, Joy Jung
Mollie Wasserman — I thank the entire Brody Lab, especially Dr. Steven Brody and Dr. Amjad Horani.
Sarah Breyer — Thank you to my advisor, Peter Bensen, who helped me shape my thesis, my readers, Professors Quinn and Lester, and my friends Alex, Molly, and Kevin.
Samuel Wiltz — Wim Dickhoff, Helfer Duuson, Dong Ding and the Office of Undergraduate Research
Camille Wight — I would like to thank my parents and grandfather, Dean Dillao, and my friends back in Senegal.
Eric Wrightston — Dr. Elizabeth Childs
Francis Wu — Professor Cricketer Sam, the staff of the Independent Women’s Zone, and the Anthropology department.
Huchuan Xia — I would like to thank Dr. Demingxue Kan, Ken-Jung and Karen O’Malley for their invaluable assistance and encouragement over the last almost 2 years. I would also like to thank Steve Harmon for helping me with the experiments.
Alexander Xu — Doecklen Lab
Mint Yung — Kevin Smith, Lauren Woods, Elisabeth Bao, Smith Lab Group, Tyson Research Center, Center staff
Teresa Yau — I would like to thank Dr. Denise Head and Dr. Ben Keske for their available advice and guidance throughout the entire process of completing this project. I would also like to thank Nathaniel Lorraine from the Head lab for his help.
Brooke Yarrows — CUR and Cynthia Barsoum
Shang-Yu Yeh — Dr. Cynthia Barsoum, Dr. Joo Aoki, Dr. Mary Ann Druhak, and the Women, Gender, and Sexuality Studies Department; Leanne McGee, MBA and KA’EY’; Dr. Donadel, MacCarney of Webster University, UNC Graham, Queer Studies Conference 2013
Han Yuan — John Constantines, Jennifer K. Lowe, Don Conrad, Laura Bierut, Nancy Saccone, and members of the Doubtful Bay.
Andrew Zhang — Thank you Dr. Raphael Kopian for letting me work in your lab. Thank you Zhenzi for your mentorship.
Hanci Zhang — Many thanks to Deborah Nawick, MD, PhD, whose steadfast support and insight guided this project to Chang Yang, MD, PhD, and Long Zeng for their invaluable role in the design and for technical instruction.
Nancy Zhang — Gerald Zampolin for NBP-TPF cDNA. Sweta Gokarn for arose wild type and mutant (3DNA constructs. Children’s Discovery Institute, the RNAi Consortium, and the Genome Institute at Washington University for the targeting shRNA.
Becca Zod — I would like to thank my theses advisor, Dr. Shanti Parikh, and my committees members, Dr. Priscilla Song and Dr. Geoff Childs. I deeply thank the past educators from Darjon who worked with me on this research. 
# Spring 2013 Undergraduate Research Symposium

**Friday, April 19, 2013**

2:30 p.m. – 7:00 p.m.

## Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:30 p.m. – 6:00 p.m.</td>
<td>American Culture Studies Research Colloquium</td>
<td>Seigle Hall, 205</td>
</tr>
<tr>
<td>4:30 p.m. – 6:30 p.m.</td>
<td>Undergraduate History Honors Symposium</td>
<td>Seigle Hall, 006</td>
</tr>
<tr>
<td>4:00 p.m.</td>
<td>Symposium Welcome Remarks</td>
<td>Rec Gym, Athletic Complex</td>
</tr>
<tr>
<td></td>
<td>Dean Joy Kiefer</td>
<td></td>
</tr>
<tr>
<td>4:05 p.m.</td>
<td>Presentation of Undergraduate Research Student Leadership Award</td>
<td>Rec Gym, Athletic Complex</td>
</tr>
<tr>
<td></td>
<td>Dean Joy Kiefer</td>
<td></td>
</tr>
<tr>
<td>4:10 p.m.</td>
<td>Introduction of Keynote Speaker and Presentation of the Chancellor’s Award for Outstanding Contributions to Undergraduate Research</td>
<td>Rec Gym, Athletic Complex</td>
</tr>
<tr>
<td></td>
<td>Dean Jennifer Smith</td>
<td></td>
</tr>
<tr>
<td>4:20 p.m.</td>
<td>Keynote Address: “Choice, Self-Control, and Impulsivity—and Why Do Research (The Short and Long, Near and Far, Now and Later, of It)”</td>
<td>Rec Gym, Athletic Complex</td>
</tr>
<tr>
<td></td>
<td>Professor Leonard Green</td>
<td></td>
</tr>
<tr>
<td>4:30 p.m. – 6:30 p.m.</td>
<td>Poster Session</td>
<td>Rec Gym, Athletic Complex</td>
</tr>
<tr>
<td>6:30 p.m. – 7:00 p.m.</td>
<td>Reception</td>
<td>Rec Gym, Athletic Complex</td>
</tr>
</tbody>
</table>
**AGENDA**

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:30 p.m.</td>
<td>Julia Lindon</td>
<td>“‘Nice Guys Finish Last’: An Insider Look at The Daily Show with Jon Stewart”</td>
</tr>
<tr>
<td>2:50 p.m.</td>
<td>Amanda Zinman</td>
<td>“An Exploration of Dolls and Doll Play”</td>
</tr>
<tr>
<td>3:10 p.m.</td>
<td>Sara Harris</td>
<td>“Bad Moms: Dehumanizing Societal Deviants”</td>
</tr>
<tr>
<td>3:30 p.m.</td>
<td>Louis Keene</td>
<td>“Deconstructing the Urban Look in Streetwear”</td>
</tr>
<tr>
<td>3:45 p.m.</td>
<td>Louis Keene</td>
<td>“Mythologizing the Urban Space in Streetwear”</td>
</tr>
<tr>
<td>4:00 p.m. - 4:30 p.m.</td>
<td>Keynote Address</td>
<td>Recreation Gym, Athletic Complex</td>
</tr>
<tr>
<td>4:30 p.m.</td>
<td>Eve Herold</td>
<td>“Teaching the American Dream: Inequality, Aspirations, and Achievement of Urban Youth”</td>
</tr>
<tr>
<td>5:00 p.m.</td>
<td>Charlotte Borner</td>
<td>“NYC Service”</td>
</tr>
<tr>
<td>5:20 p.m.</td>
<td>Genevieve Hay</td>
<td>“Vampires and Identity Violence from ‘The Vampyre’ to Buffy the Vampire Slayer”</td>
</tr>
<tr>
<td>6:30 p.m.</td>
<td>Reception</td>
<td>Recreation Gym, Athletic Complex</td>
</tr>
</tbody>
</table>
UNDERGRADUATE HISTORY HONORS SYMPOSIUM

Friday, April 19, 2013
4:30 p.m. – 6:30 p.m.
Seigle Hall, Room 006
Program Chair: Mark Gregory Pegg, Professor of History

AGENDA

OPENING REMARKS 4:30 p.m. - 4:40 p.m.

4:40 p.m. - 5:10 p.m.

ALYSSA STEIN: “From Social Reform to Urban Modernism: The Collapse of Pruitt-Igoe and Failure of Public Housing in the Twentieth Century”

ALINA SIGMOND: “Ja sóc aquí: The Construction of Catalan Culture during the Transition to Democracy”

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

BREAK 5:10 p.m. - 5:15 p.m.

5:15 p.m. - 5:45 p.m.

BENJAMIN KALLEN: “The Destroyer of Worlds: America’s Response to Nuclear Weapons in South Asia”


BREAK 5:45 p.m. - 5:50 p.m.

5:50 p.m. - 6:30 p.m.

KELLY LOUGHHEAD: “Embodying Empire: Constructing American Imperial Identity in Dime Novels and Congressional Debates, 1865-1901”

JEFFREY SHEVACK: “Going East: The Evolution of the Medieval Travel Account, 1253-1356”

MARSHALL MAYER: “Historiography, Heresy, and the Marvelous in Gervase of Tilbury’s Otia Imperialia”

HANNAH LUSTMAN: “‘Electric Shock Is Simply Something You Don’t Go Around Talking about at Cocktail Parties’: The Fractured Political Narrative of Thomas F. Eagleton”

CLOSING REMARKS
ELECTRICAL REMODELING IN A MOUSE MODEL OF HYPERTROPHIC CARDIOMYOPATHY

Adam Adenwala
Mentor: Jeanne Nerbonne

Familial hypertrophic cardiomyopathy (HCM) is the leading cause of sudden cardiac death in seemingly healthy children and young adults. Patients with HCM exhibit asymmetric left ventricular hypertrophy and an increased risk to life-threatening arrhythmias. The histopathology of HCM is characterized by cardiomyocyte disarray, interstitial fibrosis, and cellular hypertrophy. However, the molecular mechanisms linking this phenotype to the increased risk for arrhythmia and sudden cardiac death remain unknown. Studies discussed here exploit a mouse model (αMHC\textsuperscript{403/+}) of familial HCM - the cardiac histopathology and dysfunction in αMHC\textsuperscript{403/+} mice has been shown to resemble HCM in humans. Preliminary studies revealed significant QT prolongation in young (10-14 week) αMHC\textsuperscript{403/+} mice, indicative of altered ventricular repolarization and electrical remodeling. Here, whole cell voltage clamp recordings from the interventricular septum of 10-14 week αMHC\textsuperscript{403/+} mice show marked reductions of repolarizing K\textsuperscript{+} current amplitudes. These reductions help explain the observed QT prolongation and could account for increased risk towards lethal arrhythmias. However, histological analysis reveals that, at this age, cellular hypertrophy is not evident in αMHC\textsuperscript{403/+} mice, suggesting that deleterious electrical remodeling actually precedes and is independent of hypertrophy development in HCM. Further experiments explore the impact of disease progression and the development of cellular hypertrophy on repolarizing K\textsuperscript{+} currents in older (30 week) αMHC\textsuperscript{403/+} mice. The results here help to create a better understanding of the molecular correlates contributing to the increased risk to life-threatening arrhythmias in patients with HCM and could hold significant implications for the clinical treatment and care of patients with HCM.

BIOCHEMICAL CHARACTERIZATION OF ARABIDOPSIS THALIANA CHORISMA TE MUTASES

Adam Adenwala, Grace Chao, Re-I Chin, Cory Fulcher, Claudia Gambrah-Sampaney, Samantha Hsieh, Jefferson Li, Connor Liu, Joshua Lo, Samuel McKinney, Ashley Muehler, Mark Posnick, Morgan Schoer, Jeffrey Shuman, Sukrit Singh, Candace Ward, Francis Wu, Yating Ye, Hanci Zhang, Tony Zhang
(These authors contributed equally to the work as students in Bio 4522.)
Mentors: Wilhelm Cruz, Jaime Wallen, David Nathin, Joseph Jez

In plants and microbes, chorismate mutase (CM) is essential for the biosynthesis of phenylalanine and tyrosine and catalyzes an intramolecular cyclization reaction of chorismate to prephenate. In plants, multiple isoforms of CM are differentially regulated by metabolic effectors. In Arabidopsis thaliana (thale cress), CM1 allosteric effectors positively (tryptophan) and negatively (phenylalanine and tyrosine) regulate the synthesis of prephenate. In contrast, CM2 is an unregulated isoform. Comparison of the Arabidopsis CM isoforms with the microbial homologs suggests the presence of an effector binding site in CM1 but not CM2. Our project used site-directed mutagenesis to probe the function of the allosteric effector site in CM1 and to introduce allosteric control into CM2. A series of point mutations in AtCM1 (H145Q, K152E, S153Y, G213P, I273V) and AtCM2 (Q76H, E83K, Y84S, P144G, V204I) were generated by QuikChange PCR mutagenesis and the resulting proteins expressed and purified by nickel-affinity chromatography. Kinetic analysis revealed differences in the activities and regulatory effects of both enzymes.

WÖMEN (我们):

CONTEMPORARY CHINESE ART

Samantha Allen, Elizabeth Korb, Danielle Wu
Mentor: Kristina Kleutghen

Contemporary Chinese art has in recent years become the fastest growing segment of the global art market, yet Chinese women artists continue to be underrepresented in cultural institutions worldwide. WÖMEN (我们): Contemporary Chinese Art is the inaugural undergraduate exhibition of the Arthur Greenberg Curatorship and is on view until May 26th at the Mildred Lane Kemper Art Museum. This exhibition showcases work by a selection of contemporary Chinese women artists offering their own unique perspectives on a variety of major political, economic, and social issues related to contemporary China. Artists represented in the exhibition include Hung Liu, Yin Xiuzhen, Cui Xiwen, Chen Ke, Xing Danwen, Cao Fei, and Chen Man. The exhibition title, WÖMEN (我们), is a cross-cultural play on words, juxtaposing the English word “women” with the Mandarin Chinese word for “us.” This intentional pun synthesizes the theme of the exhibition, which showcases work by artists who have consciously chosen not to categorize their artistic practice through
gender or feminist politics. Rather, through their artistic production—which ranges from more traditional media including painting and lithography to virtual gaming worlds and fashion photography—they maintain and project individual perspectives on issues that affect their own personal lives as well as those of the Chinese population as a whole: the formation of Chinese identity in a globalized society, rapid urbanization and sociocultural reforms, and the incursion of digital technologies into the fabric of everyday life.

**Biochemical Studies of Phosphoethanolamine Methyltransferase and Serine Decarboxylase from Nematodes, Plasmodium, and Plants**

Tara Alpert  
Mentor: 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: 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.

**Characterizing the HideAndSeek Phage Genome**

Abena Apaw, Diana He, Sarah Swiezy, and Evan Witt  
Mentors: Sarah Elgin, Christopher Shaffer, and Kathy Hafer

Three mycobacteriophages—HideAndSeek, MisterCuddles, and Girr—newly isolated from different locations on the Washington University in St. Louis campus appear to be almost identical in sequence, an unprecedented event in the isolation of phages. However, these phages all exhibit differences in phenotype based on their electron micrographs. Focus was placed on HideAndSeek, which on infection of *Mycobacterium smegmatis*, results in large, circular, clear plaques that suggest a lytic lifestyle. HideAndSeek exhibits typical viral morphology including an isometric head (average diameter of 53 nm) and a short tail (average length of 100 nm). The HideAndSeek genome is 57,582 base pairs in length and contains 92 protein-coding genes; it shows significant but interrupted sequence similarity with the previously described mycobacteriophages Fruitloop and GUmbie. While HideAndSeek’s left arm is almost identical to those of these other Cluster F1 phages, the middle section and right arm of HideAndSeek appear more variable with the gain or loss of several genes. For example, gene 30 does not appear in Fruitloop or GUmbie. The HideAndSeek genome does not have two clearly defined arms (one left transcribed and the other right transcribed), which is consistent with the clear plaque morphology in predicting a lytic lifestyle. HideAndSeek also appears to possess a novel gene: gene 63 is unlike any other gene found in mycobacteriophage. Gene 63, however, is similar to a PAPS reductase found in a rodococcus phage, and has an adenosine binding site.

**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 Azerbaijani, 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
ISOLATION AND GENOMIC ANALYSIS OF MYCOBACTERIOPHAGE DANFORTH
Ignacio Ayoroa, Gregory Harrison, and Joy Twentyman
Mentors: Sarah Elgin, Kathy Hafer, and Christopher Schaffer

Mycobacteriophage Danforth was isolated from a soil sample taken from a lawn on the Washington University in St. Louis campus during the fall of 2012. The phage was cultured in *Mycobacterium smegmatis* (*M. smeg.*) and purified. Danforth has small-sized cloudy plaques, characteristic of temperate phages. Analysis of the phage genome using restriction enzymes *Eco*RI, *Hind*III, *Bam*HI, *Cla*I, and *Hae*III suggested that Danforth belongs in cluster K. However, after obtaining the genome sequence via Roche 454 sequencing at the Washington University in St. Louis Medical Campus and performing a BLAST comparison search (NCBI), Danforth was identified as an A8 phage. Danforth has a 52 Kbp genome, sharing genetic similarity with two previously characterized A8 phages, Astro and Saintus. Genomic analysis predicts that Danforth contains 99 genes organized into a left arm and a right arm in the genome. The left arm contains 28 genes transcribed mostly in the forward direction, including a majority of the predicted structural proteins, a 3078 bp tapemeasure protein (gp20), as well as a tRNA Lys gene. A putative integration cassette marks the junction between the left and the right arm (gp27, gp28, gp29). The presence of a putative integrase gene (gp28) in Danforth's genome provides further evidence that Danforth is a temperate phage. The right arm contains 71 genes, most of unknown function, which are almost all transcribed in the backwards direction. A genomic comparison between Danforth and the A8 phages Astro and Saintus provides a way to view evolution of lysogeny since both Danforth and Astro contain an integration cassette, which is lacking in Saintus. Further study is necessary to assign function to the remaining genes in the Danforth genome and to explore these questions of phage evolution.

METABOLISM OF AMYLOID-BETA ISOFORMS FROM HUMAN PLASMA:
DEVELOPMENT OF AN IMMUNOPRECIPITATION PROTOCOL
Anna Bareiss
Mentor: Randall Bateman

Alzheimer’s Disease (AD), the leading cause of dementia, currently affects about 5 million people in the United States. 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 (*13*C6-Leucine) and quantified over a 36-hour time course using an immunoprecipitation/mass spectrometry protocol. We 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 (Aβ 38, Aβ 30, Aβ 42) 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.
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.

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 examined two effects on the amount offered by the proposer. The first was whether the initial amount provided the proposer systematically affected the proportion of the amount offered (a magnitude effect). The second was whether the social distance between proposer and responder influenced amount offered (the social distance effect). Three amounts ($10, $3,000, and $250,000) at each of three social distances (2, 20, and 100) were studied under the Dictator Game and the Ultimatum Game. Amount offered was consistently higher under the Ultimatum Game, and the proportion of the amount offered decreased both as the size of the initial endowment increased and as the social distance between proposer and responder increased. Other than a gender difference in the Dictator Game, the pattern of findings was not differentially affected by demographic factors, including age, education, annual income, ethnicity, race, religion, political ideology, political affiliation, geographic region, or city size. Offers made to relatives were higher than those made to non-relatives at a social distance of 2 for the Dictator Game, but were 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.

HOW DEMOCRATIC ARE THE CZARS?
EVALUATING THE APPOINTMENT OF EXECUTIVE BRANCH OFFICIALS THROUGH A NONDELEGATION INDEX
Kathryn Betts
Mentor: Andrew Rehfeld

Is the appointment and empowerment of U.S. 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 nondelegation 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 nondelegation doctrine through the appointment of presidential czars is inherently antidemocratic and must therefore be seriously considered in measures of democracy.

EXAMINING MORAL LUCK AND THE ROLE OF TRUTH

Thomas Bird
Mentor: Ron Mallon

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.

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. 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=0.13, 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.

COMPARTMENTALIZATION OF DNA REPAIR IN TETRAHYMENA THERMOPHILA

Miles Black, Justin Eisenberg, and Bryan Webb
Mentor: Douglas Chalker

Every cell is challenged to maintain the integrity of its genome against the daily assault of mutagens, rogue enzymes and routine stresses that cause DNA breaks and mutations. Consequently, organisms have evolved conserved pathways to repair these dangerous events. Non-homologous end joining (NHEJ) and nucleotide excision repair (NER) are pathways that address double strand breaks and single strand damage, respectively. The ciliated protozoan Tetrahymena thermophila represents a striking case of genome maintenance because it must protect two nuclei; a germline micronucleus and a somatic macronucleus. Furthermore, potentially toxic DNA breakage is believed to be a developmental part of Tetrahymena lifecycle. Given the unusual genome maintenance task facing this binucleate organism, we sought to characterize how NER and NHEJ are compartmentalized physically in the nuclei and how their spatial organization
changes upon UV-induced DNA damage. We identify *Tetrahymena* XLF, a component of NHEJ, and potential NER components CHL1 and Rad10. We show that XLF and CHL1 localize to the germline micronucleus during vegetative growth and Rad10 to the micronucleus during prophase of meiosis. Furthermore, expression of these three genes peaks during the early stages of sexual conjugation, presumably to poise the cell for the potentially genotoxic events of meiosis, mitosis and DNA rearrangement that the micronucleus will undergo as it differentiates into a new germline. Together, our results suggest that protection of the germline genome is a primary goal for two distinct DNA repair pathways.

**INDEPENDENT COMPONENT ANALYSIS OF EEG DATA FROM THE BRAIN COMPUTER INTERFACE**

Rachel Blake  
Mentor: Arye Nehorai

My project was to analyze EEG Data from the brain computer interface with Independent Component Analysis (ICA). ICA is a form of feature extraction which tries to create the most independent subset of features based on the original signals. ICA can also be used to reduce the dimensionality of the feature set. The goal was to be able to better predict the stimulus a subject was given based on EEG data. I wanted to explore whether reducing the dimensionality using ICA would increase the predictability of the stimulus. To analyze whether ICA was effective I used several different classifiers to predict the stimulus based on the ICA features. I then calculated the accuracy at the different levels of dimensionality. Based on this I have measurement I have concluded that ICA helps to predict the stimulus as long as the dimensionality is not reduced too much.

**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.

**ASSESSING THE GREEN CLIMATE FUND: UNDERSTANDING THE DEVELOPING WORLD’S PERSPECTIVE ON CLIMATE FINANCE AT THE 18TH CONFERENCE OF THE PARTIES**

Alex Bluestone, Alaa Itani, Lauren Kan, and Ryan Mikkelson  
Mentor: Joy Kiefer

The United Nations Framework Convention on Climate Change began meeting annually at the Conference of the Parties (COP) in 1995 to assess progress in curbing greenhouse gas emissions. Following COP15 and the creation of the Copenhagen Accord in 2009, the UNFCCC established the Green Climate Fund (GCF) to support climate change mitigation and adaptation projects. Because international funding projects frequently face criticism for lack of transparency and efficacy, this study examines the varying perceptions of the GCF’s role in climate change efforts between “developed” nations (i.e. North America and the European Union) and “developing” nations. The study outlines the difference in countries’ perspectives of the GCF based on their socioeconomic and political standing within the United Nations. Data was collected through interviews with country representatives or negotiators, and NGO representatives attending the UNFCCC COP18 meeting in Doha, Qatar in late 2012. Negotiators were contacted in advance and interviews were conducted while conference negotiations transpired. Interviews were conducted with negotiators from countries including the United States, Lebanon, Chile, and Ghana. Findings matched research predications. Interviews with developed countries indicate concerns of earmarking and tracing the efficacy of their funding. Developing nations conversely viewed developed nations as responsible to support their mitigation and adaptation efforts. Concerns also included whether developed nations would follow through on their financial pledges to support the GCF. This research is important for understanding the factors that contribute to climate change discourse and thus has implications for future policy implementation. Finally, our findings indicate that these factors may transcend national borders and, therefore, require international collaboration in order to more comprehensively address the scale of environmental challenges and any respective solutions.
MYCOBACTERIOPHAGE JERM2
Jeff Bonin, Zhijie Qi, and Kevin Zhang
Mentor: Sarah Elgin
Mycobacteriophage Jerm2 is a recently isolated phage of *Mycobacterium smegmatis*. Jerm2 comes from a soil taken at the same location that yielded the phage Jerm, an unclustered phage with medium sized, turbid plaque morphology. Jerm2 belongs to the A1 subcluster and has clear plaque morphology. The Jerm2 genome is 53,205 base pairs in length and contains 94 genes. While the left half of the genome, with the exception of the first 10 genes, is very similar to other A1 phage such as Aeneas and Dreamboat, the right half of the genome has a significant amount of variance from these phages. Interestingly, while most A1 phage do not have any tRNAs, both tRNAscan-SE and Aragorn predict that Jerm2 contains a tRNA-Trp gene at the beginning of its genome. Only one other A1 phage in phagesdb, BPBiebs31, contains any tRNAs, and it also has one. Jerm2 contains an integrase gene, suggesting that despite the clear plaque morphology observed, this is a temperate phage, like Aeneas and Dreamboat.

GRANULOCYTE-COLONY STIMULATING FACTOR INDUCES HEMATOPOIETIC STEM CELL QUIESCENT BUT LOSS OF REPOPULATING ACTIVITY, PARTIALLY DEPENDENT ON TOLL-LIKE RECEPTOR SIGNALING
Joshua N. Borgerding
Mentor: Daniel C. Link
The cytokine granulocyte-colony stimulating factor (G-CSF) is an important component of the inflammatory response and is the primary regulator of basal granulopoiesis. Recent studies have shown that G-CSF also mediates changes to the bone marrow microenvironment. Because the bone marrow microenvironment regulates HSC homeostasis, we hypothesized that G-CSF would alter HSC activity and function.

To test this hypothesis, 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 and a decrease in proliferation. 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.

To explore the mechanism(s) at work, we conducted RNA expression profiling on G-CSF treated HSCs. We found enhanced expression of genes responsible for toll-like receptor (TLR) signaling. We also found increased mRNA and protein expression of TLRs in HSCs, suggesting that TLR signaling may mediate the effects of G-CSF.

To better characterize the G-CSF mechanism, we examined the effects of G-CSF treatment on HSC activity and function in MyD88 knockout mice. MyD88 is an essential adaptor for most forms of TLR signaling. We found that the absence of MyD88 abrogated the effects of G-CSF treatment on HSC number and quiescence, but had little to no effect on long term repopulating activity.

NEUTRAL GENETIC VARIATION IN SSR MARKERS ACROSS ALTITUDINAL AND LATITUDINAL GRADIENTS IN LODEPOLE PINE
Valerie Bostrom
Mentor: Jennifer Gruhn
Lodgepole pine (*Pinus contorta* subsp. *latifolia*) is an ecologically and economically important tree found throughout western North America stretching from northwestern Canada to as far south as Colorado and Utah. Because of North America’s rising temperatures since the last glacial maximum, lodgepole pine may have tracked a viable habitat by following the gradual retreat of the glaciers northward over time. In addition, since lodgepole pine occurs across wide elevation gradients, from the base of mountains to near the treeline, we may expect a finer influence of altitude upon gene flow, in the form of wind pollination, for this pine. We are investigating the variation in SSR (simple sequence repeat) neutral genetic markers in hopes of discovering patterns that may correspond to such influences. We collected and analyzed SSR markers in mountain regions in several states, organizing the samples by geographic site and stratifying by altitude within each site. We attempted to differentiate populations and individuals within populations through Bayesian clustering analysis and principal component analysis (PCA), using a number of SSR markers to improve the quality of our results. Preliminary results showed that, while there is no significant neutral genetic variation within geographic sites and across the altitudinal gradient at a site, there is notable differentiation among the sites sampled. If our further investigations confirm this, we will have found that pollination by wind allows for fewer constraints than once predicted, though limits are still placed according to geographic variability on a larger scale. If so, then patterns of neutral genetic variation in this pine may apply also to the related wind-pollinated species that make up much of the vast coniferous forests in western North America.
SYNTHESIS AND CHARACTERIZATION OF HYDRATED MAGNESIUM CARBONATES FOR CARBON DIOXIDE MINERAL SEQUESTRATION RESEARCH
Allison Brenner
Mentor: Sophia Hayes

Carbon dioxide mineral sequestration is the process through which carbon dioxide is captured and converted into more stable mineral carbonates. Current research is considering carbon mineral sequestration by reacting carbon dioxide with naturally occurring minerals, such as brucite (Mg(OH)_2) and forsterite (Mg_2SiO_4), to form different magnesium carbonate phases. These different phases can be preferentially synthesized by controlling reactant concentration, pH, and temperature. In this project, we have developed a new simple synthesis method to make pure forms of some of these magnesium carbonate phases including nesquehonite (MgCO_3·3H_2O), hydromagnesite (4MgCO_3·Mg(OH)_2·4H_2O), and dypingite (4MgCO_3·Mg(OH)_2·5H_2O). This method works in a beaker on a laboratory benchtop and uses no high-pressure equipment, unlike previous methods. In addition, we have used powder X-Ray Diffraction, Raman Spectroscopy, and solid-state Nuclear Magnetic Resonance (NMR) techniques to fully characterize these phases. We present experimental measurements that support the ongoing research on carbon dioxide mineral sequestration by providing pure mineral standards to enable more in-depth study of their physical properties.

INVESTIGATING THE ROLE OF A KINETODESMAL FIBER PROTEIN AND AN MT-A70 FAMILY PROTEIN IN TETRAHYMENA THERMOPHILA
Chris Brenner and Patrick Nugent
Mentor: Douglas Chalker

*Tetrahymena thermophila* are complex single-celled eukaryotes that are valuable model organisms. The cytoskeleton is the foundation of motility and a key component of cell structure. The protein Kdf1 (kinetodesmal fiber protein 1), which has a role in ciliary row patterning and the regulation of microtubule formation, is an important factor in maintaining normal cytoskeletal functions. RNA methylation, another major process in cellular function, regulates gene expression in cells of all organisms. Mta5 is an MT-A70 family protein and is an mRNA methyltransferase.

The goal of this project is to further characterize and better understand the function of these relatively uncharacterized proteins. Using bioinformatics research, gene homologs were identified. To determine the localization of these proteins, YFP-fusion proteins were generated and visualized under a light microscope during vegetative growth and conjugation. This determined that Kdf1 localizes to the macronucleus and ciliary rows, while Mta5 localizes to the cytoplasm. Using RT-PCR, the gene expression profiles of the two genes of interest were determined. The results of these varied approaches further implicate Mta5 in mRNA methylation and Kdf1 in microtubule regulation and ciliary row patterning.

ISOSPIN SYMMETRY TESTS USING DOUBLE PROTON DECAY
Walter Buhro
Mentor: Lee Sobotka

We studied the double proton decay of ^8_C ground state and its isobaric analog (IAS) in ^8_B. 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 T_z). 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 pointlike particles. This experiment completed the A = 8, T = 2 mass multiplet. In a previous experiment, the group measured the double proton decay of ^12_O ground state and ^12_N (IAS). If a mass multiplet has isospin symmetry, then the masses of the nuclei in that multiplet can be calculated with a quadratic polynomial in T, 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 ^8_C and ^8_B (IAS) reactions in an experiment performed at the National Superconducting Cyclotron Laboratory at Michigan State University. ^8_C 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.
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.

IS YOUR IMMUNITY COMPROMISED BY BEING NICE TO YOUR BACTERIA?
INSIGHTS FROM A SOCIAL AMOEBA.

William Éamon Callison
Mentor: Joan Strassmann

Animals are dependent on billions of beneficial microbes. How then have they evolved responses that protect them from harmful bacteria while coddling the beneficial ones? An ideal system for investigating this relationship is the eukaryote social amoeba Dictyostelium discoideum. D. discoideum has a solitary single-celled stage and a social multicellular stage. Furthermore, we have recently discovered that the social stage takes two genetically distinct forms. In some individuals, the social stage is sterile, a condition maintained by processes which include sentinel cells that mop up bacteria and carry them out of the body. But another kind of individual carries bacteria with it through the social stage, then uses them as seed corn when they reach new environments. How do these farmer clones eliminate harmful bacteria while still carrying the beneficial ones? 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.

FROM OPPRESSION TO SUPPRESSION:
THE INTEGRATION OF NORTH KOREAN REFUGEES INTO THE SOUTH KOREAN ECONOMY

Carolyn Carpenter
Mentor: Andrew Sobel

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. After testing this hypothesis I conclude that refugees who are successful in the South were once part of the North Korean elite. This is because as members of the North Korean elite these refugees were able to invest in their human capital which allowed them to better adapt to the South Korean economy.
**ISOLATION, CHARACTERIZATION, AND GENOMIC ANALYSIS OF MYCOBACTERIOPHAGE NEBS**

Samuel Chandler, Nicole Ebalo, and Tolison Fowler  
Mentors: Sarah Elgin, Kathy Hafer, and Chris Shaffer

Mycobacteriophage Nebs is a novel virus of *Mycobacterium smegmatis*. Infection results in medium sized, turbid plaques. By performing a BLAST search in phagesdb with the genome sequence, it was determined that Nebs is in the A4 cluster of mycobacteriophages. The Nebs genome was found to contain 86 protein–encoding genes, with a total genome length of 51,412 bp. Its overall genome structure is very typical of cluster A phages, with the two distinct halves of the genome being transcribed on opposite strands. The left half of the genome contains the proteins that construct the capsid and tail of the phage as is common for a phage. There is also a gene encoding the chaperone protein responsible for the construction of the tail. Interestingly, this gene contains a programmed transcription phase shift, causing it to create two different protein products. This chaperone gene is immediately followed by the tape measure gene, another common characteristic of cluster A phages. The right half of the genome, though typically more variable for mycobacteriophage, is also very similar to other A4 phages. The right half also contains an integrase protein. Overall, the genome structure strongly suggests that Nebs is a lysogenic phage, though no potential attP sites have been identified at this time. The genome of Nebs is also very similar to other A4 phages. The right half also contains an integrase protein. Overall, the genome structure strongly suggests that Nebs is a lysogenic phage, though no potential attP sites have been identified at this time. The genome of Nebs is also very similar as a whole to several other isolated phages, including phages Eagle, MeeZee, and Peaches.

**AFRICAN-AMERICAN DISTRUST OF HEALTHCARE: MYTH OR REALITY?**

Grace Faith Chao  
Mentors: Elizabeth Quinn and Bradley Stoner

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 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. Three urban legends in St. Louis were particularly interesting symptoms of this distrust of healthcare: 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.

**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.
SEARCHING FOR MEANING IN THE TIME OF THE BLACK DEATH
Meytal Chernoff  
Mentor: Robert Wiltenburg

The need for understanding and the search for meaning in times of suffering can be seen throughout human history. One example of this phenomenon is the various explanations for the Black Death, a plague which ravaged Europe from 1348-1351, killing about a third of the European population. This paper investigates these explanations and their effects on European society in the context of the universal human need for meaning, and finds that this need to explain the sometimes unexplainable transcends time.

To conduct the research, primary source documents written in Europe during the plague were examined. The documents include both religious and scientific explanations for the plague as well as some artwork depicting the changing attitudes and philosophies as a result of the rampant death. Finally, in order to understand the explanations of the Black Death in the context of a search for meaning in times of distress, modern psychological themes were applied. The central themes were identified and explanations for the Black Death put forth by scholars and common men during the fourteenth-century Europe were placed in their historical context, and central themes were identified.

This work shows that while at first glance the reactions of the people to the flood of death brought on by the plague seem superstitious and antiquated, they reflect phenomena still seen today. In times of suffering, the human response to the question of why, is quite predictable and takes several paths: A turn toward science, a turn towards religion and unfortunately the creation of scapegoats, and the culture of fear that develops as suffering increases. Only by recognizing the universal themes which link past and present and studying their past impact can an understanding of the current actions of people placed in similar situations be achieved.

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.

WHAT IS A WAR CRIME?: MOVING BEYOND VICTORS’ JUSTICE AND THE LEGACY OF THE TOKYO WAR CRIMES TRIAL
Martha Clark  
Mentor: Lori Watt

The Tokyo War Crimes Trial prosecuted 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. 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.

**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.

**DESIGNING A SOFT-MODEM TO OPTIMIZE COMMUNICATION THROUGH AN AUDIO A/D**

Andrew Cowley  
Mentor: Robert Morely

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. 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). 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.

**CHARACTERIZATION OF MYCOBACTERIOPHAGE AMELIE**

Daniel Cui, Jessica Erlich, and Rebecca Foreman  
Mentor: Sarah Elgin

Mycobacteriophage Amelie is a newly isolated cluster K1 phage of Mycobacterium smegmatis. The site (for the soil sample) that yielded Amelie was the same GPS site that yielded Broseidon, a cluster A phage. However, it is clear that Amelie and Broseidon are very different phages. Amelie has a viral morphology with an isometric head and a long flexible tail. Upon infection of Mycobacterium smegmatis, it forms small, turbid plaques, indicating that Amelie is a lysogenic phage. In gel electrophoresis, the Amelie genome was cut only by the restriction enzymes HaeIII and AvaI. The Amelie genome is 56,439 bp long and contains only 76 genes, a smaller number than other K1 phages. All but two of the Amelie genes are coded in the positive direction. On the left arm of the genome, the tapemeasure and tail sub-
unit coding genes have been identified. There are significant gaps in the Amelie genome with no coding potential or predicted genes, which violate the phage tight pack rule, a property of the genome that should be investigated. Amelie’s genome is most closely related to cluster K1 mycobacteriophages Anaya and Adephagia, with some similarities with BarrelRoll and CrimD. However, the Amelie genome is still very different from its closest homologues, suggesting the possibility of a novel genome. Several areas of Amelie’s genome should be analyzed in depth. Since there is lots of variation in the first few genes in phage genomes, this region will receive additional attention. Furthermore, genes 24 and 25 both have a high identity with gp28 of other phages, and so these two genes will be further analyzed to determine their evolutionary history.

Nick Curry
See Brooke Yarrows

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.

DIFFERENCE IN LOCOMOTION BETWEEN NAKED MOLE RATS (NMR) AND MICE WHEN EXPOSED TO DIFFERENT CONCENTRATIONS OF CARBON DIOXIDE AND NITROGEN
Angelina Diaz
Mentor: Thomas Park, University of Illinois at Chicago

This research looks at the difference in locomotion between Naked Mole Rats (NMR) and mice when exposed to different concentrations of carbon dioxide (CO2) and nitrogen (N2). NMR live in East Africa predominantly southern Ethiopia, Kenya and Somalia. NMR are one of two mammals known to be eusocial. They inhabit an underground tunnel system that can consist of as many individuals as 300 per colony. With this amount of individuals living underground together, oxygen becomes depleted and CO2 increases to noxious levels. Despite this toxic environment, NMRs are adapted and thrive in these extreme environments. Due to this adaptation we study the difference of activity levels of NMR and mice in low O2 and high CO2 environments. The experiment uses an animal cage divided into six quadrants. Quadrants are labeled with letters a-f. As animals move about the cage their location can be collected by the quadrant in which they enter. With this study I hypothesize that an environment with depleted levels of oxygen (hypoxic) and high levels of CO2, the NMR will retain activity levels more than the mouse.

FARMER SEED CHOICES IN THE WARANGAL DISTRICT OF ANDHRA PRADESH, INDIA
Christine Diepenbrock
Mentor: Glenn Stone

Farmer interviews were conducted in villages and tribal thandas in the Warangal district—known primarily for its production of hybrid cotton—throughout the region's growing season in Summer 2012. These data were collected to continue a longitudinal study led by Dr. Glenn Stone of the Washington University Department of Anthropology regarding farmer seed choices following the introduction of Bt cotton. Bt is a genetic modification technology in which a Cry gene from the bacterial strain Bacillus thuringiensis is inserted into crop systems to express a protein that punches holes in the gut of insects who ingest the plant—in the case of Bt cotton, the cotton bollworm. Points of inquiry in farmer interviews included number and types of crops and acres cultivated, yield in 2011, seed choices for both 2011 and 2012 and reasons for selection, and other parameters pertaining to pests and irrigation. Seed shops and farmers were also interviewed to investigate the effects of price ceilings in place for Bt cotton seed in Andhra Pradesh. Consistent with past findings of periodic seed fads, this cohort of results further suggests that farmer preferences are cyclic and transient, with a new variety spiking in popularity every three years only to quickly decline again. Also of interest were a permit system reinstated in 2011 for varieties for which demand has been far outstripping supply and the changing role of the black market in seed sales and policy.
“GOOD” GALS REPRESENT THE “BAD” GUYS: THE PERSONAL AND PROFESSIONAL LIVES OF FEMALE CRIMINAL DEFENSE ATTORNEYS
Laura Megan Dietrich
Mentor: Jami Ake

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. Little existing research explores how their struggles manifest in their professional duties and in their personal lives. My study analyzes the origins and implications of female defenders’ unique struggles. 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.

“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 re-analyzing 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.

Sam Donohue
See Andrew Hess

HEALTH AND SUB-SAHARAN MIGRANTS IN MOROCCO: RECENT CHANGES AND FUTURE TRENDS IN HEALTHCARE ACCESS AND IMMIGRATION POLICY
Sylvie Doppelt
Mentor: Carolyn Sargent

This work 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. 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.

**EXAMINING THE ACCESSIBILITY OF THE BUILT ENVIRONMENT FOR PHYSICAL ACTIVITY IN SALVADOR, BRAZIL**

Phenesse Dunlap  
Mentor: Derek Pardue

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 explores the perceived accessibility of the Academias das Praças according to users in Salvador, Bahia, Brazil.

Nicole Ebalo  
See Samuel Chandler

Justin Eisenberg  
See Miles Black

**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.

**SECOND MOMENT ANALYSIS OF SODIUM ALUMINOHEXAHYDRIDE NMR**

Tim Ellis-Caleo  
Mentor: Mark Conradi

Sodium aluminohexahydride (Na₃AlH₆) is a promising candidate for reversible hydrogen storage. Understanding the motion of individual atoms within the crystalline lattice is a key challenge of studying hydrogen storage candidates. This molecule is formed by sodium cations and an aluminohexahydride (AlH₆⁻) anion cluster. We examined the relative widths of the lineshapes over the temperature range 23°C to 240°C and noticed significant narrowing, allowing us to conclude that some of the nuclei are moving. It is important to understand not only which nuclei are moving, but also how they are moving. In this case, second moment calculations can be performed to examine
the effects of specific motions on the lineshapes. In particular, we looked at three distinct cases of movement: where the entire crystal is rigid, where the AlH₆⁻ clusters rotate isotropically on the 10⁻⁵ second time scale and finally where the sodium atoms diffuse rapidly through the lattice in addition to the isotropic rotation. We located all of the nuclei in the crystalline lattice and then designed a computer program to perform the second moment calculations to calculate the linewidths. We were able to see that the hydrogen nuclei undergo rapid rotational motion as the experimental linewidths were much narrower than the calculated values for the rigid case. Also, we conclude that the sodium atoms are not diffusing as the hydrogen and aluminum lineshapes do not narrow to the degree predicted if the sodium atoms were diffusing. Our experimental lineshapes did match our calculated values well for the case of fast rotation of the hydrogen around the aluminum cluster without sodium diffusion, allowing us to conclude that this is the correct model.

**ANALYSIS OF THE DIVERSITY OF PROTEINS THAT LOCALIZE TO THE CORTICAL LAYER IN TETRAHYMENA THERMOPHILA**

Ezinwanne Emelue, Vishnu Halthore, Ray Suzuki and Nancy Zhang  
Mentor: Douglas Chalker

The epiplasmic layer in *Tetrahymena thermophila* is a very unique biological structure. This proteinaceous layer contains a multitude of diverse proteins that maintain the organization of the cytoskeleton and the ciliary rows that are critical for *Tetrahymena* mobility. Our study highlights the diverse nature of the epiplasm by focusing on four different proteins that all show very similar localization. These four proteins can be subdivided into two categories: structural proteins and kinases. Both EPN1 and EPN2 are hypothetical structural proteins. Their only conserved domain is DUF2816 (domain of unknown function) and closest homologs to these proteins are epiplasmin proteins found in *Paramecium tetraurelia*. Both of these proteins are found to localize around basal bodies along the ciliary rows during both vegetative growth and conjugation. EPK1 is a kinase that contains the STYKc domain, which is a conserved domain in proteins that phosphorylate serine, threonine, or tyrosine residues. EPK1 also appears to localize to the epiplasm in rings around the basal bodies during vegetative growth. DNK1 shares a conserved protein family domain with deoxynucleoside kinase, which acts to phosphorylate deoxynucleosides. Initial visualization results during vegetative growth show DNK1 localization to the cytoplasm, but it was observed that during conjugation, DNK1 localizes at the basal bodies of the ciliary rows.

**IDENTIFICATION OF INTRAGENIC SUPPRESSOR MUTATIONS OF ftsZ84**

Ezinwanne Rosemary Emelue  
Mentor: Petra Levin

FtsZ is a tubulin homolog that is essential for cell division in bacteria. It assembles into a ring structure at mid cell and recruits cell division machinery. The Levin Lab investigates FtsZ assembly and regulators of FtsZ ring formation. With this knowledge, parallels can be drawn to tubulin assembly in eukaryotes and a broader knowledge of bacterial cell division can be gained.

My main goal is to identify secondary mutations in a temperature sensitive allele of FtsZ, *ftsZ84*, that restore ring formation and division in non-permissive conditions. We can then map these secondary mutations back to the FtsZ protein structure, and through a combination of biochemical assays we can further characterize the activity and assembly of these mutant proteins and learn more about FtsZ assembly.

To identify intragenic (in the *ftsZ84* gene) suppressor mutations, E.coli with the *ftsZ84* allele was grown at permissive conditions, and then plated at non-permissive conditions (No Salt (NS) media at 42°C) selecting for spontaneous suppressors of *ftsZ84*. Since *ftsZ4* is located near a region containing a tetracycline resistance gene, I was able to use phage transduction to transfer these intragenic suppressor mutations into wild type E.coli. From this screen we found three suppressors (F39L, M206I, V293I) out of eighty-eight total cells screened. Twenty-six of these eighty-eight cells were screened with the addition of ethane methyl sulfonate (EMS). Although the mutation rate was high (13 mutants out of 26 cells screened) all of the suppressors found using EMS were consistent in having the V293I mutation. Current and future directions include characterization of these suppressors through biochemical assays such as GTPase and light scattering assays.

Jessica Erlich

*See Daniel Cui*
ALZHEIMER’S DISEASE AND DEMENTIA IN THE DIGITAL AGE:
USING GOOGLE TOOLS TO INDEX TRENDS IN PUBLIC INTEREST

Molly Evans
Mentor: Brian Carpenter

Alzheimer’s disease (AD) is a critical public health problem, with over 400,000 people coping with the disease, and with a prevalence expected to increase in the decades ahead. Public interest in AD has grown steadily, as more and more individuals and families come to cope with the disease. There are many ways to study public interest in disease, and with the advent of the Internet and large online databases there are new avenues to understand how the public grapples with health issues.

In this study we adopt a new analytical approach, culturomics, to examine public interest in AD. Culturomics is the study of human behavior and culture through the application of quantitative data analysis to digitized texts and digital data. In short, culturomics involves analysis of large, comprehensive databases to understand how people approach topics like AD. There are several tools developed by Google that can be used for this purpose. In this study we used Google Trends to investigate the frequency with which people searched for similar terms using the Google search engine between 2004 and 2012. We mapped data on the major events in the history of AD.

Innovative technologies provide a new way to examine interest in diseases such as AD. In particular, Google offers several tools that can be used to investigate cultural trends in health literacy and how people seek information through books and the Internet. These tools provide a unique window into public interest and concern about health conditions.

CHEMOKINE GPCR CCR7 ACTS AS A NEGATIVE REGULATOR OF WNT/β-CATENIN PATHWAY AND CELL PROLIFERATION IN SW480 COLON CARCINOMA CELLS

Lubov Ezerskiy
Mentor: Lilianna Solnica-Krezel

Although G-protein coupled receptors (GPCRs) are the largest receptor family, and have multiple roles in immune and nervous systems, they have not been considered as major regulators of cancer cell proliferation. Our group has shown that chemokine GPCR signaling negatively regulates β-catenin to limit embryonic axis formation at the onset of zebrafish development. Previous studies suggested that an activated Gaq pathway inhibited β-catenin stimulated cell proliferation in human colon carcinoma SW480 cell line via triggering a Ca"+-dependent nuclear export and degradation of β-catenin. This implies that an unknown endogenous GPCR signaling axis exists in intestinal epithelium that can limit β-catenin. We hypothesized that if SW480 cancer cells are treated with GPCR CCR7 ligands CCL19 and CCL21, they will inhibit cell proliferation and decrease β-catenin levels in these cells. We determined that both the receptor (CCR7) and the ligands are expressed in the cells. Both agonists, CCL19 and CCL21 down regulated levels of total and active β-Catenin in a time dependent fashion. Moreover, proliferation studies with SW480 cells revealed that the ligands induced a significant reduction in the number of cells that were proliferating. When the CCR7 receptor was blocked with a function-blocking antibody, the inhibition of proliferation was reversed. Our mechanistic studies showed that CCR7 may be utilizing G proteins different from Gai for the inhibitory effects on β-catenin levels in the cells. These results allow us to believe that the CCR7 ligands CCL19/21 may be used in slowing the growth of the SW480 cells and therefore could possibly be used in tumor reduction.

THE GAMBLE WITH JIHAD:
Pakistan and the United States 1947-2009

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 affect 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 U.S. 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.

Rebecca Foreman  
See Daniel Cui

MECHANICAL ORIGINS OF TORSION AND BENDING IN THE EMBRYONIC BRAIN  
Nickolas Forsch  
Mentor: Larry Taber

During early development, the tubular brain of the chick embryo undergoes a combination of progressive ventral bending and rightward torsion as a result of mechanical stresses and strains. These morphological changes are one of the major organ-level symmetry-breaking events in development. Although the bending can be attributed to differential growth, the mechanism for torsion remains poorly understood. The looping of the heart is thought to contribute to the direction of brain torsion, but the mechanical origin of such torsion is not yet understood. In this study, experimental perturbations show that the bending and torsional deformations in the brain are coupled and that the vitelline membrane applies an external load necessary for torsion to occur. In addition, the asymmetry of the looping heart produces the directionality of the twisted brain and cerebrospinal fluid pressure contributes to ventral bending. The amount of rotation and curvature of the embryo are quantified to develop a mathematical model and to better understand the growth of the embryo as a whole.

Tolison Fowler  
See Samuel Chandler

Cory Fulcher  
See Adam Adenwala

Claudia Gambrah-Sampaney  
See Adam Adenwala

ISOLATION, PURIFICATION, PHYSICAL CHARACTERIZATION AND GENOMIC ANNOTATION OF THE A2 MYCOBACTERIOPHAGE BadWolf  
Aakash Gandhi, Alex Hallwachs, and Harsha Jujjavarapu  
Mentors: Sarah Elgin, Christopher Shaffer, and Kathy Haver

BadWolf is a novel temperate phage capable of infecting Mycobacterium smegmatis that was isolated from soil on the Washington University in St. Louis Danforth campus at the same location as the previously sampled A4 phage LittleGuy. Plaque-screening, purification, transmission electron microscopy, and full genomic sequencing (Roche 454) were performed to characterize the virion structure and genome. Local nucleotide BLAST search of the entire BadWolf genome (53,166 bp) against the Mycobacteriophage Databases (http://phagesdb.org) confirm sequence similarity to subcluster A2 phages, demonstrating that a phage cluster can be resampled at a location one year apart. Positional annotation demonstrates that the BadWolf genome contains 92 open reading frames (ORFs), organized into a left arm containing 34 genes (~800 bp/gene) as well as a right arm containing 58 genes (~450 bp gene) mostly transcribed in the reverse direction. Additionally, translational BLAST search (NCBI) of ORF sequences demonstrates significant similarity to the gene products of the A2 mycobacteriophages Turbido, Trixie, RedRock, and Pukovnik. Preliminary functional annotation demonstrates that the left arm mostly expresses structural elements, including a 2904 bp tape-measure protein (gp26). Comparison to previously published gene maps of Turbido and Trixie demonstrates that BadWolf gp3 expresses a structural element that is likely part of a distinct family. The right arm expresses proteins for infection and life cycle regulation, and is functionally distinct from other A2 phages. We putatively assign the integrase function of BadWolf to gp31 and the attP site to a region between gp36 and gp37, which are the only two forward-transcribed ORFs in the right arm. Within this cassette, we also identify a new gene (gp32) of currently unknown function that is not found in either Trixie or Turbido, which could represent a functionally distinct mechanism for site-specific recombination into host genomes.
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 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.

AN ANTHROPOLOGICAL PERSPECTIVE ON CONCUSSION
Xinyi Ge
Mentor: Carolyn Sargent

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.

THE DARRYL CONE CASE:
THE DEFICIENCIES OF INDIGENT DEFENSE
Patrick Georgen
Mentor: Mike Bezemek

Darryl Cone was arrested in the summer of 2009 in Clark County, Nevada on misdemeanor charges of theft and possession of drug paraphernalia. He could not afford an attorney and was appointed representation by the county. Cone's attorney, Paul Wommer, attempted to coerce him into pleading guilty. When Cone refused, Wommer severed all contact. On the first day of his trial, without an attorney, Cone pled guilty. Despite the prosecutor's prior claim to consider probation, Cone received the maximum sentence of up to ten years in prison.

This analysis of the Cone case seeks to explain Wommer's behavior and Cone's seemingly excessive sentence. I proceed with a brief examination of U.S. indigent defense at the national level, which reveals a patchwork of systems varying state-by-state and at times county-by-county.

Clark County’s system employs two forms of indigent defense delivery: the public defender’s office and the contract system. Both forms are plagued with problems engendering substandard representation. The Cone case demonstrates problems with the contract system, an ad hoc hiring of private attorneys by the county. A built-in financial incentive causes marginalization of contract clients, like Cone, who are not charged with capital crimes. Additionally, the contract system's poor oversight thwarted Cone's efforts to receive attorney replacement. Cone, literally defenseless and without recourse, was left to the will of a prosecutor who likely recognized him as an easy target.

Scholarly research on indigent defense suggests these systemic deficiencies are not limited to Clark County. Furthermore, a disparity
between public and private representation may exist in many jurisdictions, suggesting possible wide-scale violation of the 14th Amendment’s Fair and Equal Protection clause. This disparity, coupled with the diversity of U.S. systems, demands consideration of comprehensive federal reform.

**Wedding Celebrations in Lamu, Kenya:**
*Examining the Transition from a Colorful Cultural Celebration to a Product of Societal Homogenization*

Anisah Giansiracusa  
Mentor: Mungai Mutonya

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 study, 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. The research relied heavily on the oral histories of Lamu women. Their ages ranged from 25–88 years, and they represent three generations of women. I 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.

**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 studied 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 work 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 study 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.

**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. Many zoos have created bachelor groups rather than house males solitarily. 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 observed and classified; the occurrences of these behaviors were then 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.

**Localization of STK1 and Sub1 in Tetrahymena Thermophila**

Rahul Goel and Grace Kroner  
Mentor: Douglas Chalker

*Tetrahymena* is part of a group of eukaryotes known as ciliates. These organisms have many unique qualities such as rows of cilia and nuclear dimorphism that make them an interesting group with which to work. *Tetrahymena* has specifically been used as model organism because of its short generation times, ease of transduction, as well as its relatively large cell-size, which facilitates visualization. The ciliated structure as well as the functionally distinct nuclei facilitated study of the localization and function of both of these proteins because STK1 serves as a cilia production regulator, while Sub1 acts a transcriptional co-activator of RNA polymerase II. Construction of YFP-fusion proteins allowed visualization of the localization by fluorescence microscopy. Through these methods, STK1 was seen to localize around the basal bodies found in the epiplasm. These results were reasonable considering STK1’s function in ciliary production, which occurs at basal bodies. Sub1 localized to the macronucleus; this was logical since the macronucleus is the transcriptionally active nucleus. Both proteins are upregulated during conjugation, which was shown through RT-PCR. Research in these proteins can facilitate translational studies. The cilia structure of *Tetrahymena* is used to model lung cilia, and so further research about STK1 could prove beneficial in understanding the mechanisms surrounding human lung cilia function. Further research about Sub1 could enhance understanding of gene regulation and activation because Sub1 contains a conserved PC4 domain, which is known to activate gene transcription in mammals.

**Demand Response Management Using Game Theory for the Smart Grid**

Daniel Golberg and Lauren Steimle  
Mentor: Arye Nehorai

There are large fluctuations in the demand for electricity throughout the day. Utility companies, especially in residential areas, observe a large peak in the demand during late evening hours of the day. In order to maintain such high demands, the companies must run old, inefficient power plants as back-up generators to ensure they can satisfy all demand and retain reliability. To lessen this burden on the power grid, our research considers a model using smart grid technology that redistributes residential electrical usage through autonomous load scheduling. We assume that we know each user’s energy consumption needs, including schedulable loads and base loads. We also consider some users may have future household appliances including plug-in electric vehicles, which require a large amounts of energy to charge, and distributive generators, like solar panels, which when not needed can sell electricity back to the grid. Our model uses a convex optimization algorithm to find an optimal energy consumption schedule for each user in order to reduce the total cost to all users in the system. This algorithm is paired with strategic pricing schedules derived from game theory principles to reduce the peak-to-average-ratio (PAR). Analysis of our simulation shows that our algorithm does reduce the total cost of electrical use by 20%.

**Parenting Preschoolers with Disruptive Behavior Disorders: Does Child Gender Matter?**

Antonya 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.

**PARTICLE IMAGE VELOCIMETRY ANALYSIS OF CILIA MOVEMENT**  
Olivia Gonzalez  
Mentors: Philip Bayly and Ruth Okamoto

Primary Ciliary Diskinesia (PCD) encompasses any genetic disorder in which the cilia within the body function abnormally. A greater understanding of cilia mechanics could provide insight into the varied forms of PCD. Observation of cultured cells from individuals with PCD has allowed clinicians to identify characteristics such as slower beat frequency, but a more detailed analysis describing the motion of cilia may better differentiate between different genetic disorders. The objective of this research was to discover whether or not Particle Image Velocimetry (PIV) could be applied to high speed video recordings of beating cilia, in order to quantify the motion of cilia on clusters of cultured cells.

PIV is a method of analyzing flow between images. It splits images into sections and matches the intensity of the image pixels in them to create vectors. Sequences of images were obtained from high speed video microscopy. PIVlab 1.32, a MATLAB program, was modified to analyze multiple images and to scale them, so that videos of the vector fields superimposed on the original images could be created to show the local flow.

PIV was successful in assigning quantitative values to the motion of cilia in a sequence of images. The magnitude and periodicity of these values will be analyzed to determine whether PIV provides repeatable and reproducible results.

**UNDERSTANDING LEGAL CLAIMS AGAINST THE FEDERAL GOVERNMENT: CAUSES AND CONSEQUENCES OF SOVEREIGN IMMUNITY**  
Daniel Guenther  
Mentor: Randall Calvert

This study 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 work 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.

**COGNITIVE EFFORT DISCOUNTING IN YOUNG AND OLDER ADULTS**  
Dalton Guthrie  
Mentor: Leonard Green

Psychologists and behavioral economists have long assumed that, other things being equal, people prefer to expend less effort rather than more. Although early research examined the effects of physical effort on animal choice behavior, only recently has research begun to explicitly examine the effects of cognitive effort on human decision making. In the present experiment, young adult and older adult participants completed multiple versions of the \( n \)-back task, a working memory task in which participants have to remember the item presented \( n \) items previously; as the value of \( n \) increases, the level of cognitive effort required increases. Participants chose between performing an easy 1-back task for a small amount of money and a more difficult task (i.e., \( n > 1 \)) for a larger amount of money. If a participant chose the harder \( n \)-back, then the payment for the easy 1-back task was increased; if the participant chose the easy task, then the
payment for the easy task was decreased. As the difficulty \((n)\) of the more cognitively effortful task increased, participants increasingly discounted the value of the payment for performing that task. More specifically, the amount of money that people would accept for performing the easy 1-back task decreased systematically as a function of the cognitive effort required by the harder task. This pattern was observed in both young and older adults, but the older adults were significantly more affected by the degree of cognitive effort than younger adults. The discounting of the payment for the difficult task was analogous to the discounting of delayed monetary rewards in that the decrease in the value of the payment as \(n\) increases and the decrease in the value of a reward as the delay to its receipt increases are both described by a hyperbolic function.

Alex Hallwachs  
See Aakash Gandhi

Vishnu Halthore  
See Ezinwanne Emelue

**EXPLORATION OF BEHAVIORAL INHIBITION AND ACTIVATION IN PRESCHOOL CHILDREN USING A REWARD PROCESSING PARADIGM: A PUPIL DILATION STUDY**

Gloria T. Han  
Mentor: Michael Gaffrey

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.

**LESBIANS WITH EATING DISORDERS: REWORKING HETERO NormATIVE UNDERSTANDINGS OF EATING DISORDERS TO INCLUDE ALTERNATIVE SEXUALITIES**

Elizabeth Handschy  
Mentor: Rebecca Lester

Since the 1990s, eating disorder research has expanded to include diverse groups for study; however, lesbian women are still largely excluded from these investigations. This work highlights three challenges to dominant models of eating disorders brought by the inclusion of the experiences of lesbian women and concerns in theorizing these conditions. Drawing on memoirs and other first-hand accounts of lesbian women with eating disorders, I bring lesbian eating disorder experiences into dialogue with the existing literature, and identify where new lesbian illness narratives needs to be told. Lastly, I argue that lesbian experiences with healing and recovery from eating disorders can improve current treatment paradigms.
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, 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.

Experiments were completed 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 anti-body 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.

ARE WE CHANGING FOR BETTER OR WORSE? POPULAR OPINIONS OF THE FSLN AND ITS POLITICAL PROPAGANDA IN NICARAGUA

Nay’Chelle Harris
Mentor: Zoilamérica Narváez, Centro de Estudios Internacionales, Nicaragua

In 1979 the Sandinista National Liberation Front (FSLN) overthrew a 43-year-old dictatorship in Nicaragua and spent the next decade fighting counterrevolutionary forces funded by the United States government until they were voted out of office in 1990. During the years following their election loss, the party went through many contentious transformations, and from the mid 1990s onward people have claimed that the FSLN in its current form does not uphold the values of its revolutionary past. Supporters, however, have defended the government’s commitment to its original values by pointing out its success in improving the quality of life for a large number of Nicaraguans since returning to power in 2006. This rift has led to an antagonistic relationship between pro-FSLN loyalists and anti-FSLN opposition, with those who do not completely agree with either side caught in the middle.

This project looks at how the political spectrum in current Nicaragua is reflected in common interpretations of government propaganda, the most ubiquitous way in which the state intervenes in the lives of its residents on a daily basis. I interviewed and surveyed people from university age up to senior citizens from a variety of different backgrounds in the cities of Managua, Esteli, Matagalpa, and their periphery towns. What the research suggests is that people use regular interactions with state advertising as a way to dialogue indirectly with the government, regardless of whether it is a result of political apathy and a lack of trust in elected officials or because it is the closest they get to coming in contact with the leaders they admire.

BAD MOMS: DEHUMANIZING SOCIETAL DEVIANTS

Sara Harris
Mentor: Jillian Powers

To begin to understand societal perceptions of mothers as criminals, I conducted a qualitative study of online commenting on the Huffington Post. In completing this project, I not only was interested in what commenters were saying, but also the manner in which individuals engage in online space. I chose to complete a detailed analysis of three representative case studies, focusing primarily on the content of the comments of the three case study articles to illuminate perceptions of and beliefs regarding women who have inflicted harm against their children, accidentally or intentionally. I focus on three cases: Shana Bishop who was arrested for child neglect, Dalisha Adams who was arrested for child abandonment, and Elizabeth Escañona who was arrested for felony injury to a child. When news articles are posted online, the comment board creates a rather interesting public jury, where anonymity empowers users to reveal a litany of thoughts in response to the story. In turn, these comment boards provide an ideal opportunity to explore understandings of race, class, and gender through the lens of female criminals.

A cross-analysis identifying trends in the rhetoric of the comments left behind on Huffington Post articles detailing these three crimes
revealed three major themes: the role of parenting, the criminal justice system, and reproductive rights. Across all three articles, commenters tended to engage in extreme marginalization of certain members of society: those who are mentally ill, incarcerated, or poor. Amidst their condemnations, online users frequently belittled these marginalized populations, often calling for a restriction of their rights. Through this work, I have identified an alarming process of dehumanization attached to people deemed a societal deviant, sentiments reminiscent of historical atrocities.

Gregory Harrison
See Ignacio Ayoroa

VAMPIRES AND IDENTITY VIOLENCE FROM “THE VAMPyRE” TO BUFFY THE VAMPIRE SLAYER
Genevieve Hay
Mentors: Jami Ake, Heidi Kolk, and Philip Sewell

In this study, 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.

PULSE OXIMETRY FOR THE APPLE iPHONE
Daniel He and Satcher Hsieh
Mentor: Arye Nehorai

This research focuses on sleep disorders, specifically sleep apnea. Sleep apnea is a common sleep disorder that remains largely overlooked. This is because the symptoms, including excessive daytime fatigue and weight change, are too often attributed to causes of personal habit. The current preferred method of diagnosis, polysomnography, helps identify this disorder, but it also contributes to the problem by introducing extreme financial strain and overall inconvenience. Execution of this test requires that the patient sleep in a sleep laboratory, a foreign environment that is not only inconvenient, but also an inaccurate representation of a typical night of sleep. This can potentially lead to a misdiagnosis of the patient’s condition. Furthermore, with the cost of a diagnostic polysomnogram sometimes reaching $6,000, it is easy to see that many potential sufferers forgo this procedure and remain unaware of their condition.

Our proposed solution is to create a home polysomnography solution that utilizes the processing power of a smartphone. We begin by interfacing an Apple iPhone with a core component of the polysomnogram: pulse oximetry. We have been largely successful in implementing a real-time, bench version of a pulse oximeter. In future work, we plan to complete a live iPhone version, as well as expansion to other smartphone platforms. In addition, we hope to expand our devices into a full, medical-grade polysomnography.

Diana He
See Abena Apaw
EXAMINING THE EFFECTS OF COMMUNITY REDUCTION AND ACIDIFICATION ON PATTERNS OF EXTINCTION AND LOCAL AND REGIONAL BIODIVERSITY OF A PROTOZOA SYSTEM

Vanessa R. Hensley
Mentor: Kevin 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.

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.

My theoretical synthesis is enhanced with grounding in the individual, showing how each aspect of theory connects to 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, but rather that our larger societal values have not adjusted to the more unfortunate social and economic realities.

SMART SCHEDULING ALGORITHMS FOR CHARGING PLUG-IN HYBRID ELECTRIC VEHICLES

Andrew Hess and Sam Donohue
Mentor: Arye Nehorai

With the growing public awareness of clean energy and efforts towards a sustainable society, the demand for and number of plug-in hybrid electric vehicles (PHEVs) and electric vehicles (EVs) has been increasing over steadily over the past decade. These vehicles utilize rechargeable batteries or other energy storage devices, and are much more energy-efficient than traditional gasoline or diesel vehicles. As these vehicles come more mainstream in society, the charging demands of many PHEVs and EVs could raise problems to the power grid—increased demand for electricity and unwanted peak loads due to simultaneous charging. An optimal scheduling strategy that takes into account cost efficiency, user demands, and load distribution would help offset peak loads and keep the power demand balanced. This research project took many different scheduling theories and applied them to the case of charging the electric vehicles. To help find efficient solutions, each scheduling algorithm was developed in Python and tested against varying parameters such as arrival rate, user demands, as well as for particular scenarios. To determine which algorithms produced the best results, profit and success rate metrics were used. Furthermore, some algorithms deployed admission control, which would significantly limit the amount of items that could be tended to, but guaranteed their success.
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, this study 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.

WORTH THE RISK? AN EXAMINATION OF THE DIFFERENCES IN RISK PERCEPTION BETWEEN OBSTETRICIANS AND CERTIFIED PROFESSIONAL MIDWIVES IN MISSOURI
Allison Horan
Mentor: Carolyn Sargent

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 study 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 discuss the implications that differences and similarities in risk perception may have on the future of maternity care in Missouri.

Samantha Hsieh
See Adam Adenwala

Satcher Hsieh
See Daniel He

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 work 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.

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 Role of Palestinian Female Suicide Bombers in the Search for Gender Equality
Shilpa Iyyer
Mentor: Julie Cohen

This work seeks both to explore the factors that motivate Palestinian women to participate in political violence, as well as to analyze how responsive the Palestinian gender structure is to this trend. The discussion is focused through the lens of female Palestinian suicide bombers who violate cultural gender expectations and force both national and international communities to consider the circumstances that surround their cause. Prevailing cultural perceptions, personal motivations, and the social significance of the actual act of suicide will all be considered in this evaluation of the female Palestinian terrorist.

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 work 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. 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. 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.
KINECT: CONTROLLING A RHINO XR-4 ROBOTIC ARM
Matthew 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 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.

(TRADITIONAL) GENDER CONSTRUCTS IN CHILE: PERPETUATION BY THE CHURCH AND THE STATE, AND SOCIOLOGICAL EFFECTS
Angelica Maria Juarbe-Santaliz
Mentor: Kedron Thomas

This study analyzes 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. 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 hyper-masculine 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. 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 Nacional de la Mujer, SERNAM, acts today as the symbol of the state’s interest in gender roles. I also 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.

Harsha Jujjavarapu
See Aakash Gandhi

“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. 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 U.S., 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 unifying discourse to explain Haiti’s precarious social legacy while simultaneously inhibiting further conversations regarding challenges experienced within a Haitian diasporic community.

**THE DESTROYER OF WORLDS: AMERICA’S RESPONSE TO NUCLEAR WEAPONS IN SOUTH ASIA**

*Benjamin Kallen*

*Mentor: Krister Knapp*

This study examines 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 work examines primary documents as well as secondary sources in an effort to more fully understand this issue. This work 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 continue to form the bedrock of American policy toward both Pakistan and India. No other weapons technology has affected war as dramatically as nuclear weapons have. 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.

*Lauren Kan*

*See Alex Bluestone*

**DOES IMMEDIATE LIQUID FEEDBACK HELP IMPROVE TASK PERFORMANCE TO MAXIMIZE MONETARY REWARD?**

*Brian Katz*

*Mentor: Todd Braver*

While previous work has shown that both primary (liquid) and secondary (monetary) rewards improve cognitive task performance, neuroimaging results showed differences both in brain regions recruited and the temporal dynamics of brain activation. These findings were expanded upon in a pilot study in which primary reinforcers (juice and saltwater) were used as performance feedback to indicate receipt of later monetary reward. The purpose was to investigate how different liquids affect motivated task performance. While both feedback liquids improved task performance in comparison to baseline measures, juice resulted in greater improvements than saltwater. The current study serves as an extension upon the previous pilot through the inclusion of a neutral liquid to determine if juice feedback improves task performance, or saltwater feedback hinders task performance. The cognitive task was a letter/digit task-switching paradigm. Subjects first performed a series of task trials without reward to determine baseline performance measures. Next, the experiment was performed under three different incentive conditions, one for each feedback liquid. Participants now had the opportunity to earn a monetary reward on indicated trials if they performed the trial correctly and were faster than the 50th percentile of their baseline reaction time. The participant received a drop of liquid if they met the criterion, indicating that they earned the monetary reward for that trial. Each individual’s reward rate (the percentage of trials in which they were rewarded) was calculated for all three feedback liquids. Preliminary results (n=11) suggest that average reward rate was significantly higher for juice than for saltwater. The average reward rate for the neutral solution was between that of saltwater and juice, and showed a trend toward being higher than saltwater reward rate. Future analyses will be conducted on reaction time and accuracy measures in all three liquid conditions.
CAMPAIGN SPENDING MATTERS: NEW APPROACHES TO CAPTURE THE TRUE EFFECT OF INCUMBENT SPENDING

Alex 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 less effective, or at least as effective, as challenger spending. Many scholars believe that spending does matter but most research has been unable to measure the effects. Scholars agree that past models designed to test the effect of incumbent spending have suffered from specification error and endogeneity problems.

I designed and tested 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. A 2SLS model was used to avoid the endogeneity problem that results from a simultaneous relationship of spending and vote share. To estimate incumbent spending, I tested novel instruments related to constituency’s income and participation data. My model is also the first to use district level instruments 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 found evidence that the proposed instruments are methodologically sound and that incumbent spending does affect vote share, almost as much as challenger spending does. The effect of including independent and party-coordinated expenditures did not significantly affect vote share in the models tested.

MYTHOLOGIZING THE URBAN SPACE IN STREETWEAR

Louis Keene
Mentor: Heidi Kolk

This study explores the ways authenticity is articulated and contested in male urban streetwear, a clothing industry that emerged from the entrepreneurial confluence of two youth subcultures, punk and hip hop. As streetwear has moved from the fringes of popular fashion to the forefront of contemporary menswear, its consumers, often called “hypebeasts,” must mediate the tension created in this seemingly contradictory heritage. Consequently, the term “hypebeast” has become a loaded word, representing the authentic streetwear devotee but also his counterpart, the mainstream poser attempting to buy the look and the self-image he thinks comes with it.

Consumers of streetwear engage in a constant debate over what constitutes “street” authenticity. This negotiation of semiotic value occurs both on the clothes and online, where hypebeasts police the boundaries of a community that may be more claimed than real. Issues of race, class, and gender inform the construction of urban identity as much as the clothing does.

Building on previous research, this work examines streetwear companies vis-à-vis theories of subculture invented by Dick Hebdige, who studied the origins and eventual assimilation of the British punk movement. I culled from online message boards and comment forums to consider streetwear’s claim to personal authenticity and group identification, and find out why hypebeasts feel anxiety about that claim being compromised. Ultimately, this project seeks to uncover the mythology of urban life constructed on streetwear and by those who wear it.

“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 the legacy of reputable journalism replaced. Under a profit-driven media environment, serious, unappealing, or complicated issues simply do not receive adequate coverage. Dry but indispensable details about complicated issues, like the economic ramifications of pending political decisions, do not hold attention when 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 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 work I characterized the Broadcast Network Era and investigated the economic systems that produced traditional broadcast television news. To explore how those systems have changed to produce our current news environment, I examined how consumers have adopted new technology and the ramifications of new media consumption practices. I analyzed 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 has produced 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.

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*. The malaria parasite exhibits many behaviors that are most likely coordinated via extracellular chemical communication. 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 monoterpane 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, 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 that include quorum sensing as well as inter-species communication, such as the attraction of arthropods. To test the possibility of inter-species communication, our collaborators tested these specific monoterpenes against 80 *Anopheles gambiae* odorant 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.

FUNCTIONAL CHARACTERIZATION OF PUTATIVE P. FALCIPARUM METALLEPROTEASES

Kevin Kim  
Mentor: Daniel E. Goldberg

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 metallopeptide PF3D7_1009500. Based on gene sequence homology, we hypothesized that this metallopeptide 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 this protein. 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.

HUMANITARIANISM AND THE ANTHROPOLOGY OF HUNGER

Kate Klein  
Mentor: Peter Benson

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 work, 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 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 analysis of cultural constructions of hunger shows how they can exclude certain populations from being considered in aid efforts, which themselves can be problematic.

**THE ADVENT OF HAART AND REPRESENTATION OF HIV/AIDS IN AMERICAN FILM, 1993-2007**

Brian Kline

Mentors: Colin Burnett and Shanti Parikh

This work analyzes the changing representations of HIV/AIDS in (primarily U.S.) cinema, particularly in how representations differ before and since the advent of the first highly effective HIV treatment, Highly Active Antiretroviral Therapy, 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.

Elizabeth Korb

See Samantha Allen

**THE EFFECT OF VISITOR GROUP SIZE ON STEREOTYPIC BEHAVIOR AND USE OF AVAILABLE SPACE BY CAPTIVE ASIAN ELEPHANTS (ELEPHAS MAXIMUS)**

Kavitha Krishnan

Mentor: Stan Brode

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.

Grace Kroner

See Rahul Goel
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.

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 sixties, 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 this 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, the 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). 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, 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.”

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.

Attending to the Structure of Events and Its Effect on Memory

Claudia Landazabal
Mentor: Jeffrey Zacks

Researchers have long searched for solutions to age-related memory deficits. One possible target for intervention is event segmentation, an automatic process in which humans break up the flow of everyday activity that is crucial in subsequently remembering those events. In this study, 64 older adult subjects were randomly assigned to either a segmenting or a non-segmenting condition. All participants watched on a computer screen four short videos of a person engaged in everyday activities. Participants in the segmenting condition were asked to press the spacebar whenever they identified a small unit of activity during the video. Participants in the non-segmenting condition watched passively. Subjects in both groups then completed free recall, recognition, and order memory tests to assess their recollection. We hypothesized that asking participants in the segmenting condition to explicitly identify event boundaries would lead to better memory. There was no statistically significant difference in recall performance between participants in the two conditions in terms of the proportion of small action details remembered or the accuracy of order recollection. There was also no statistically significant difference in recognition accuracy or reaction time. There was a statistically significant difference for the order memory task such that those in the non-segmenting condition had better performance. This suggests that the explicit segmentation task could have impaired event memory. However, this finding was not strongly significant and, given the number of analyses performed yielding null results, is unlikely to be informative. These findings suggest that while event segmentation of everyday events is an important automatic task for
later memory, simply drawing attention to the boundaries people naturally identify may be insufficient in improving memory. Future studies will focus on aiming to improve memory performance by drawing attention to normative event boundaries.

**HOPE AND WORRY AS RELATED TO SUBJECTIVE AND OBJECTIVE SENSORY LOSS**

Aviya Lanis  
Mentor: Mitchell Sommers

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.

**PERCUTANEOUS OSSEOINTEGRATED IMPLANT SURGERY WITHOUT SKIN THINNING IN CHILDREN: A RETROSPECTIVE CASE REVIEW**

Aviya Lanis  
Mentor: Malou Hultcrantz, Karolinska Institutet

Research has demonstrated a significant benefit of using a novel approach for adult implantation of bone-anchored hearing aids without skin thinning. In order to determine if the omission of skin thinning in percutaneous osseointegrated implant surgery can also be beneficial for children, two groups of children who underwent surgery with and without skin thinning were compared. Altogether, 34 children who had undergone implantation from 2001 to 2012 were included in this single-center, retrospective case review. The two groups were divided according to whether or not skin thinning was used. Percutaneous osseointegrated implantation was performed in one- or two-step surgeries on all patients under general anesthesia. 23 patients were operated with traditional skin thinning and with a 5.5-mm long abutment, while 11 patients were operated without skin thinning and with a 6-, 8.5-, or 9-mm long abutment. Primary points of interest were clinical signs and symptoms of inflammation or infection at the site of skin penetration, the time required for surgery, healing time, and any additional complications experienced by the patients. The group of children who underwent surgery without thinning experienced fewer complications, shorter time for surgery, minimized healing time, no numbness, and improved cosmetic appeal in comparison with the group that underwent the traditional skin thinning procedure. This study shows that the percutaneous osseointegrated implantation technique without skin thinning that has recently been implemented in adults is also beneficial for children.

**RADIO FREQUENCY DIRECTION OF ARRIVAL DETERMINATION**

Daniel Lazar  
Mentor: Arye Nehorai

This project is focused on implementing different algorithms to ascertain the direction of arrival of transmitted radio frequency signals on an array of receivers. The various algorithms are compared against a simple Fast Fourier Transform estimation of the direction of arrival. The MuSIC (multiple signal classification) algorithm is used, as well as a variant, smooth-MuSIC, which mitigates the effects of multipath interference. Beamforming techniques, which combine temporal and spatial filtering, are also used to find the direction of arrival. Implementing beamforming minimizes the transmission power needed to send a signal. Further work building on this research can be used to implement directional transmission and receiving with beamforming, which yields many advantages including minimized signal interception. The results from this research can be used to choose a direction of arrival algorithm depending on the specific circumstances, or make adaptive arrays of receivers that mitigate the effects of noise or interfering signals, as well as address universal communications issues on a cost-effective platform.
INSURGENCY UNENDING:
THE EVOLUTION OF THE AFGHAN TALIBAN IN 1994-2013 AND BEYOND
Matthew Lee
Mentor: Robert Canfield
The Afghan Taliban, since the group’s formation in 1994, has 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 remains mysterious and understudied. The aim of this work 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. I examined 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. I discovered 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 work 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 these findings 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.

THE EFFECT OF SYMBOLIC INFORMATION ON DELAY DISCOUNTING
IN HUMANS USING REAL LIQUID REWARDS
Sangil Lee
Mentor: Leonard Green
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.

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 know as chronic traumatic encephalopathy (CTE). CTE is characterized by extensive tau. 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 hyper-phosphorylation, to see if the cause of disease can be linked to gene expression. We subjected htau mice, which contain all elements of the human tau transgene, to a repetitive concussive traumatic brain injury (rcTBI) model. Using qPCR, RT-PCR, 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.
Jefferson Li
See Adam Adenwala

Miserable and Sub-Human: Tuberculosis as an Indicator of Social Injustice in the Brazilian Favela Vila Velha
Joanne Li
Mentors: Shanti Parikh and Bradley Stoner

This work 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 fieldwork conducted with community health agents based in Vila Velha. By using João Biehl’s critique, I argue that 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. By using quotes and observations, I demonstrate how Vila Velha is a forgotten community with a socially neglected population. The work examines community-based interventions that work to provide social services to these disregarded areas, particularly the motivations of social workers and their impact. I argue that despite the commendable dedication to helping those in greatest need, the community needs greater assistance in order to significantly improve its social conditions. This work’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, that will continue to persist if attention is not brought to the millions of Brazilians that live in social abandonment.

On-Road Driving Performance in Patients with Moderate and Advanced Glaucoma
Hannah Lin
Mentor: Anjali Bhorade

Glaucoma is an age-related ocular disease that damages peripheral vision. The purpose of this study is to determine the extent that glaucoma affects driving performance and evaluate factors associated with unsafe driving. Using 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 elder patients with moderate to advanced glaucoma, and age-matched subjects with no ocular disease. Through visual, cognitive and motor tests, participants were clinically assessed for off-road functioning related to driving. The main outcome variables for driving ability was a score of pass, marginal pass, or fail on the 12-mile modified Road Test 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.

Older drivers with moderate or advanced glaucoma performed worse 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.

Does a Difference in Religiousness Between Spouses Correlate with Decreased Marital Satisfaction?
Kevin Lin
Mentors: Joshua Jackson and Sara Weston

Although religiousness has been assumed to affect marriage outcomes, there has been less focus on differences between spouses. In the Kelly Longitudinal Survey (N= 600), each spouse reported their perceived difference in religiousness with their spouse and participated in personality tests measuring their religiousness. Each spouse reported on whether he or she regretted the marriage, whether the
couple had considered separation or divorce, feelings of love, and overall happiness of the marriage. Couples’ perception of a difference in religiosity was generally correlated with less marital satisfaction (correlations range from -0.198 to 0.363), although there was less correlation with the husband’s responses. Actual difference in religiousness generally did not correlate with decreased marital satisfaction.

“NICE GUYS FINISH LAST”:
AN INSIDER LOOK AT THE DAILY SHOW WITH JON STEWART
Julia Lindon
Mentor: Heidi Kolk

This project focuses on an original comedic video, “Nice Guys Finish Last,” which was produced in the same style of The Daily Show with Jon Stewart. The video incorporates comedic interviews with Washington University students, faculty, and alumni to discuss the negative aspects of Wash U’s overly friendly, supportive, and social atmosphere.

The piece compares two news stories from the summer of 2011, The Huffington Post’s ranking of Wash U as the #2 Friendliest College in America, and a Cornell psychology study titled, “Do Nice Guys—and Gals—Really Finish Last?: The Joint Effects of Sex and Agreeableness on Income.” The mainstream media took the results of this study to claim that “mean people” do better in business and are generally more successful in life. The fake news correspondents in the video make the claim that being too nice will ultimately make the Wash U graduates less successful in their future lives and careers.

Methods used to conduct the research include one-on-one interviews and a careful analysis of the literature on the significance of The Daily Show with Jon Stewart.


In addition, elements of comedy, culture, humor, audience understanding, and journalism are explored. Along with breaking down the intricacies of video production, the project provides a unique voice to the discussion of what we consider to be substantial news in our culture.

Connor Liu
See Adam Adenwala

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.

TUMOR NECROSIS FACTOR AS PROTECTION AGAINST CXCL10-INDUCED APOPTOSIS IN OLIGODENDROCYTE PRECURSOR CELLS
Laindy Liu
Mentor: Robyn Klein

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.

**THE EFFECT OF STORAGE TIME ON ANTI-OXIDANT CAPACITY OF RBCS**

Max Mian Liu  
Mentor: Allan Doctor

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 (an 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.

Joshua Lo  
See Adam Adenwala

**Q/R SITE INTERACTIONS WITH THE M3 HELIX IN GLUK2 KAINATE RECEPTOR CHANNELS**

Melany N. López  
Mentor: James E. Huettner

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.

**EMBODYING EMPIRE:**

**CONSTRUCTING AMERICAN IMPERIAL IDENTITY IN DIME NOVELS AND CONGRESSIONAL DEBATES, 1865-1901**

Kelly Loughead  
Mentor: Iver Bernstein

The United States experienced vast social, political, and economic changes after the Civil War. This work 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 work 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. However, Eagleton is best known for an infamous bid for the Vice-Presidency for 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 work.

This research 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.

**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 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.

**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.

**GATA1: AN IMPORTANT GENETIC FACTOR IN THE LINK BETWEEN STRESS AND DEPRESSION**

*Seth Margolis*

*Mentor: Ryan Bogdan*

Stress, particularly when occurring early in life, is amongst the strongest predictors of depression. A wealth of non-human animal research suggests that stress might disrupt synaptic plasticity as well as brain structure and function. A recent study in rodents has shown that chronic stress is associated with increased GATA1 expression. Because GATA1 is a transcription factor that suppresses the expression of synaptic-function-related genes, this stress-induced increase in GATA1 expression is one potential etiologic mechanism underlying the depressogenic effects of stress. In this study we examined whether genetic variation in GATA1 moderates the effects of childhood adversity on amygdala habituation, a neural phenotype linked to reduced stress reactivity. For the present study, genetic and neuroimaging data were available from 322 participants who completed the Duke Neurogenetics Study, an ongoing protocol assessing a wide range of behavioral and biological phenotypes among young adult volunteers. We selected the only GATA1 SNP on our genome-wide array, rs5906709, to examine its association with amygdala habituation, in the context of childhood adversity. To measure amygdala habituation, participants completed a canonical threat-related fMRI task. Amygdala habituation was defined as a decrease in activation over time with repeated presentation of threat-related stimuli GATA1 genotype interacted with childhood adversity to predict amygdala habituation in the left dorsal and ventral amygdala (p<0.003). In the right amygdala, this interaction predicted habituation at a trending level (p=0.07). Post-hoc testing showed that minor allele carriers had reduced left amygdala habituation in the context of elevated childhood adversity (p=0.01), while there was no relationship in major allele homozygotes. Because increased amygdala habituation has been linked to more adaptive responses to stressors, these data suggest that minor allele carriers at rs5906709, may be more susceptible to stress-related psychopathology, including mood and anxiety disorders.

**WAR ON DRUGS: A STUDY OF THE ECONOMIC EFFECTS OF DRUG VIOLENCE AND PROBLEMS FACING MEXICO**

*Nathan Mariano*

*Mentor: Guillermo Rosas*

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 objective is 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 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 more 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.

**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.

**HOLY HISTORY! HISTORIOGRAPHY, HERESY, AND THE MARVELOUS IN GERVASE OF TILBURY’S OTIA IMPERIALIA**

Marshall Mayer  
Mentor: Mark Pegg

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 work 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.

**BRAVE NEW PHARMACEUTICALS: THE ECONOMIC ADVANTAGE OF GENOMICS**

Joseph McDonald  
Mentor: Sandra Matteucci

Given a certain, diagnosable and treatable condition, out of a range of possible drugs that are used for treatment, ideally, one specific drug will be the most effective, with the fewest side effects, and the best value. When looking at business in general, a successful one provides the right amount of incentives, to the right people, at the right time. The implementation of electronic records with the rapidly decreasing price of human genome mapping has the ability to align incentives in all healthcare spheres to decrease the cost of healthcare by quantifying the effectiveness of different pharmaceuticals.

Since the human genome project, researchers have been developing faster and cheaper methods for sequencing the human genome. A complete human genome allows for identification of specific, genetic mutations. Therefore, given the knowledge of the consequences of these genetic mutations in conjunction with access to paired environmental factors (age, sex, weight, previous medical history, etc.) and efficacy of certain pharmaceuticals (i.e. range of outcomes, side effects, etc.), a computer algorithm should be able to rank the effectiveness of a range of different drugs for a treatable condition. This efficiency ranking, when combined with the price of these drugs, will give doctors a new toolbox to use when prescribing pharmaceuticals to their patients.

In conclusion, the idea of implementing effective preventable medicine has long been regarded as one of the most promising ways to reduce the cost of healthcare. Healthcare insurance companies will be incentivized to cover human genome sequencing as soon as the value of using the better preventable medicine outweighs the upfront cost of sequencing. As the genetic library of information grows, this algorithm will become more accurate and therefore more effective.

Samuel McKinney  
See Adam Adenwala
THE CLINICAL AND BEHAVIORAL CHARACTERISTICS OF BIPOLAR TRANSPLANT CANDIDATES:
A CASE SERIES
Allie Michels
Mentor: Barry Hong

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.

CONFINING THE COSMOS STATE SOVEREIGNTY IN NEAR SPACE
Daniel Michon
Mentor: Michael Peil

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 work, 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 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.

Ryan Mikkelsen
See Alex Bluestone

THE ROLES OF JNK 1-3 AND MKK4 IN A DLK-MEDIATED AXON DEGENERATION PATHWAY
Derek Miller
Mentor: 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. However, the details of which MAP2Ks and which subsequent JNK isoforms are activated downstream of DLK 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 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.

**THE RELATIONSHIP BETWEEN ELECTRIFICATION THROUGH Luz Para Todos and Rural Development in Bahia, Brazil**

Karen Mok  
Mentor: Guillermo Rosas

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 study assessed whether 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.

Ashley Muehler  
See Adam Adenwala

**NEW SOCIAL PROTEST AND SOCIAL MEDIA: EXAMINING “KONY 2012”**

Christopher Munley  
Mentor: Doreen Salli

As technology has progressed, so too has the method of protesting. I focus specifically on the viral video “Kony 2012” to illustrate how a movement can evolve from a typical protest to a “new social movement.” Looking at Malcolm Gladwell’s essay, “Small Change: Why the Revolution Will Not be Tweeted,” I explore how Invisible Children, the organization behind “Kony 2012”, functioned as a traditional social movement, but how “Kony 2012” departed from Invisible Children and became a movement in its own right. The new movement that “Kony 2012” created can be described by the theory of “cyberplace,” as explained in David Meek’s essay, “YouTube and Social Movements: A Phenomenological Analysis of Participation, Events and Cyberplace.” These movements have different goals from traditional social protest and can function without central leadership but cannot be relied on to transfer support to any traditional movement.

I conducted this research by examining both primary sources such as the “Kony 2012” video and reactions to the movement in the media, as well as secondary scholarly essays about social protest and specifically “Kony 2012”. This research is important for any organization that wants to augment a protest movement with social media. It is important to realize that once social movements go viral like “Kony 2012”, they cannot effectively be used for the goals of a traditional movement like Invisible Children Inc. but instead must be used for fundraising and raising awareness, two areas in which “new social movements” succeed.

**ESTIMATING MECHANICAL PROPERTIES OF THE HUMAN BRAIN USING MAGNETIC RESONANCE ELASTOGRAPHY**

Jordan Nick  
Mentors: Philip Bayley and Ruth Okamoto

Traumatic brain injury (TBI) is associated with linear and angular acceleration of the skull, however the process by which mechanical loads on the skull lead to neurological injury is still poorly understood. Computer models of head accelerations may be used to predict injury, but these models require accurate descriptions of the mechanical behavior of brain tissues (gray matter and white matter). The goal of this study is to characterize brain deformation and brain tissue mechanical properties in vivo using non-invasive magnetic resonance imaging (MRI) techniques. A paddle-shaped diaphragm attached to the skull of a healthy volunteer transmits low amplitude pressure waves though the skull at 45 Hz. Magnetic resonance elastography (MRE), an MRI technique, provides images of the periodic motion of a portion of the brain due to the skull vibration. This MRE data is processed to estimate local brain deformation and mechanical
properties of brain tissues. High-resolution images of the brain anatomy are combined with diffusion tensor imaging (another MRI technique) to map white matter structures within the brain. Local mechanical property maps can be compared with white matter structure maps to separately identify mechanical properties of gray matter and white matter. These properties help to develop a further understanding of how the brain functions as a mechanical body, thus improving our understanding of TBI.

**Viral Protein X from HIV-2 Is Degraded in the Presence of Cyclin L2 in HEK293T Mammalian Cells**

Austin Niu  
Mentor: Lee Ratner

Two notable strains of the HIV virus are HIV-1 and HIV-2. HIV-1 is responsible for the current epidemic, while cases of HIV-2 are significantly easier to treat. However, these two strains are identical except for one small protein. This small protein, which is called Vpx (viral protein x), is present only in HIV-2 and is a homolog of another small protein present in both strains, Vpr (viral protein r). A screen previously done in the lab pulled down a number of proteins that interacted with Vpx and Vpr, and one protein tested was Cyclin L2. When co-transfected with Vpx, it is evident from the resulting Western blot that increased amounts of Cyclin L2 resulted in the degradation of Vpx. The pathway by which this occurs was elucidated utilizing mgm130 to essentially “rescue” the production of Vpx from degradation by Cyclin L2 by deactivating the proteosome pathway. The Western blot confirmed that Vpx production was in fact rescued, and that the proteosome pathway is the pathway by which Cyclin L2 degrades Vpx. This entire experiment will be repeated utilizing the Vpr plasmid in the co-transfections. If Vpr is not degraded by Cyclin L2, an important distinguishing interaction will be discovered to exist between the two protein analogues, and by extension, the two strains of HIV.

Patrick Nugent  
See Chris Brenner

**The Separate Worlds of Physician and Patient in the Clinical Encounter**

Eunhye Oak  
Mentor: Stephen S. Lefrak

Doctors and patients converse using terms such as “disease” and “illness” that presuppose a common meaning understood by the other. However, a doctor’s conception of disease as a categorized entity and target of treatment is entirely different from a patient’s lived experience of bodily disruption. For example, a doctor recognizes multiple sclerosis as the “disease” in which nerves of the brain and spinal cord lose their protective covering and become damaged. For a patient, multiple sclerosis is lived every day as he loses muscle control and adapts to life in a wheelchair. A doctor diagnoses disease to categorize symptoms while patients seek explanation and relief for their discomfort. From a “philosophy of medicine” perspective, I examine the predominant beliefs in medical thought that separate the physician’s and patient’s worlds.

This is a creative nonfiction writing project in progress that is intended for a general audience. Drawing upon research in philosophy and history as well as my own observations and interviews, I analyze the clinical encounter between physician and patient with the following questions: How are the physician’s and patient’s worlds separate? What philosophical beliefs perpetuate this difference? How does a doctor’s clinical judgment bridge communication? By revealing and explaining such overlooked gaps, I hope to make readers aware of the words and concepts taken for granted in medicine, and by making explicit what currently is, I argue that these assumptions influence the practice of medicine and therefore merit deeper reflection.

**Rainbow Street: Heritage, Cosmopolitanism, and Urban Space in Amman, Jordan**

Jessica Page  
Mentors: Lois Beck and Robert Canfield

In this work 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 socioeconomic 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 many diverse peoples. 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.

PROBLEMATIZING FOREIGN WOMEN’S HEALTH AID PROGRAMS: THE HISTORY OF UNITED STATES HEALTH AID TO LATIN AMERICA AND ITS CURRENT IMPACT IN GUATEMALA
Justine Parisi
Mentor: Peter Benson

In this work 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 describe 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 U.S.-sponsored maternal health programs in the department of Sololá, Guatemala. I 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 and 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.

IDENTIFYING A DOMINANT SUPPRESSOR OF TRA-2(q122) IN CAENORHABDITIS ELEGANS
Gary Parizher
Mentor: Tim Schedl

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 germline.

ELECTRONIC EFFECTS IN MONONUCLEAR Pd(III) COMPLEXES
Sungho Park
Mentor: Liviu M. Mirica

Pd coupling reactions are among the most widely used chemical transformations in the synthesis of pharmaceuticals and bioactive compounds. Development of novel Pd catalysts can lead to new and more economical methodologies for obtaining a wide range of
complex organic molecules with biomedical applications. We recently reported unprecedented mononuclear organometallic Pd\textsuperscript{III} complexes with a tetradentate ligand $N,N'$-di-terr-butyl-$2,11$-diaza[3,3](2,6)pyridinophane (tBuN\textsubscript{4}). With a smaller N-substituent, MeN\textsubscript{4} was found to support high-valent Pd\textsuperscript{III} and Pd\textsuperscript{IV} complexes that have recently been proposed as important intermediates for a variety of Pd-mediated catalytic reactions. A further modified version of the tBuN\textsubscript{4} ligand has been synthesized by attaching a methoxy group at the 4-carbon positions of the two pyridine ring regions. Pd\textsuperscript{III} complexes were prepared with this new ligand (MeN\textsubscript{4}OM\textsubscript{e}) in order to investigate the electronic effects in these Pd\textsuperscript{III} complexes.

**ERK-mediated Regulation of Amyloid-Beta Production in a Mouse Model of Alzheimer’s Disease**

Pamela Peters  
Mentor: John Cirrito

Amyloid-beta (A\textsubscript{B}) plaques are a hallmark of Alzheimer’s disease (AD) pathology. A\textsubscript{B} plaques form when the typically soluble A\textsubscript{B} peptide reaches a critically high concentration, causing it to form toxic aggregates. A\textsubscript{B} is generated when the enzymes $\beta$-secretase and $\gamma$-secretase cleave the amyloid precursor protein (APP). When APP is cleaved instead by $\alpha$-secretase instead of $\beta$-secretase, no A\textsubscript{B} is produced.

Synaptic activity is a key regulator of A\textsubscript{B} levels in the brain extracellular fluid. When neurons depolarize and there is high synaptic activity, A\textsubscript{B} 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 A\textsubscript{B} levels by activation of an extracellular-regulated kinase (ERK) mediated pathway, which favors the $\alpha$-secretase cleavage of APP.

Our goal is to understand how ERK regulates A\textsubscript{B} 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 $\alpha$-secretase activity and did not change $\beta$-secretase activity, although we were not able to replicate a significant decrease in $\alpha$-secretase activity. Nonetheless, changes in $\alpha$-secretase activity and A\textsubscript{B} 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), $\alpha$-secretases (ADAM\textsubscript{10}, ADAM\textsubscript{17}), $\beta$-secretase (BACE1), and key components of the $\gamma$-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 A\textsubscript{B} levels.

**THE ROLE OF EMOTIONS IN POLITICAL ATTITUDES:**

**DO NEGATIVE FEELINGS TOWARD THE OPPONENT PREDICT SUPPORT FOR THE FAVORDED 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.

**MICE USE STEREO OLFACTORY DETECTION TO PROCESS DIRECTIONAL ODOR CUES**

Matt Pieters  
Mentor: Timothy 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 SEA: 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. *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 Sea 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.

Mark Posnick
See Adam Adenwala

Zhijie Qi
See Jeff Bonin

**LEARNING APPROACHES IN GENERAL CHEMISTRY**

Michael Rauch
Mentors: Mark McDaniel, Kit Mao, and Regina Frey

To best provide chemistry education, it is essential to understand how students acquire and represent scientific concepts. Laboratory research in cognitive psychology has demonstrated that stable individual differences exist in the way that learners approach concept-learning. There are two distinct student-learning approaches: rote learners (apply algorithms or memorization) and conceptual learners (extract underlying concepts). These learning approaches can be identified with a function-learning task, independent of any discipline (e.g., chemistry) knowledge. We propose that these differences in learning approach impact students' success in their first college science courses; specifically, we posit that rote-based learners struggle in introductory STEM courses. Most standard student measures focus on student preparation and knowledge, which excludes the underlying issue of their learning approaches.

In order to determine the impact of these learning approaches in real-world settings, a pilot study in 2009 at Washington University in St. Louis examined the relationship between function learning performance and general chemistry performance. Results showed that the course grades of conceptual learners were significantly higher than those of the rote learners, demonstrating that the function-learning task could be a useful tool for identifying students who are more likely to struggle in this course.

The objectives of the current study are to validate that differences in learning approaches exist across student populations and that these learning approaches lead to different performances in general chemistry. The students in the study are in general chemistry at
Washington University and six partner institutions varying in location, size, selectivity and other characteristics. Despite the variety of institutions, preliminary results reveal an advantage of conceptual learners that is remarkably consistent across institutions. In the future, curricular changes could be implemented based on these learner classifications to achieve greater success and retention in the field.

**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: i) Neurons that respond with an increase in firing rate during saccades in any direction; ii) Neurons that respond with a decrease in firing rate during saccades in any direction; iii) 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; iv) 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.

**Executive Abilities in Children from Families with Inter-partner Violence**

Brian Richter  
Mentor: Desiree White

In this 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.

**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 study, 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
The central research questions I 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?

Alan Sariol
See Khushdeep Vig

TWIN STUDIES: THE IMPACT OF DEVELOPMENTAL PROGRAMMING
Allison Schelble
Mentor: Elizabeth Quinn

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.

Morgan Schoer
See Adam Adenwala

SMALL FARMS:
CAN THEY FEED THE WORLD?
Emma K. Searson
Mentor: Mike Bezemek

The path taken by agriculture in the next century will establish food security for future generations, and responsible food production must keep the well-being of those generations in mind. The current debate on sustainable agriculture is polarized, with a sharp divide between those who support further industrialization and those who support independent, small-scale production. This work examines the potential productivity of modern industrial farming as well as that of small-scale farming against existing agricultural research and case examples. It determines that small-scale, polycultural farms that implement diversified, ecological systems are both capable of and necessary to sustainably provide for the growing global population, given the limited life expectancy of conventional agricultural systems. Three works of popular literature as well as seven scholarly articles were analyzed in order to reach this conclusion. Implications include that agricultural policy, market systems, and development must favor the growth of small farms in the near future in order to enable agroecological practices to take hold and global production to attain maximum potential.

SURVIVING ON MY OWN:
DOES OSTRACISM INFLUENCE ATTENTION TO FITNESS-RELEVANT STIMULI?
Angela L. Senne
Mentor: Randy Larsen

Previous research by DeWall et al 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.

LINGUISTIC IDEOLOGY IN MOROCCO:
AN EXPLORATION INTO THE COMPLEXITIES OF A MULTILINGUAL SOCIETY
Simone Sept
Mentor: John Bowen

In this work, 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 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.

GOING EAST:
THE EVOLUTION OF THE MEDIEVAL TRAVEL ACCOUNT, 1253-1356
Jeff 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.

Jeffrey Shuman
See Adam Adenwala
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, Catalanian culture confronted issues of cultural identity, especially where culture intersected with politics. This study 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 their 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.

PARTICIPATORY HEALTH EDUCATION:
AN ETHNOGRAPHY OF THE MALARIA AWARENESS PROGRAM IN HAMAKUYA, SOUTH AFRICA
Molly Simon
Mentor: Carolyn Sargent

Malaria is a critical health concern of HaMakuya, a remote region in Northern 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. I created The Malaria Awareness Program (MAP) 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.

Sukrit Singh
See Adam Adenwala

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 questions 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 (1973-1990). 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.
THE INIQUITY OF INEQUITY: A COMPARATIVE ANALYSIS OF CHERNOBYL AND FUKUSHIMA
Pooja Sohoni
Mentors: Peter Benson and Bradley Stoner

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 study, I 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 investigate Fukushima and Chernobyl both from the perspective of the individual as well as how this relates to group suffering. Ultimately, I 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 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.

(A)SEXUALITY AND PATHOLOGY: HISTORICAL WRITINGS ON ASEXUALITY
Josh Soller
Mentor: Amy Cislo

Sexuality studies scholars have established a clear history of homosexuality and transsexuality, highlighting that modern ideas of sexuality did not even exist until relatively recently—the word “homosexual” was not invented until 1868, and understanding of the varied relationships between sexual desire, gender, and biological sex did not come until much later. What much of this research has overlooked is how asexual people, or people who do not experience sexual desire for anyone, fit into LGBT history. My research was complicated by the fact that the term “asexual” was not in common use until 2001. Instead, sexologists who were writing at the end of the 19th century and beginning of the 20th used a variety of different terms, including “frigid,” “impotent,” and “sexual anaesthesia (sic).” However, both frigid and impotent have other meanings that are related to getting pleasure from sex independent of desire, sexual performance, and fertility, which makes it very difficult to distinguish which cases that were documented were asexuality and which were other conditions. Sexual anaesthesia had a meaning very close to today’s asexuality, but it was not commonly used. Notably, sexologist Richard von Kraft-Ebbing included eight out of 238 case studies on sexual anaesthesia in his book Psychopathis Sexualis, but I was unable to find it thoroughly discussed anywhere else. Ultimately, I found that though there has been minimal acknowledgment of asexuality since near the beginning of scientific study of sexuality started, historic ambiguity of terms and frequent misdiagnosis of asexual people make it very difficult to pin down a precise history.

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.

ANALYSIS OF RECOVERY IN A POST-STROKE POPULATION
Charlotte Srnka
Mentor: Catherine Lang

This study from the Brain Recovery Core Project 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 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. 102 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.

**Health in the United States:**
**Examining Social Determinants of Health and the Doctor Patient Relationship**
Alissa Stavig
Mentors: Robert Canfield and Bradley Stoner

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.

Lauren Steimle
See Daniel Golberg

**From Social Reform to Urban Modernism:**
**The Collapse of Pruitt-Igoe and Failure of Public Housing in the Twentieth Century**
Alyssa Stein
Mentor: Margaret Garb

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 work 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.
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 work, 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 by Marinetti.

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.

**AN EVOLUTIONARY TRADE-OFF BETWEEN VISION AND ELECTROSENSATION IN WEAKLY ELECTRIC FISH**

Jennifer Stevens  
Mentor: Bruce Carlson

Mormyrid fish use electricity to communicate, and they process electric signals in the exterolateral nucleus (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 use temporal aspects of electric signals for species recognition, but the mechanism enabling species recognition in EL fish is unknown.

I hypothesized that EL species rely more on vision for communication and thus have a larger visual system, better visual acuity, and higher contrast sensitivity as compared to ELa/ELp mormyrids. I surveyed species descriptions in the literature and found that EL species have larger eyes than ELa/ELp species. I also measured the volume of the optic tectum (OT), a major visual region of the midbrain. EL fish have a larger OT than ELa/ELp mormyrids. To test visual acuity and then contrast sensitivity, I rotated stripes of varying width, then varying contrast, around a fish, at a constant speed and for a set time. I measured the total distance swum by the fish as a response measure. Although all species tested showed similar contrast sensitivity, EL species responded more to smaller stripes. These data support the hypotheses that EL mormyrids have an enlarged visual system and better acuity as compared to ELa/ELp fish.

Upon testing close outgroups, I found that the ancestral state for mormyrids is likely smaller eyes and lower visual acuity. A trade-off thus occurred early in mormyrid evolution, when different lineages specialized in different sensory modalities. This trade-off implies that multiple sensory systems can aid in communication, but a species generally cannot specialize in all of them, a universal concept that can help explain phenomena from bats’ auditory specialization to improved hearing in blind humans.

**SOUTHEAST ASIAN TEXTILES: TRADITION, FORMATION AND MODERNIZATION**

Chantal Strasburger  
Mentor: Robin VerHage-Abrams

In the summer of 2012, ikat, a pattern named after its dyeing technique, was one of the most popular trends in fashion. However, while it became ubiquitous in every fashion house in the U.S., there is a much more intricate and meaningful story behind the Southeast Asian textile. I researched textile manufacturing, design and costs in Cambodia, Vietnam, Laos, Myanmar and Thailand to understand if and how markets are manipulating traditional textiles to appeal to modern consumers and what cultural, geological and sociological differences effect and influence their production and design.

I explored how textiles are made, beginning to end, in each area and the history and influences behind the differing designs. I compared the different techniques and traditions behind the textile and learned from and interacted with a large array of individuals in the textile industry, including an 80 year-old weaver in Vietnam, local Master Weavers who taught me to weave on a traditional loom in Myanmar as well as a young entrepreneur who is modernizing Asian textiles for the Western market. I discovered that the differences in each country’s traditional textiles come down to what materials are available to them, the social interactions they encounter, and the religious beliefs in which they hold. This can be seen in everything from the Naga motif of Laos to the specialized Lotus silk of Inle Lake,
Myanmar. This research was incredibly important to me, because when you learn the stories behind a textile, it not only adds layers of meaning to the fabric itself, but can also teach you invaluable information about a culture's values and beliefs.

**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 work argues that the aegyo speech style is objectively recognizable because it is marked by a set of linguistic features. 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 work 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 work 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.

**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 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. The indigenous craft industry, although it has the potential to exacerbate this imbalance of power, 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.

**Role for Chemokine-Mediated Immune Cell Trafficking in Cervicovaginal HIV Dissemination**
Tony Sun
Mentor: Andrew D. Luster. Harvard University

More than 80% of adults living with HIV-1 acquired the infection through sexual exposure of mucosal barriers to the virus. Of interest, studies in rhesus macaques using SIV revealed vulnerabilities of founder virus populations at the mucosal barrier during the earliest stages of infection. This novel paradigm has led to new approaches in vaccine-oriented research, bolstered by developments in humanized mouse models of HIV-1 infection. Notably, the recent renaissance in humanized mouse research has allowed investigators to study pathogenesis of a strictly human pathogen using *in vivo* animal models. The current study aims to address this question in the cervico-
vaginal infection model, which recapitulates sexual transmission of HIV-1 through mucosal barriers. Using immunohistochemistry, we observed that CD4 T cells were activated and recruited to the cervix area following HIV-1 challenge. Recruitment of immune cells led to increasing viral RNA loads in genital tract tissue as assayed by RT-PCR, suggesting a local expansion of HIV-1 in infected CD4 T cells. The initial recruitment of CD4 T cells was correlated with transcriptional upregulation of two gamma-interferon induced chemokines, IP-10 and MIG, which have been implicated to mediate lymphocyte trafficking to tissue sites of infection. In the draining iliac lymph node, CCL19 and its receptor, CCR7, were upregulated, suggesting the presence of a chemokine gradient that attracts CD4+CCR7+ T cells, including infected T cells, to the draining lymph node and back into lymphatic circulation. To test the hypothesis that circulation of infected T cells mediates HIV-1 dissemination within the host, we administered a sphingosine-1-phosphate receptor antagonist, FTY720, to block immune cells from exiting lymph nodes. Notably, a reduction in serum levels of HIV-1 RNA was observed following treatment with FTY720 within 2 days post-infection, suggesting the presence of an opportune time period for countering systemic infection.

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 post-natal 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.

Mll1flox mice were bred to Crx-Cre mice to conditionally knock out (CKO) Mll1 in developing photoreceptors. Additionally, Mll1floxs 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 were analyzed using immunohistochemistry (IHC).

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 detected 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.

Sarah Swiezy
See Abena Apaw

BUILDING AFRICA:
DECONSTRUCTING A CHINESE CONSTRUCTION FIRM IN KENYA
Lucas Tcheyan
Mentor: Nathan Jensen

In recent years Chinese economic interests in Africa have expanded into a worldwide topic of debate and discussion. In Kenya, Chinese construction companies have begun to dominate the construction market. Chinese construction firms see Kenya and other African countries as a means to develop their own construction force and profit. This study investigates the difficulties that Chinese construction firms face as they try to enter the Kenyan market, addressing the advantages and disadvantages that come with the arrival of Chinese construction firms and concludes that despite the numerous difficulties they face, Chinese firms have a positive influence on Kenya's development.

In order to gather data I use an ethnographic method, focusing primarily on one Chinese construction firm working in Kenya, Chinese Overseas Engineering Ltd. (COVEC). I interviewed Chinese and Kenyan employees of COVEC in addition to other local Kenyan businessman and civilians. Chinese construction brings a cheaper and more efficient construction force to Kenya, improving Kenya's infrastructure and development despite having a limited impact on employment and firms importing most materials used in projects. In addition, due to the large number of Chinese construction firms in Kenya, Chinese companies face enormous competition, decreasing both profits and projects.

China's importance in the economic development of Africa has increased tremendously over the last decade, but much is still to be learned about China's operations and involvement on the continent. As African countries such as Kenya continue to develop, companies
such as COVEC will play a very important role helping to build more reliable and advanced infrastructure. My own observations, interviews, and data collection contribute towards greater understanding of how China's economic integration in Africa is taking hold.

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.

BLOGGING BOURGEOISIE:
USING THE STATE TO IMPROVE THE ONLINE PUBLIC SPHERE
Alexander Tolkin
Mentor: Clarissa Hayward

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.

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 Biocological 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.
A TWO-PASS ALGORITHM FOR CONSTRAINING LORENTZ VIOLATIONS
Adam Trebach
Mentor: James H. Buckley

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.

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. 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 to previous studies on the effects of MPP+ on mitochondria. 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. 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.

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.

105 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.
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.

The endosomal sorting complex required for transport (ESCRT) pathway is a major player in multivesicular body (MVB) biogenesis, which deliver cargo to the vacuoles or lysosomes for degradation. The organism used in this study, *Tetrahymena thermophila*, is a eukaryotic organism that forms a distinct conjugation junction during mating cell pairing. The goal of this study was to explore the role of ESCRT complex proteins in the formation of the conjugation junction by investigating the localization of three proteins with homology to known ESCRT proteins: the ESCRT-I protein TSG1 and ESCRT-III related proteins VPS24 and VPS4. In order to study these genes of interest, the genes were fused with fluorescent protein tags and transformed into *Tetrahymena*. Localization was visualized by inducing the expression of the fluorescent protein fusions.

During vegetative growth, it was found that the TSG1 protein localized to the cytoplasm in some cells and to the macronucleus in others. During conjugation, TSG1 protein localized to the conjugation junction, the macronucleus and the basal bodies. The VPS24 homolog localized preferentially to the vesicular bodies in the cytoplasm. The VPS4 homolog localized throughout the cell during growth, seen around the basal bodies, in the cytoplasm, and on vesicles.

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.

Candace Ward
See Adam Adenwala

LRRC6 AND CCDC65 ARE NOVEL REGULATORS OF MOTILE CILIA ASSEMBLY
MUTATED IN HUMAN AIRWAY DISEASE
Mollie Wasserman
Mentor: Steven Brody

Cilia are organelles with roles in host defense, cell sensing and signaling. 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 pathophysiological mechanisms has taught us more about proper cilia assembly. Our PCD study group has identified two novel genes, LRRC6 and 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 LRRC6 and CCDC65 in normal human airway epithelial cells. Mutation in LRRC6 was associated with ciliary dynein arm defects and immotile cilia. In contrast, mutation in 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. 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, CCDC65 silencing resulted in cilia that were hyperkinetic. Interestingly, our data showed a decrease in CCDC65 expression in 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.

IDENTIFYING PROTEINS IMPORTANT FOR FORMATION AND FUNCTION OF ACTIN STRUCTURES IN DIFFERENTIATED CELLS:
A GENETIC AND WHOLE GENOME SEQUENCING APPROACH
Bryan Webb
Mentor: Kathryn Miller

Actin is an important protein that assembles and disassembles to form many of the cytoskeletal structures. The mechanisms by which actin structures maintain their long-term stability and reorganization capabilities remain ambiguous. To understand processes that require the complex actin formations, spermatid individualization in Drosophila was used as a model. 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. To 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. Candidate genes were identified using whole genome sequencing. 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. We use RNAi expression 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 the building and maintenance of 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.
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 work 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.

MEDICINAL CHEMISTRY:
TARGETING EPIGENETIC CONTROLS FOR HIV ERADICATION AND ANTIMALARIALS
Richard Brewster Wikersham III
Mentor: Garland Marshall

Epigenetics, the study of phenotypic changes in an organism due to factors other than the genetic code, has been identified as a powerful therapeutic avenue in the fight against many diseases. Histone deacetylase (HDAC), one of the enzymes integral in the regulation of gene expression, has been determined as a likely target in a number of different medical challenges, especially HIV eradication and targeting plasmodium falciparum, the parasite which causes malaria. Thus, the creation of HDAC inhibitors (HDACIs) has become an increasingly important field in medicinal chemistry in the past decade. Unfortunately, current HDACIs are broad-targeting, non-specific molecules which affect the entire range of zinc-based HDACs, making them potentially toxic. A set of HDACIs selective for the different HDACs is necessary in order to provide powerful molecular scalpels for therapeutic use against the many different diseases which are each intertwined with different combinations of the many human HDACs. Here we show the in-use methodology of computational screening of known HDACIs against a variety of HDACs from humans and plasmodium in order to identify potential pharmaceutical leads selective for one or more sets of zinc-based HDACs for use in targeted therapy against these specific diseases. Here we also show the logic behind using these potential selective HDACIs against our two target medical challenges, HIV eradication and antimalarials.

Evan Witt
See Abena Apaw

SUPERFLUIDITY IN NEUTRON STARS
Samuel Witte
Mentor: Willem H. Dickhoff

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 $^3P_0 - ^3F_2$ channel in various hadronic cooling models is closely examined. An analysis of the $^1S_0$ 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 $^1S_0$ gap does not significantly alter the nature of neutron star cooling, improved calculations in the $^3P_2 - ^3F_2$ 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.
UNPACKING SANSE:
CHANGE AND DURABILITY WITHIN SENEGALESE FASHION AND IDENTITY
Camille Wright
Mentor: Elizabeth C. Childs

This is the documentation of formal and informal research on the fashion culture in Dakar, Senegal, drawing upon personal interviews, secondary sources such as essays, photography, fashion illustration, and observation of Dakar Fashion Week 2012. The text focuses on personal identity in fashion, globalization, and the Western construction of African “authenticity” and “Africanness,” as well as the challenging of that construction by fashion designers from all over the African continent. Inspiration for the research was born from experiences with black youth in Chicago, Illinois and the growing trend amongst them of promoting black identity through afrocentric clothing, as well as growing numbers of “tribal” garments in mass-market clothing stores. This work offers first-hand insight into the evolving attitudes of Senegalese designers and consumers towards fashion culture, as well as a specific context to understand globalization in the world of fashion.

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 throughout his lifetime. The Paris Opéra and its ballet were at the heart of cultural life for the nineteenth-century city dweller, as Parisians of all classes could attend its performances. Degas’ interest in the ballerinas, however, transcended his commitment to depicting the realities of an aspect of city life. Through a deconstruction of the idealized façade of the Opéra, Degas exposes his fundamental interest in artifice and artistic process. I argue the ballet works distill artistic process into a paintable subject. Degas uses the works to construct a broader narrative of the creation of the ballet, 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 process.

I also evaluate 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. I investigated 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, that he devised a subject that could mirror this artistic interest, the dancers of the Paris Opéra Ballet.

SELLING A DIVERSE NATION:
ETHNIC MINORITIES AS PORTRAYED BY CONTEMPORARY CHINESE PHOTOGRAPHER CHEN MAN
Danielle Wu
Mentor: Kristina Kleutghen

Chen Man (b. 1980), a contemporary Beijing-based Chinese artist, prides herself on her art for being adamantly nationalistic; however, her productions remain consistently more well-received amongst international audiences than at home. Perhaps most telling of the truly international scale of Chen’s success is her new position as a photographer and visual director at *I-D*, a British magazine dedicated to fashion, music, art, and youth culture founded by former *Vogue* art director, Terry Jones. As with many of her works, Chen’s series of covers for *I-D*’s “Whatever the Weather” issues, each titled *Rise and Shine*, contained implicit social critique along with innovative reconstructions of traditional Chinese fashion; in this case, the issues published in Pre-Spring 2012 featured unconventional, avant-garde variations of Chinese ethnic minority (*shaoshu minzu*) costumes. I argue that this series was an exploration of the current limits of Chinese ethnic minority culture to harmless display, performance, and exhibit, thereby addressing the problems of ethnic representation in advertisement. Moreover, it was reconstruction of what it means to represent China, in emphasizing extreme variations in skin color, heritage, and other biological traits, thus stressing the uplifting power of individual autonomy, as well as ideological, individualized transformation rather than technological improvement. Thus, Chen’s depictions of Chinese *shaoshu minzu* is a rare case given the processes of globalization and the modernizing aspirations of China, which has historically marginalized ethnic minorities to remain uncivilized, tourist spectacles in favor of a Han majority. This implores a closer look at how Chen Man provides a solution to formulate a new diverse cultural consciousness and individualist subjectivity, given the seemingly contradictory nature of China’s new post-1979 steadfast collective identity and introduction of an individualistic materialism with a consumer-driven market economy.
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.

**In Vitro Degradation Characteristics of Novel Electrospun Polycaprolactone (PCL) Scaffolds for Hernia Repair Applications**

Alexander Xu

Mentor: Corey Deeken

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 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% CO\(_2\)). 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 in vitro degradation. Future studies will investigate longer incubation periods and/or accelerated degradation solutions.

**FUNCTIONAL TRAITS, ENVIRONMENTAL GRADIENTS AND COMMUNITY ASSEMBLY**

**IN A TEMperate Forest**

Elizabeth Yablon  
Mentor: Jonathan Myers

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. 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.

**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. 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.
EFFECTS OF STRESS ON CATEGORY LEARNING
Teresa 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.

HOLEY MATRIMONY:
QUEERING THE MARRIAGE DEBATE
Brooke Yarrows and Nick Curry
Mentor: Cynthia Barounis

While the mainstream LGBT movement is focused on gaining the right to same-sex marriage, there is opposition to this goal from within the queer community. Activists and theorists alike argue against the privilege inherent to marriage, as well as the possibility of assimilation, or the dissolution of a distinct queer community. Is same-sex marriage the appropriate main goal for the LGBT movement? How is marriage a privileging institution? What are the effects of legalized marriage on the queer community? Looking to contemporary queer theory and activism, these are some of the questions we explore in our research.

Yating Ye
See Adam Adenwala

POLYAMORY AND THE DULUTH MODEL:
WHAT QUEER THEORY AND DOMESTIC VIOLENCE INTERVENTION COULD LEARN FROM EACH OTHER
Shang-Tzu Trish Yeh
Mentor: Susan E. Stiritz

As one of the most commonly referenced models of domestic violence, the Duluth Model guides the approaches of activists, researchers, and intervention programs to address domestic violence. Some of the limitations of the model and current intervention work, however, lie in their assumptions to use the heterosexual, monogamous relationship as the model of intimate relationships and gender as the primary axis of oppression. Consequently, domestic violence intervention perpetuates patriarchal oppression by enforcing compulsory heterosexuality and privileging monogamy.

The work sets a dialogue between domestic violence and queer communities. I will launch a queer critique of the assumptions underlying the literature on domestic violence intervention by applying practices in Dossie Easton’s guide to polyamory and open relationships in *The Ethical Slut* to the Duluth Model. Gayle Rubin’s defense of alternative sexual practices sheds light on ways in which radical feminists have denied individuals the potential to achieve autonomy. Michael Warner’s challenge of monogamy and Adrienne Rich’s critique of compulsory heterosexuality further inform the Duluth Model.

Easton’s use of negotiation as a means to fulfill every partner’s priorities and desires contrasts with the stable, stereotypical ways that the Duluth Model defines healthy and unhealthy relationships. In particular, relearning jealousy as a socially constructed byproduct of monogamy opens up new ways to create non-violence alternatives to abuse and violence. Current intervention efforts have not sufficiently addressed domestic violence in marginalized sexual communities. By challenging assumptions of heterosexuality and monogamy in the Duluth Model, the work offers more nuanced, comprehensive understandings of abuse and violence in intimate relationships.

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 turnover 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.

Kevin Zhang
See Jeff Bonin
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 responsivity 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 min 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 min following treatment and pJNK peaked at 30 min. 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.

Tony Zhang
See Adam Adenwala

AN EXPLORATION OF DOLLS AND DOLL PLAY

Amanda Zinman
Mentor: Heidi Kolk

Dolls have been very influential in female youngsters’ lives, operating as agents that ostensibly enact their conceptions of the world. Countless sociologists, psychiatrists, and psychologists have demonstrated over history that these miniature plastic replicas of the living incessantly affect race relations and have unearthed that dolls gauge the development of racial attitudes, preference and identification in children. I propose that dolls, given the fact that they hold these racial implications, can impact race itself. I analyze Mattel’s Barbie and Shani dolls to assess the problems with the racial messages that these dolls impart to children and share my ideas to correct them. Ultimately, I propose a novel doll construction that is crafted around a new idea of doll play itself and try to lessen the negative feelings of self-worth that racism enacts in youngsters.

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 study 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 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.
PRESENTERS’ ACKNOWLEDGEMENTS

Adam Adenwala — Dr. Nerbonne, Dr. Rocco Huenek

Katherine Ayanian — I would like to thank my advisor, Professor Wertsch, my family, and my friends for supporting my research.

Anna Bareis — Randall J. Bateman; Tom Kasten; Kwasi G. Mavuenyega; Wendy Sigurdson; Vitaly Ovod; all participants in our clinical studies

Elizabeth Basow — Dr. Mitchell Sommers, the Alzheimer’s Disease Research Center (ADRC), Becky Fierberg, Alyse Firtel, and Avanti Dey

Christopher Bechler — I would like to thank Professor Leonard Green for his dedication to this project. I also would like to thank Professor Joel Myerson, Professor Bruce Petersen, and Professor Dorothy Petersen for their valuable time and insightful comments.

Kathryn Betts — Dr. Clarissa Hayward

Thomas Bird — I would like to thank Dr. Ron Mallon for the abundance of guidance and feedback he has provided me as my primary advisor, as well as Dr. Julia Driver for serving as my secondary advisor.

Allison Bischoff — Denise Willey, Rachel Kolko, Rebecca Bollinger, and Mitchell Sommers

John Bleurs — University of Michigan Atmospheric, Oceanic, and Space Sciences Department

Valerie Bostron — Jennifer Gruhn for all her patience in mentoring, and Sharon Jia, without whom I would not be a part of this project

Allison Brenner — I would like to give a big thanks to Andy Surface and Dr. Sophia Hayes for their support on this project and throughout my college career.

Walter Buhr — Lee Sobotka, Bob Charity, Kyle Brown, Walter Reviol

William Collison — The Strassmann and Queller Lab. Dr. David Queller, Dr. Joan Strassmann, Dr. Dianne Duncan, and Dr. Debra Brock.

Carolyn Carpenter — Professor Andrew Sobel, Professor Ji-Eun Lee and Sheena Greitens

Grace Chao — Rebecca J. Lester and Shanti Parikh

Meytal Chernoff — Professor Robert Wiltenburg

Re-I Chin — I thank the Department of Radiation Oncology, the Office of Undergraduate Research, and the Advanced Summer Program for Investigation and Research Education for the financial support and the academic guidance that made this project possible.

Martha Clark — Professor Watt, Professor Pegg, Professor Borgwardt

Andrew Cowley — Ed Richter

Neel Desai — Frank Lovett (WUSTL Advisor), David Hall (Oxford Advisor)

Angelia Diaz — Dan Applegate

Laura Dietrich — I extend my deepest appreciation to my parents, my sister, my advisers – Professors Ake, Baumgartner, and Rosenbury – and WCSS for their vital help and guidance. I also thank Katie, Priyanka, Cari, Rivioka, Victoria, Mark, and Julien for their encouragement.

Susan DiMauro — I am deeply grateful for the support and guidance provided by my advisor, Dr. Glenn Stone, throughout the course of this research. Many thanks are also due to my committee members, Dr. Peter Benson, Dr. Venus Bivar, and Dr. William Lowry.

Phenesse Dunlap — Dr. Damiana Miranda, Francisco Santos, Dr. Derek Pardue, and Dr. Burt Gustafson

Ezinwamne Emelue — MARC Undergraduate Student Training in Academic Research Program

Molly Evans — Brian Carpenter, Clinical Geropsychology Lab

Lubov Ezerskiy — Dr. Lillianica Sonica-Krexel, Dr. Mariana Belcheva and the Solnica-Krexel Laboratory

Adam Ezraour — Professor Mark Pegg and Professor Kriser Knapp

Nickolas Forsch — Z Chen, Matthew Wyckzallowski, Alina Oltean

Aakash Gandhi — We would like to thank the instructors, TAs, and sponsors through the Biol 191/192 PHAGE Hunters & Bioinformatics

Xinyi Ge — I would like to express my gratitude to the following: Dr. Stoner and Professor Sargent for their guidance, Professor Benson and Professor Abrams for their feedback, and my family and friends who motivated me to work my hardest.

Patrick Georger — Special thanks to Mike Bezemek

Elena Gittleman — Mark Pegg, The Office of Undergraduate Research

Simone Godwin — Crickette Sanz, Stephanie Braccini, D.T. Rasmussen, R.W. Sussman, Monica McDonald, Alex Garcini, Jim O’Brien, Sara Henley, Siting Liu, and Zev Powell, the staff of the Saint Louis Zoo Jungle of the Apes

Antonia Gonzalez — Dr. Joan Luby, Ms. Rebecca Tillman, The Early Emotional Development Program, The Office of Undergraduate Research

Olivia Gonzalez — Dr. Bayly, Dr. Okamoto, and Kate Wilson for their mentoring

Daltion Guthrie — I’d like to especially thank Dr. Green and Andrew Westbrook for their guidance this summer.

Gloria Han — Michael Gaffrey, Riviorka Shenoy, and members of the Early Emotional Development Program at Washington University School of Medicine

Michael Harries — Eric Milner

Nay’Chelle Harris — The OUR, Aynn Sretight, Zolamerica Narvaez, Maria Teresa Fuentes Lopez, Violeta Sarria, The CIT Nicaragua staff, host families, and students

Sara Harris — Dr. Jillian Powers, Dr. Sowande Mustakeem, Dr. Heidi Kolk

Gregory Harrison — Hatfull Lab, HHMI

Diana He — Hatfull lab

Vanessa Hensley — Kevin Smith, Beth Biro, Lauren Woods, Jennifer Heemeyer and Eleanor Pardini

Rosa Heyman — I would like to thank my advisor Jami Ake, for her support and patience, as well as Rebecca Wanzo and Linda Nicholson for their thoughtful feedback throughout my research project.

Allison Horan — Dr. Sargent, for your enthusiasm, guidance and support, Dr. Baumgartner, for your interest in my research and words of reassurance, Dr. Wall, for being an incredible inspiration, and of course, the CPMS and OBs for opening their worlds to me.

Satcher Hsieh — Ed Richter, Dr. Robert Morley, Dr. Harvey Hopkins

Alaa Itani — Dr. Peter Benson, Dr. Shanti Parikh, Dr. Nancy Reynolds

Shilpa Iyer — I’d like to thank my instructor, Julie Cohen, for her support and advice on this paper.

Diana Jack — Matthew Gabel, Paul Michael Lützeler, Matthew Erlin, Steven Hause, Hans-Jürgen Bieling

Matthew Johnson — Ed Richter and Arye Nehorai

Angelica Juarte-Santaliz — Kedron Thomas, Jami Ake

Lauren Kan — WUSICE, Office of Undergraduate Research, the United Nations, the Qatari people and government, the interviewees (Lebanon, Iraq, Indonesia, Chile, Mexico, Sierra Leone, Ghana, and Malawi, Germany, the Province of Buenos Aires)

Alexander Kaufman — Dr. Guillermo Rosas, Dr. Stephen Ansolobehere, Dr. Dawn Brancati

Louis Keene — Dr. Heidi Kolk, Noah Cohan, Amanda Zinnman, Sara Harris, Eric Fischer, David and Joelle Keene

Megan Kelly — Audrey Odom and the Odom Lab

Kevin Kim — Dr. Daniel E. Goldberg, Dr. Jeremy P. Mallari

Brian Kline — Professors Shanti Parikh, Colin Burnett, Rebecca Lester, The Subject Librarians Brad Short and Jennifer Moore.

Elizabeth Korb — The Arthur Greenberg Curatorship, The Mildred Lane Kemper Art Museum, The Sam Fox School of Design & Visual Arts, The Department of Art History and Archaeology

Kavitha Krishnan — Dr. Robert Sussman

Prateek Kumar — Drs. Leonard Green, Joel Myerson and Carl Craver, and the lab members of Dr. Green’s Choice & Decision-making Lab

Eugene Kwon — Professor Lutz Koeppnick, Professor Joseph Loewenstein, Professor Til Boon Cuillé, Professor Anca Parvulescu, Professor Colin Burnett, Professor Ji-Eun Lee, curators at the Nam June Paik Art Center, and my IPH cohorts (Anna, Julie, Don, Dan, and Sophia)

Claudia Landazabal — Dr. Jeffrey Q. Sargent, Ms. Michelle Eisenberg, and the rest of the Dynamic Cognition Lab

Aiviya Lanis — I would like to thank my mentors, Malou Hultcrantz and Claudia Priwin, for their continued hospitality, support and enthusiasm as I worked to complete this project during my summer abroad at Karolinska Institutet in Stockholm, Sweden.

Aiviya Lanis — Many thanks to my advisors, Dr. Mitchell Sommers, Dr. Michael Merbaum, Dr. Nancy Tye-Murray, and Professor Philipp Kortlus, for their time and support throughout this process of completing my thesis.
Participants also wish to acknowledge the support of their research mentors, many of whom have contributed funding from their grants to support undergraduate research experiences.
THANK YOU

The Office of Undergraduate Research would like to thank the following people for their support of the Spring 2013 Undergraduate Research Symposium:

Heidi Kolk
Randall Calvert
Mark Pegg
Jennifer Gallinat
Hannah Paulding
The College of Arts & Sciences

OFFICE OF UNDERGRADUATE RESEARCH
http://ur.wustl.edu
research@artsci.wustl.edu

Joy Kiefer, Director
Kristin Sobotka
Holly Tasker
Jennifer Kohl