



**French Family Science Center**  
**Friday, April 29, 2013**  
**11:30 a.m.-2:00 p.m.**

Visible Thinking is a Program of  
The Undergraduate Research Support Office  
Trinity College of Arts and Sciences  
Duke University

Ron Grunwald, Director  
Deborah Wahl, Associate Director  
Laura Stein, Staff Specialist  
*[undergraduateresearch.duke.edu](http://undergraduateresearch.duke.edu)*

Acknowledgments

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The Duke Undergraduate Research Society  
The Academic Deans of Trinity College of Arts and Sciences  
Coordinators of Undergraduate Research and Fellowship Programs

Funding Provided by Trinity College of Arts & Sciences

# Undergraduate Research Support at Duke University

Duke undergraduates have received support from the following College and University programs in 2012-2013:

## **All Disciplines**

Career Center Summer Internship Awards  
Dannenberg Summer Fellowships  
Mellon-Mays Undergraduate Fellows  
Office of Study Abroad Fellowships  
Office of University Scholars and Fellows  
Summer Session Fellowships  
Trinity College Deans' Summer Research Fellowships  
Undergraduate Research Support (URS) Awards

## **Humanities and Social Sciences**

Asian/Pacific Studies Institute East Asia Projects  
Benenson Awards in the Arts  
Center for Latin American and Caribbean Studies Mellon Fellowship  
Center for Documentary Studies John Hope Franklin Awards  
Classical Studies Travel Grants  
Economics Davies Fellowships  
Duke Center for Civic Engagement Summer Research Fellowships  
Duke Global Health Institute  
Duke University Center for International Studies  
Franklin Humanities Center – Haiti Lab  
History Department New Majors Grants  
International Comparative Studies Senior Thesis Grants  
Office of the Vice Provost for the Arts – Creative Arts Grants  
Political Science Summer Research Initiative  
Psychology Vertically Integrated Partners Program

# Undergraduate Research Support at Duke University (*cont'd*)

Research in Practice Program

Public Policy Summer Research Fellows Program

Schiff Family Foundation Summer Research Fellowships

Service Opportunities in Leadership Program

Womens' Studies Program

## **Natural & Quantitative Sciences and Engineering**

Chemistry Summer Research Fellows

Computer Science Undergraduate Research Fellowships

Evolutionary Anthropology Undergraduate Research Program

Marine Lab Rachel Carson Research Fellows

Institute for Genome Sciences and Policy Summer Fellowships

Goldman Sachs Summer Research Fellowships

Howard Hughes Research Fellows Program

Howard Hughes Vertically Integrated Partners Program

Mathematical Biology Summer Research Program

Neurosciences Program of Research

NSF-PRUV - Department of Mathematics

Physics - High Energy Physics Program

Pratt Fellows Program

Trinity College Forums in Biological Sciences and Neuroscience



**A Presentation of Undergraduate  
Research  
11:30am – 12:30 pm  
Poster Session**

<b>Name</b>	<b>Advisor</b>	<b>Research Field</b>	<b>Title</b>
Joel Bray	Brian Hare	Behavioral Sciences	How do media portrayals of chimpanzee behavior impact youth conservation perception?
Katie Burke	Phil Costanzo	Behavioral Sciences	The Effect of Graphic but Irrelevant Evidence in Prosecutorial Decision Making
Kaitlyn Dunlap	Karen Murphy	Behavioral Sciences	Neural correlates of social reward processing and friendship quality in adults with high functioning autism
Carmen Lai	Kevin LaBar	Behavioral Sciences	Top-Down Modulation of the Influence of Regret on Decision Making
Matt Truwit	Harris Cooper	Behavioral Sciences	Evaluation of a Summer Enrichment Program: Effects on Self-Concept and Motivation For Middle and High School Students
Shubhangi Arora	Christopher Kontos	Biological Sciences	Regulation of Endothelial Gene Expression by Caskin 2
John Davis	John Davis	Biological Sciences	Effect of Elizabeth River Sediment Exposure on Antioxidant Defenses in Cancer and Non-Cancer Cells
Donald Ellis	Michael Armstrong	Biological Sciences	Role of Mxi1 and Mxi0 in the Pathogenesis of Neuroblastoma
Ryan Gimple	Nina Sherwood	Biological Sciences	The Ring Gland: An Investigation of the Role of Katanin-p60 in the Development of the Nervous System in <i>Drosophila melanogaster</i> .
Jacob Golan	Jonathan Shaw	Biological Sciences	Phylogeographical Effects of Pleistocene Glaciations: Genetic Variation in Eastern North America <i>Sphagnum capillifolium</i>
Ana Luiza Granciro	Miguel Pais-Vieira	Biological Sciences	Motor Representation in the Somatosensory Cortex: The Effects of Learning on the Duration and Magnitude of Neuronal Firing
Andrew Hickey	Christina Meade	Biological Sciences	HIV-associated Hepatic Tuberculosis

Mariah Hukins	Leslie Digby	Biological Sciences	Do sex differences affect behavioral thermoregulatory strategies in lemur species?
Syed Nabeel Hyder	Mohamad Mikati	Biological Sciences	Spontaneously Recurring Seizures in Kv1.1 Heterozygous Mice Treated with Neonatal Hypoxia
Taylor Jackson	Christina Meade	Biological Sciences	The Effect of HIV and Cocaine on Impulsivity and Functional Connectivity
Daniel Li	David Dunson	Biological Sciences	Accounting for Concomitant Variables: Lipid Adjustment for Chemical Exposures
Carmen Lopez	Fred Nijhout	Biological Sciences	Modeling the Folate Pathway in <i>Escherichia coli</i>
Shamaita Majumdar	Susan Muprhy	Biological Sciences	Oncogenic Behavior of Long Noncoding H19 RNA in Ovarian Cancer
Michelle Michelson	Rindy Anderson	Biological Sciences	Analysis of song sharing in an eastern population of song sparrows, <i>Melospiza melodia</i>
Arin Pamukcu	Cagla Eroglu	Biological Sciences	Neurotrophic effects of astrocyte-secreted proteins Hevin and SPARC
Trevor Thomas	Keith Brodie	Biological Sciences	God in the Brain: a review of neurotheology
Alissa Wall	Erica Davis	Biological Sciences	Dysfunction of 60S ribosomal protein (RPL10) is associated with X-linked microcephaly
Catherine Wang	Hai Yan	Biological Sciences	Role of IDH mutations in development and progression of gliomas
Joshua Weiss	Daniel Wechsler	Biological Sciences	Therapeutic Targeting of CALM-AF10 Leukemia by Iron Chelation
Eli Wilber	Dan Kichart	Biological Sciences	Investigation of Cell Division Proteins in the Halophilic Archaeon <i>Halobacterium salinarum</i>
BJ Williams	Nicolas Buchler	Biological Sciences	Measuring cell-cycle dynamics in budding yeast at single cell resolution
Kelly Williams	Bahie Abou-Donia	Biological Sciences	Role of CaMKII in the death of SH-SY5Y cells following treatment with organophosphates
Sean Wu	Ryan Baugh	Biological Sciences	Phenotypic characterization of candidate antagonists to the DAF-2 Insulin-like receptor
Diana Xie	Michael Platt	Biological Sciences	The effects of oxytocin on social behavior in rhesus macaques

Zohair Zaidi	Ute Hochgeschwender	Biological Sciences	Manipulation of Neuronal Activity with Increased Cell-Type Specificity by using Luciferase-Op sin Heterodimers
Yuqi Zhang	Daniel Kiehart	Biological Sciences	Deciphering the Role of Drosophila Beta-Spectrin and Ankyrin in the Morphogenesis of Drosophila melanogaster
Federica Brecha	Liliana Paredes	Community Engaged Research	The Future of Romagnolo: Change Seen Through Generations
Angie Diaz	Angie Diaz	Community Engaged Research	El Aire es Frío: The Boys and Girls Club of Greater Houston as a Community Organization
Arin Pamukcu	Alma Blount	Community Engaged Research	How did the situation of domestic violence change after the November 2011 earthquake in Van, Turkey?
Allison Smalley	Ashley; Jeff Corra; Quinn	Community Engaged Research	CATCH: Evaluating Carrington Middle School's Peer Tutoring Program
Alexis Spieldenner	Scott Lindroth	Community Engaged Research	To what extent do El Sistema-inspired music education programs enhance the academic, behavioral and social development of underprivileged youth?
Jacqueline Stedman	Elizabeth Snyder-Fickler	Community Engaged Research	Standards Based Grading: Reporting Meaningful Progress
Ishan Thakore	Alma Blount	Community Engaged Research	E-Learning Program Evaluation for the SEWA Manager Ni School, Gujarat, India
Saher Valiani	Charles Thompson	Community Engaged Research	Second-hand Citizens: Assessing Peruvian Immigrants' Access to Public Resources in Santiago, Chile
Sunhay You	William Chafe	Creative Arts	Mirrored Reflections
Sara Adam	Bill Chafe	Humanities	Vulnerability, Relationships and Poverty among Women in Kenya
Camille Anderson	Charles Piot	Humanities	Keeping the Togolese Abreast
Alice Kim	Raquel Salvatella de Prada	Humanities	The Precious Littles: Destruction of a Creation Creation of a Destruction
Julianne Kolb	John Martin	Humanities	Portraits of a Tigress: Caterina Sforza and the Tightrope of Gendered Identity in the Renaissance

Rachel Leng	Carlos Rojas	Humanities	Tongzhi Tales in Mainland China: Gay Male Subjectivities in Online Comrade Literature
DeDe Mann	John Martin	Humanities	Anxieties of Power: Pierfrancesco Riccio and the Politics of Art
Diana Ruiz	Kimberly Lamm	Humanities	What Remains to be Seen: Exploring Intersectionality through Cinematic Representations of Black Women's Rape
Jeong Hoon Ko	Stephen Craig	Physical Sciences	Mechanochemically activated polymeric system for triggered release of molecules
Jackson Matteucci	Alfred Goshaw	Physical Sciences	Analysis of Z Boson Decays Involving Photon Emissions
Kaitlyn Batt	Robert Thompson	Psychology-Graduation with Distinction Candidate	Undergraduate Christian Communities: Functions and Correlates of Self-Compassion
Xuan Duong Fernandez	Mark Leary	Psychology-Graduation with Distinction Candidate	carol@ncpsychology.org
Madeline Lyons	Elizabeth Marsh	Psychology-Graduation with Distinction Candidate	Selective Highlighting
Alyssa Fowers	Lasana Harris	Social Sciences	Leading by example: Using fictional exemplars to reduce bias against women in leadership.
Devon Gagliardi	Tanya Chartrand	Social Sciences	The Effects of Introversion and Extraversion on Ego-Depletion
Kelly Heo	Hwansoo Kim	Social Sciences	Moving Outside the Hermit Kingdom: Policies and Programs that Aid North Korean Adolescent Refugees
Rachel Leng	Ken Rogerson	Social Sciences	Chinese Comrade Literature, Queer Political Reality, and the Tongzhi Movement in Mainland China
Blake O'Connor	Ben Goodman	Social Sciences	Best Practices for Assessing Social-Emotional Learning at the Central Park School for Children
Ana Susac	David Rubin	Social Sciences	Life Script for Bosnian Croats – A Culture of War Survivors
Divya Taneja	James Shah	Social Sciences	Implicit Self-Regulation
Ezgi Ustundag	Jen'nan Read	Social Sciences	The Influence of Islamic Centers on the Formation of Muslim-American Identity



**A Presentation of Undergraduate  
Research  
12:00-1:00pm  
Poster Session**

<b>Name</b>	<b>Advisor</b>	<b>Research Field</b>	<b>Title</b>
Preston Cotnoir	Christina Meade	Behavioral Sciences	Independent and Combined Effects of Aging and HIV Affect the Neurocognitive Capacities of Cocaine Users
Tiffany Chien	Mary Foster	Biological Sciences	Enumerating Anti-laminin B cells in NZB Lupus Mice
Emily Du	Michael Platt	Biological Sciences	Social learning of food preferences in rhesus macaques.
Justin Fu	George Truskey	Biological Sciences	Cell Senescence Alters Proliferation and Markers of Inflammation in Human Cord Blood-Derived Endothelial Cells
Brendan Huang	Timothy McMahon	Biological Sciences	Separation and Nitric Oxide Quantification of Hemoglobin Variants in Umbilical Cord Blood
Brandon Metra	Christina Meade	Biological Sciences	Functional Neuroimaging of HIV-Associated Effects on Delay Discounting in a Cocaine-Using Sample
Crystal Owens	Meng Chen	Biological Sciences	How plants respond to light: Formation of photobodies in <i>Arabidopsis thaliana</i>
Evan Schwartz	Rahima Zennadi	Biological Sciences	The effects of small molecule MEK1/2 inhibitors on vaso-occlusion in sickle cell disease.
Jenny Xue	Pei Zhou	Biological Sciences	Inhibition of Translesion Synthesis for Cancer Therapy
Arun Augustine	Kristin Goss	Community Engaged Research	Evaluating The Success of Project Access of Durham County's Programs
Ian Harwood	Joel Rosch	Community Engaged Research	How University Decision-Makers Select Sexual Violence Prevention Programs
Nelly-Ange Kontchou	Luciana Fellin	Community Engaged Research	A Comparative Sociological Investigation of the Conceptions and Perceptions of Mental Health and Illness in Arica, Chile and Rome, Italy



Courtney Liu	Timothy Strauman	Community Engaged Research	Trauma and Mental Health Services for Domestic Violence Survivors: Barriers to Services and Potential Solutions for the Greater Durham Area
Wilma Metcalf	Alma Blount	Community Engaged Research	Enhancing the Learning Environment: Supporting Students at the Urban Assembly School for Criminal Justice
Claire Sorrenson	Catherine Admay	Community Engaged Research	Playing with Power and Narrative Process in Kenya and Senegal
Nandini Srinivasan	Alma Blount	Humanities	Do Humanities Still Have a Place in Education? Evaluating the role of humanities in modern society.
Katherine Ferguson	Alan Boudreau	Physical Sciences	Petrology of sulfides in the Middle Banded series of the Stillwater Complex, Montana, USA
Michael Asher	Laura Richman	Psychology-Graduation with Distinction Candidate	Power in the Doctor's Office: The Effects of Power on the Recall of Medical Instructions
Yixuan Cao	Tanya Chartrand	Psychology-Graduation with Distinction Candidate	Nonconscious Goals in Online Shopping: Satiation Effects and Timing
Steven Dallas	Tanya Chartrand	Psychology-Graduation with Distinction Candidate	When Bigger is Actually Better: The Effect of Brand Logo Size and Familiarity on Consumer Attitudes and Purchasing Intentions
Eric Emery	Robert Thompson	Psychology-Graduation with Distinction Candidate	The Effects of Childhood Acute Lymphoblastic Leukemia Treatment on Neurocognitive Outcomes
Cassidy Fox	David Rubin	Psychology-Graduation with Distinction Candidate	All My Children: Factors Underlying the Misnaming of Familiar Individuals
Ryan Johnson	Makeba Wilbourn	Psychology-Graduation with Distinction Candidate	Don't Worry Be "Happy": Mother-Child Emotion Talk During a Picture-Book Task
Eun Won Kang	Lisa Linnenbrink-Garcia	Psychology-Graduation with Distinction Candidate	Unpacking Achievement: A Richer Exploration of the Relation between Achievement and Motivation

Allison Kratka	Laura Richman	Psychology- Graduation with Distinction Candidate	The Effects of Obesity Stigma: How media explanations for the causes of obesity impact weight bias
Courtney Liu	Timothy Strauman	Psychology- Graduation with Distinction Candidate	Feasibility of a Dance Intervention for Children Exposed to Intimate Partner Violence
Matthew Nemoy	Tobias Egner	Psychology- Graduation with Distinction Candidate	Dopamine Influence on Cognitive Flexibility and Stability
Ashley Ruba	Makeba Wilbourn	Psychology- Graduation with Distinction Candidate	18-month-old Infants Discriminate and Categorize Anger and Disgust Emotional Expressions



**A Presentation of Undergraduate  
Research  
12:30-1:30pm  
Poster Session**

<b>Name</b>	<b>Advisor</b>	<b>Research Field</b>	<b>Title</b>
Mehmet Yavuz Acikalin	Michael Platt	Behavioral Sciences	Monkey Advertising: Effects of a Social Image Campaign on Monkey Reward Preferences
Emma Blumstein	Brian Hare	Behavioral Sciences	Assistance Dog Cognition
Drew Young	Christina Meade	Behavioral Sciences	The Effects of Cocaine on Loss Aversion Decision Making in patients with HIV infection
Avionna Baldwin	Andrea Taylor	Biological Sciences	Male mangabeys increase muscle stretch to facilitate relatively wide jaw gapes without compromising muscle force.
Joel Bray	Brian Hare	Biological Sciences	Energetics of infant chimpanzees: Implications of nursing and feeding behavior
Emily Chang	David Sherwood	Biological Sciences	Evolution of Anchor Cell Invasion across rhabditid nematode species
Skylar Klager	Christine Drea	Biological Sciences	Increasing Signal Longevity: Conspecific response to odorant mixing and decay in ring-tailed lemurs, <i>Lemur catta</i>
Charles Kuang	David Sherwood	Biological Sciences	Role of PAR Proteins in Anchor Cell Invasion
Tyler Lacy	Qiu Wang	Biological Sciences	Affinity Probe Synthesis for a Cancer Stem Cell Toxin (Compound 302)
Rebecca Leylek	Terry Lechler	Biological Sciences	In Vivo Roles for the Arp2/3 Complex and Nincin
Sami Natour	Michel Bagnat	Biological Sciences	Characterizing the role of serine-threonine kinase 24a during gut morphogenesis in zebrafish
Jasmine Nee	Gerard Blobe	Biological Sciences	sTBR111 promotes neuronal differentiation and reduces proliferation in neuroblastoma
Emily Ngan	Staci Bilbo	Biological Sciences	The role of microglia in addiction
Adrienne Niederriter	Erica Davis	Biological Sciences	Development of in vivo models for the genetic dissection of craniosynostosis

Hunter Nisonoff	Ute Hochgeschwender	Biological Sciences	Combining Optogenetics with Bioluminescence
Christine Tsai	Dr. Michel Bagnat	Biological Sciences	Characterizing expression of gut specific zebrafish genes during lumen formation using in situ hybridization
Chirag Vasavda	Vann Bennett	Biological Sciences	E-cadherin polarity is determined by a multi-function motif mediating lateral membrane retention through ankyrin-G and apical-lateral transcytosis through clathrin
Jessica Wang	Paulo Ferreira	Biological Sciences	Cone-specific ablation of RanBP2 causes rod death by a distinct mechanism
Ruth Zhang	David Sherwood	Biological Sciences	Identifying adhesion proteins mediating anchor cell invasion of vulval cells in <i>C. elegans</i>
Renata Dinamarco	Kari Lock Morgan	Community Engaged Research	City of Pembroke Pines Small Business Entrepreneurial Preparedness
Anne Yeung	Giovanna Merli	Community Engaged Research	Health Situation and Needs of Beijing Migrant Mothers and their 0-3-year-old Children
Alexis Spieldenner	Leo Ching	Humanities	Examining the Transformation of the Japanese Canadian Community from First-Generation to Fourth-Generation
Archer Wang	Eileen Chow	Humanities	In Search of Chineseness
Amanda Nickens	Lisa Linnenbrink-Garcia	Psychology-Graduation with Distinction Candidate	Gender differences in career aspirations of college science students
Emily Mendenhall	Michael Orbach	Social Sciences	Development and the Moroccan Artisanal Fishing Sector
Anirudh Saraswathula	Andrew Muir	Social Sciences	A Systematic Review of Racial and Ethnic Diversity of Hepatitis C Virus Clinical Trials

**VISIBLE THINKING 2013**  
**Abstracts in Alphabetical Order**

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**Mehmet Yavuz Acikalin**

***Monkey Advertising: Effects of a Social Image Campaign on  
Monkey Reward Preferences***

Research Advisor: Michael Platt

Neurobiology

Many advertising campaigns are based on associative conditioning, particularly the association of a product with sensory stimuli evoking sexual activity, social status, and primary reward. Moreover, many animal species are capable of learning associations between rewards and their predictive stimuli. This research explores whether advertising campaigns are effective in the rhesus macaque, a species closely related to humans. We assayed choice behavior in rhesus macaques that have been trained to use touchscreens in response to visual cues for a fruit juice reward. We attempted to answer if it is possible to influence monkey reward preferences using a social image based advertising campaign. We additionally explored whether there is a difference between the effects of sexual pictures, pictures of dominant males, and pictures of subordinate males. This study has demonstrated that it is possible to influence monkey reward preferences using advertising the way it is used on humans, establishing a stronger link between evolution and consumer behavior.

**Shubhangi Arora**

***Regulation of Endothelial Gene Expression by Caskin 2***

Research Advisor: Christopher Kontos

Medicine - Cardiology

Caskin2 is an uncharacterized scaffolding protein that our lab has identified as a novel interactor of the endothelial receptor tyrosine kinase Tie1. Unpublished data demonstrate that Caskin2 is expressed specifically in the vascular endothelium in vivo, promotes endothelial cell quiescence in vitro, and is necessary for normal vascular development in zebrafish. In vitro, Caskin2 is detectable in both the cytosol and the nucleus of endothelial cells. We hypothesized that Caskin2 affects the endothelial cell phenotype in part through transcriptional regulation. To test this hypothesis, we performed a microarray experiment to analyze the transcriptional profile of human umbilical vein endothelial cells (HUVECs) overexpressing Caskin2 compared to control HUVECs overexpressing green fluorescent protein (GFP). 106 genes were up- or down-regulated at least two-fold as a result of Caskin2 overexpression compared to GFP-treated cells. Among these, the apelin receptor gene APJ was significantly upregulated while several cell cycle regulatory genes were significantly downregulated, consistent with the hypothesis that Caskin2 affects endothelial cell quiescence. APJ has been shown previously to play an important role in vessel maturation and neovascularization following ischemic events. The gene expression changes for APJ and selected cell cycle genes were validated in independent experiments using real-time quantitative PCR. The panel of validated genes will be used in future experiments that assess the impact of Caskin2 on endothelial cell quiescence under varying conditions. These studies may lead to improved understanding of endothelial quiescence and disorders of vascular integrity.

**Michael Asher**

***Power in the Doctor's Office: The Effects of Power on the Recall of Medical Instructions***

Research Advisor: Laura Richman

Psychology and Neuroscience

This study examined the connection between the doctor-patient power dynamic and the patient's comprehension of and adherence to a doctor's instructions. This study had a 3 x 2 design, as undergraduate students (N = 50) completed a scrambled sentence task designed to prime a state of high, low, or neutral power, and then interacted with a confederate who impersonated a doctor in a manner that was either paternalistic and high power or non-paternalistic and low power. Although there were no significant differences in the extent to which high- and low-power participants recalled or adhered to the doctor's instructions, there were a number of nonsignificant trends indicating that high-power participants perform slightly better in these areas than their low-power counterparts. Additionally, participants who interacted with the non-paternalistic doctor demonstrated a greater orientation toward promotion goals rather than avoidance goals, while those who interacted with the paternalistic doctor focused more on avoidance goals.

**Arun Augustine**

***Evaluating The Success of Project Access of Durham County's Programs***

\*Service Opportunities in Leadership Project

Research Advisor: Kristin Goss

Public Policy

Founded in 2008, Project Access (PA) of Durham County allows for low income and uninsured Durham residents the opportunity to receive free specialty medical care by partnering with medical facilities across Durham County. PA determines which patients are eligible for these donated appointments by patterning with Lincoln Community Health Center, Durham's main primary care facility for the uninsured. Seeking to evaluate PA's current programs and identify ways in which PA is able to improve its outreach and capacity, I interviewed a number of current and past members of PA to learn more about their opinions regarding PA's enrollment process, the care provided to them from PA's partners, and the support systems they may have elsewhere in the Durham community for their health. In addition, I also interviewed the full time staff for their opinions regarding the operations of Program Access. Overall, I found out that patients are generally satisfied with their relationship with PA and the services they received through the organization. I also determined that the staff identified their primary concerns with the operations of PA to be miscommunication with patients about what PA encompasses, lack of effort by Primary Care Providers to educate patients about what PA is, and the ramifications that Health Care Reform may have on PA's ability to continue to provide speciality healthcare access for undocumented immigrants.



**Avionna Baldwin**

***Male mangabeys increase muscle stretch to facilitate relatively wide jaw gapes without compromising muscle force***

Research Advisor: Andrea Taylor

Evolutionary Anthropology

Sooty mangabeys (*Cercocebus atys*) are sexually dimorphic monkeys that routinely feed on hard-shelled nuts. Feeding observations indicate they generate powerful postcanine muscle and bite forces to fracture the nuts. Males also engage in wide-gape canine threat displays. Generating relatively large muscle and bite forces and wide jaw gapes places competing demands on the masticatory apparatus. How do males generate relatively wide jaw gapes while maintaining adequate muscle/bite forces? In this study, we examined jaw-muscle fiber architecture of the superficial masseter (SM) and temporalis (TM) muscles in adult male and female *C. atys*. We measured muscle mass, fiber length (proportional to stretch), pinnation angle and physiologic cross-sectional area (PCSA). We tested the hypothesis that compared to females, males have relatively: 1) longer, less pinnate fibers; and 2) smaller PCSAs, as an architectural trade-off of their longer, less pinnate fibers. To examine relative differences, variables were adjusted by jaw length. As predicted, males have relatively longer SM and TM fibers ( $p < .05$ ). Contrary to predictions, males and females have similar SM PCSAs ( $p = 0.231$ ) and males trend toward a relatively larger TM PCSA ( $p = 0.071$ ). Results suggest that males increase muscle stretch to facilitate relatively wide jaw gapes without compromising TM force, but they do so in a metabolically costly way by increasing muscle mass. These findings, in combination with previous work on other monkeys, indicate that primates are circumventing the expected trade-off by altering other aspects of muscle biology, including muscle mass and fiber type distribution.

**Kaitlyn Batt**

***Undergraduate Christian Communities: Functions and Correlates of Self-Compassion***

Research Advisor: Robert Thompson

Psychology and Neuroscience

Individuals in undergraduate Christian communities may be particularly vulnerable to low self-compassion. Self-compassion, a strategy for processing negative self-relevant information, does not entail total self-forgiveness, but acts as an emotional safety net, allowing individuals to embrace failures without emotional distress or defensiveness. Self-compassion is particularly relevant in Christian communities, encouraging growth in faith without ignoring or over-identifying with moral failures. This study, building on Barnard and Curry (2012) which highlighted self-compassion as a unique predictor of burnout in clergy, considers how self-compassion may affect non-clergy Christians. Specifically, this study addresses two research questions: Do undergraduate Christians demonstrate a discrepancy in compassion for self compared to compassion for others; and how are salient constructs including moral perfectionism, openness to values, authenticity, and multiple facets of religious experience related to self-compassion? Undergraduates (N=129) at a private university in the southeastern United States completed an online survey. On average, individuals scored a full scale point higher on other-compassion than self-compassion. Four subgroups were formed on level of self-compassion, based on standard deviations above and below the mean. MANOVA results indicated a significant effect for groups. In comparison to groups low in self-compassion, groups high in self-compassion had lower levels of non-display of imperfection and non-disclosure of imperfection, and higher levels of authenticity, forgiveness by God and others, religious coping, and support from one's campus ministry. Potential benefits of raising self-compassion in Christians are discussed.

**Emma Blumstein**

***Assistance Dog Cognition***

Research Advisor: Brian Hare

Evolutionary Anthropology

Training service dogs is a very expensive process and less than 50% of the dogs that enter the training program successfully graduate. The program requires the dogs to develop a certain set of skills in order to graduate, yet there is currently no way to predict whether or not a particular dog will be successful in the extensive training program. The Duke Canine Cognition Center aims to identify any predicting factors of success so as to maximize the potential of service dog training programs such as the Canine Center for Independence (CCI) headquartered in Santa Rosa, CA. This past summer, the Duke Canine Cognition Center visited the Canine Center for Independence and performed a series of cognitive tasks with the dogs in the program. We then compared the dogs' performance with whether or not the dogs successfully graduated from the program. Our results suggest that there may indeed be a battery of tests that will be able to predict a dog's success in the service training program however we are still far from collecting enough data to draw any definitive conclusions on which tests are the best predictors.

**Joel Bray**

***Energetics of infant chimpanzees: Implications of nursing and feeding behavior***

Research Advisor: Brian Hare

Evolutionary Anthropology

Infancy in primates is marked by dependence on the mother for milk and terminates with weaning. During this period, chimpanzee mothers have been documented to deplete their energy reserves to feed dependent offspring, constraining future reproductive opportunities. While an infant's energy derives exclusively from nursing at birth, and is acquired exclusively from solid food post-weaning, data on this transition in chimpanzees is sparse. To explore the relationship between female energetics and infant nursing and feeding behavior, we observed 15 chimpanzees between the ages of 1 month and 4.5-years-old in the Kanyawara community of Kibale National Park, Uganda. We compiled short-term and long-term data from infants to calculate daily nursing and feeding times and solid feeding rates. Nursing was highest among infants below 12 months ( $4.50 \pm 2.16\%$ ) and above 36 months ( $4.95 \pm 1.22\%$ ), dropping for infants in the middle. Daily solid feeding times increased steadily, starting at zero for infants below 6 months and peaking for infants above 48 months ( $49.36 \pm 23.18\%$ ). Similarly, feeding rates on *Uvariopsis congensis* were zero for infants below 12 months and increased each year, peaking for infants above 36 months ( $3.23 \pm 1.09$  fruits processed per minute). These results are consistent with data from other field sites and suggest that nursing and feeding behavior is regulated by both infant energetic requirements and maternal energy reserves, although temperamental differences may account for some variation. These findings suggest that further research on infant behavior is essential to a complete understanding of maternal and infant energetics.

**Katie Burke**

***The Effect of Graphic but Irrelevant Evidence in  
Prosecutorial Decision Making***

Research Advisor: Phil Costanzo

Psychology and Neuroscience

The relative recent phenomena of pervasive exonerations of individuals wrongfully convicted bright lines specific flaws within the U.S. legal system. Wrongful convictions are injustices infringing on the rights of an individual as provided for under the constitution, and thus it is important to study what precipitates the causes and errors in decision-making. A wrongful conviction is initiated with a prosecutor's decision to charge an individual with a crime. The purpose of this experiment is to examine how prosecutors evaluate the evidence used in deciding to attribute guilt to an individual. Previous research has suggested that prosecutors are especially susceptible to the influence of the emotional content of evidence. A total of 112 law students completed an online survey, which included vignettes of wrongful conviction cases with either graphic (emotionally charging language) or non-graphic evidence. The evidence being tested was either relevant or irrelevant to the defendant's guilt. Participants completed a legal decision questionnaire to evaluate the relevance of the evidence and guilt attribution, along with various individual difference measures. The results suggest that graphicness intensifies the evidence to make the participant evaluate the evidence as more guilt leading. The graphicness accentuates the evidence, which may explain how this type of evidence can affect prosecutorial and jury decision-making in the legal system and lead to wrongful convictions. The research represents steps toward addressing this societal injustice and is intended to inform the legal community of the psychological and influence on wrongful convictions and other sources of bias in legal decision-making.

**Yixuan Cao**

***Nonconscious Goals in Online Shopping: Satiation Effects and Timing***

Research Advisor: Tanya Chartrand

Psychology and Neuroscience

Nonconscious goals exist outside of consumer awareness but affect behavior in ways very similar to conscious goals. Previous work has shown that nonconscious goals can be activated by various environmental cues and priming techniques, can affect behavior including motivational and directional behavior, and are nearly indistinguishable from conscious goals in the way they are formed, pursued, and persist. What has not been as thoroughly studied is nonconscious goal satiation, which we look at as it applies to shopping and purchase decisions. The purpose of this study is two-fold: First, to determine whether a nonconscious thrift goal affects purchase decisions in realistic online purchases, and to what extent it affects behavior in terms of money spent. Second, to determine whether the goal satiation effects of goal construct accessibility and affect response can be measured for goal satiation, by comparing them before and after the timing of its satiation. Results indicate that a nonconscious thrift goal significantly influenced consumers to purchase less than those in the control group. No significant results were found for the goal satiation testing, but methodological limitations are considered. Implications for consumers as well as future research in nonconscious influence are discussed.

**Emily Chang**

***Evolution of Anchor Cell Invasion across rhabditid nematode species***

Research Advisor: David Sherwood

Biology

Tissue connection is a complex yet fundamental biological behavior essential for cellular and developmental processes in all animals. It is difficult to examine due to a lack of biological models that facilitate genetic and cellular studies. To understand tissue connection I studied the nematode vulva from a comparative perspective to investigate how evolution has conserved – or allowed for plasticity in – a developmental process called Anchor Cell (AC) invasion. To connect the uterine and vulval tissues, a specialized gonadal cell called the AC invades through the underlying basement membrane to contact the vulval precursor cells (VPCs). Like many developmental events in *C. elegans*, AC invasion is a tightly regulated process with little intra-specific variation. I am interested in determining if the role of the AC in initiating the uterine-vulval connection is conserved across nematode species. I examined AC invasion in 21 nematode species, representing several hundred million years of rhabditid nematode evolution. I utilized Normarski optics and Dextran injections for imaging and laser ablations for removing the AC. From these experiments, I found that the AC is required to initiate the uterine-vulval connection and that the basement membrane gap boundaries stabilize over the post-mitotic vulD cells. However, in eight of the 21 species, the AC invades one vulval cell division earlier. Given the plasticity of other aspects of nematode vulval development (e.g., cell fate induction, cell divisions), it appears that AC invasion is under strong selective pressure to ensure a stable uterine-vulval connection.

**Laura Chao**

***Chinese Theater: Translation, Immersion, and Cultural Transmission***

Research Advisor: Claire Conceison

Theater Studies

In this past year, I have worked with Professor Claire Conceison on a culturally immersive project of theatrical translation, including an independent project translating Chinese playwright Nick Rongjun Yu's play *Dust to Dust* for two consecutive semesters. I worked with Mr. Yu in Shanghai on the final script and experience the context of contemporary urban Chinese theatre from which it emerged. Yu is the most prolific and produced living Chinese playwright, and his plays have far-reaching cultural impact in China and abroad. Yu's play *Dust to Dust* is a contemporary social commentary on corruption, love, and betrayal in Shanghai throughout the past century. A faithful translation of the play into English achieves a transmission of knowledge in both theatrical style and cultural background. Through DSRF, I progressed in my Chinese language studies and fulfilled my goal of introducing Yu's modern Chinese perspective into the Western world through producing a polished translation ready for publication and production. Professor Conceison is editing an anthology of Yu's plays that will include my translation of *Dust to Dust* in the future.



**Tiffany Chien**

***Enumerating Anti-laminin B cells in NZB Lupus Mice***

Research Advisor: Mary Foster

Nephrology

Systemic lupus erythematosus (SLE) is a deadly chronic autoimmune disease caused by a failed immune tolerance that leads autoreactive B cells and T cells to attack self tissues. However, the mechanisms by which gene mutations cause susceptibility to SLE are poorly understood. To gain insight into how lupus B cells are regulated, the Foster lab has previously developed a model system in which the anti-laminin antibody transgene is expressed on B cells in different inbred lupus strains of mice. We found that the NZB lupus transgenic B cells are unique in secreting high levels of anti-laminin antibodies when cultured with bacterial lipopolysaccharide. The goal of this project is to determine the frequency of anti-laminin B cells in the NZB spleen that are capable of secreting anti-laminin antibodies. This is an important step to determine the mechanism by which autoreactive B cells are dysregulated in NZB lupus. For this purpose, I am developing a novel ELISpot assay that can detect B cells that secrete antibodies that bind to laminin. I successfully developed an ELISpot that captures and detects B cells that secrete IgM, using polyclonal goat anti-mouse IgM plate coat and monoclonal mouse anti-IgMa detection reagent. Results from ELISpot assays using intact laminin protein antigen as a plate coat are inconsistent using current conditions. The next stage of this project involves using a laminin peptide antigen capture reagent and anti-laminin antibody-producing cell lines as positive controls to modify our assay technology. Ultimately, enumeration of autoantibody secreting B cells will provide insight into the mechanisms by which immune tolerance is lost in NZB lupus.

**Preston Cotnoir**

***Independent and Combined Effects of Aging and HIV  
Affect the Neurocognitive Capacities of Cocaine Users***

Research Advisor: Christina Meade

Medical Psychology

Background: Cocaine use has a harmful effect on adult neurocognitive functioning. Combined with an HIV-positive serostatus, the risk of neurocognitive impairment is even greater. However, few researchers have examined the impact of aging on neurocognitive functioning in the context of HIV and cocaine. Aims: This study examines how the independent and combined effects of aging and HIV affect the neurocognitive capacities of cocaine users. Methods: The sample includes 34 adults, ranging in age from 21 to 63, who met criteria for current cocaine dependence. Approximately half of the sample had a verified HIV diagnosis. With the support of URS funding, this semester we enrolled an additional 11 participants who were “older” (>50 years) and “younger” (<35), enabling the current analysis. In terms of neuropsychological domains, verbal learning, visuospatial memory, rates of information processing, and sustained attention were measured. Results: Preliminary results show that as HIV-positive and cocaine using individuals aged, their neurocognitive functioning decreased. Specifically, there are significant mean t-score differences for verbal learning, visuospatial memory, and sustained attention. The results from this analysis are relevant to both clinicians and researchers who work with HIV-infected persons.

**Steven Dallas**

***When Bigger is Actually Better: The Effect of Brand Logo Size and Familiarity on Consumer Attitudes and Purchasing Intentions***

Research Advisor: Tanya Chartrand

Psychology and Neuroscience

During the course of the day, consumers are continually exposed to brands and brand logos. Fleeting, unintentional encounters with brands have been referred to as Incidental Consumer Brand Encounters (ICBEs). The current research examined two important aspects of the brand logos in ICBEs—their relative size and familiarity to the consumer. The study revealed that repeated exposure to familiar brand logos—regardless of their size—did not cause participants to change their attitudes with respect to the brands. However, repeated exposure to large logos of novel brands led participants to like the brand more, rate it as more popular and possessing a larger market share, and report being more likely to purchase the brand's products for a friend than repeated exposure to the small logos of the novel brand or exposure to no logos. The practical implications and limitations of the research are discussed.

**John Davis**

***Effect of Elizabeth River Sediment Exposure on Antioxidant Defenses in Cancer and Non-Cancer Cells***

Research Advisor: John Davis

Pathology

A population of Atlantic killifish (*Fundulus heteroclitus*) inhabiting a contaminated site on the Elizabeth River (Norfolk, VA) is tolerant to the acute toxicity of sediments from the site. Previous research shows that upregulated antioxidant defenses played a role in the acute and heritable tolerance of the toxicity to Elizabeth River sediment extract (ERSE), a complex mixture of toxicants derived from the contaminated water of the Elizabeth River that has been shown to increase oxidative stress in killifish. The enhanced ability to clear harmful reactive oxygen species (ROS) through increased antioxidant production is a phenomenon that our laboratory has observed in cancer cells that have acquired resistance to therapy. With this knowledge, this study proposes to determine cancer cell response to ERSE compared to the response seen in non-cancer cells and determine the mechanism of any differential response. This information will help to further elucidate the ability of cancer cells to become adapted to high levels of toxic ROS, allowing them to evade treatment, and determine new targets to inhibit this ability. Cell viability, proliferation, and antioxidant and pro-survival signaling data from both the cancer cell lines and normal cell line was obtained.

**Renata Dinamarco**

***City of Pembroke Pines Small Business Entrepreneurial Preparedness***

\*Service Opportunities in Leadership Project

Research Advisor: Kari Lock Morgan

Statistical Science

The City of Pembroke Pines is a South Florida suburb of the Miami - Fort Lauderdale - Pompano Beach Metropolitan Statistical Area. The voters in Pembroke Pines approved a bond issue regarding Economic Development in 2005, specifically addressing the issue of eastern development. City staff proposed a project to redevelop the older, eastern portion of the city in late 2008 because economic activity in the region has declined due to the population shifting to the newer, western front of the city. One of the noted key challenges of this redevelopment project is “to update the perceptions that eastern businesses can and will provide the same level of customer satisfaction as newer commercial areas.” My report aims to explore these perceptions, specifically that business owners in the east may be underprepared or otherwise different when compared to those in the west. It is important to understand the demographics of the small business population that drives the economy in east Pines in order to make informed policy decisions. I interviewed 55 businesses in the east and west regions of the City to find that there are no significant differences between how prepared entrepreneurs in the east and west are to open a small business. However, owners in the east are much more likely to hold negative opinions of the City government. Overall, resources are underused and under-promoted. I also found that attractive streetscapes act as an incentive for businesses to locate themselves in those regions.

**Emily Du**

***Social learning of food preferences in rhesus macaques***

Research Advisor: Michael Platt

African and African American Studies

The brain mechanisms that allow animals to develop food preferences by observing conspecifics remain unknown. This study examines the effects of temporarily inactivating a set of prefrontal regions on the ability of monkeys to learn from observing conspecifics. A Demonstrator monkey tastes good and bad-flavored foods in front an Observer monkey who has had no previous interaction with the foods. Learned preferences are then separately measured in the Observer when he is presented food behind a glass. The behaviors of the Observer towards these foods are compared to his behaviors towards foods that he has already tasted. Food preferences are measured using behaviors related to interest in the food, such as frequency of lip-licking and time spent looking at food. Our preliminary results have shown that Observer monkeys develop preferences for food that they have never tasted. Our hypothesis is that the inactivation of three neural areas, the insula, anterior cingulate gyrus, and anterior cingulate sulcus, will prevent social learning while leaving non-social learning unaffected.

**Kaitlyn Dunlap**

***Neural correlates of social reward processing and friendship quality in adults with high functioning autism***

Research Advisor: Karen Murphy

Psychology and Neuroscience

Autism spectrum disorder (ASD) is a pervasive developmental disorder that is defined by social and communication impairments in addition to repetitive stereotyped behaviors and interests (DSM-IV, 2004). Social deficits associated with autism often cause impairment in forming and maintaining friendships and a lack of social and/or emotional reciprocity, which is crucial in the development of friendship. According to the Social Motivation Theory of Autism, individuals with autism are less motivated by social rewards, which contributes to impaired social functioning. The present study utilized functional Magnetic Resonance Imaging (fMRI) techniques in addition to questionnaire data to investigate whether the ability to form friendships is related to the processing of social rewards and specifically the neuronal activation associated with altruism among adults with high functioning autism. The central hypothesis was that scores on the Friendship questionnaire (FQ) in adults with ASD would be related to the neural responses to social reward in the ventral striatum, particularly in the nucleus accumbens. More specifically, individuals with ASD who show reduced responses in striatal regions during trials where they are playing to win money for others would also have greater difficulty in forming friendships.

**Xuan Duong Fernandez**

***Moderators of behavioral reactions in romantic relationships***

Research Advisor: Mark Leary

Psychology and Neuroscience

In every romantic relationship, people become angry, annoyed, or frustrated by their partner's behaviors even when those behaviors do not have large tangible consequences for their own well-being. This study examined potential moderators of these reactions, including the degree to which a social exchange violation is perceived in the behavior, the amount of relative power participants feel they have in their relationship, and their satisfaction with the relationship power dynamic. To investigate how these variables contribute to emotional and behavioral reactions to a partner's trivial transgression, 250 men and women who were in a monogamous, committed relationship described their reactions to a partner's annoying behavior and answered questions about the behavior and their reactions. Results showed that perceived social exchange violations strongly predict responses to trivial transgressions. Among women, greater sense of power was associated with more anger towards the partner's behavior, as well as greater desire and effort to change the behavior. Greater sense of power was negatively associated with nonreaction across all participants. For women only, higher satisfaction with power predicted less passive disengagement in situations of high exchange violation when compared to those who were less satisfied with their power.



**Donald Ellis**

***Role of Mxi1 and Mxi0 in the Pathogenesis of Neuroblastoma***

Research Advisor: Michael Armstrong

Pediatrics- Hematology/Oncology

In aggressive cases of neuroblastoma, the third most common extracranial tumor in children, the oncogene “N-Myc” is significantly overexpressed. These advanced cases portend a poor prognosis, which is why novel treatment methods that can affect the N-Myc pathway are critical. Mxi1 and Mxi0 are two alternatively transcribed transcription factors that play a role in neuroblastoma tumorigenesis, with suspected tumor suppressive and proliferative roles, respectively. I tested the hypothesis that Mxi1 inhibits the growth of N-Myc amplified tumors, and that Mxi0 gives them a growth advantage. In order to accomplish this task, I cultured neuroblastoma cell lines and infected them with a lentivirus that contained my gene of interest: either Mxi1 or Mxi0. Using an inducing agent called Doxycycline, I was able to overexpress these proteins in vitro and determine their effect on viability and proliferation without compromising the cell lines. I used techniques of RT-PCR and gel electrophoresis in order to verify that the infected cells were indeed responding to the inducing agent by expressing Mxi1 or Mxi0. Upon verification and screening of potential candidates, I began testing the effects of overexpressing Mxi1 and Mxi0 on cell viability and proliferation. I performed viability and proliferation assays on samples with varying levels of an inducing agent. I found that with increasing levels of Mxi0, neuroblastoma cells seemed to become more aggressive and proliferate more quickly. With increasing levels of Mxi1, neuroblastoma cells began to lose their growth advantage compared to the control, and proliferate at a slower rate.

**Eric Emery**

***The Effects of Childhood Acute Lymphoblastic Leukemia Treatment on Neurocognitive Outcomes***

Research Advisor: Robert Thompson

Psychology and Neuroscience

Due to increasing rates of remission for children and adolescents with acute lymphoblastic leukemia (ALL), current research has been focused on immediate and delayed treatment effects. However, neurocognitive changes occurring during chemotherapy treatment are not well understood. As a secondary analysis, the purpose of this study is to characterize the changes in nonverbal areas throughout the different phases of ALL treatment. A total of 37 participants, 3-10 years of age, from two medical centers were enrolled in the primary study, but only 15 high risk and standard risk patients had complete data for all follow-up evaluations. The patients were evaluated within twenty-eight days of baseline diagnosis and for three consecutive years (year 1, year 2, and year 3, respectively) on measures of fine and gross motor skills and visual-motor integration. Significant declines in visual-motor integration were observed at all three follow-up years for high risk and exclusively year three for standard risk. Motor skills were initially lower than population expected means at baseline and remained lower for all three years, particularly the high risk group. These results indicate disease and treatment effects that negatively impact areas of nonverbal development for children and adolescents undergoing ALL treatment. Sustained deficits and the influence of treatment stratification implicate the need for future research and the initiation of early cognitive intervention.

**Katherine Ferguson**

***Petrology of sulfides in the Middle Banded series of the Stillwater Complex, Montana, USA***

Research Advisor: Alan Boudreau

Earth and Ocean Sciences

The 2.7 billion year old Stillwater Complex is a layered igneous intrusion located in Montana. It contains a layer known as the J-M Reef which has been extensively studied and mined for its platinum group elements (PGE), which are associated with sulfide minerals. How this layer formed is under debate, with two main theories. The traditional view is that the J-M Reef is the result of the settling of sulfide minerals that exsolved from the melt as it became more evolved and sulfide-saturated. The alternative hypothesis is that the ore components (S, Cu, and the PGE) were leached from the rocks and moved upward through the partially crystallized melt by magmatic volatile fluids. This project aims to find information to support one of these theories through examination of sulfides from the Middle Banded series, a 1750m thick section above the J-M Reef. This series includes troctolites and olivine-bearing gabbros and gabbro-norites. These rocks contain multiphase Cu- and Ni- sulfides in addition to more common Fe-sulfide minerals. The observed assemblages of sulfides differ from those expected in magmatic crystal fractionation and settling models where nickel is quickly depleted and copper becomes dominant. Instead, the nickel and copper profiles indicate modification of sulfides during cooling, possibly by late magmatic vapor that caused melting and remobilization of ore elements. The nickel content of sulfide minerals fluctuates considerably within the Middle Banded series but does not decrease overall as expected and, while the copper remains fairly constant and shows no marked increase.

**Alyssa Fowers**

***Leading by example: Using fictional exemplars to reduce bias against women in leadership.***

Research Advisor: Lasana Harris

Psychology and Neuroscience

The literature on implicit bias suggests that female leaders are thought of as less skilled than their male colleagues, and may encounter greater gender-based bias than women in subordinate positions. The current study uses an exemplar-based media intervention to try to decrease the amount of implicit bias faced by female leaders. Participants read information about and viewed images of existing fictional women who were authoritative, subordinate, or power-neutral and were instructed to either perform a mentalizing or visual search task. Exposure to female characters under any condition reduced men's bias against women in leadership. In contrast to the literature, no backlash effect was observed against fictional women leaders. Implications of these results for representation of female leaders in the media and for future research are discussed.

**Cassidy Fox**

***All My Children: Factors Underlying the Misnaming of Familiar Individuals***

Research Advisor: David Rubin

Psychology and Neuroscience

In social situations, we commonly need to remember someone's name; occasionally, we make mistakes with someone's proper name being misremembered or even forgotten altogether. Literature exists explaining why this phenomenon occurs when addressing new acquaintances, but little work has been done to explain the misnaming of highly familiar individuals. Our study explores the conditions underlying the misnaming of familiar individuals, both within the family and within friend groups. We conducted surveys of undergraduates and Amazon Mechanical Turk workers, querying whether they had either been misnamed (study 1) or had personally committed misnaming (study 2) and what social and emotional conditions may have spurred the phenomenon of misnaming to occur.

**Justin Fu**

***Cell Senescence Alters Proliferation and Markers of Inflammation in Human Cord Blood-Derived Endothelial***

Research Advisor: George Truskey

Biomedical Engineering

Atherosclerosis develops in regions of a blood vessel where there is high endothelial cell (EC) turnover and high oxidative stress, both of which can cause senescence of the cell. Disruption of cell junctions during cell division and subsequent increases in permeability allow macromolecules from the blood to enter the tissue, leading to the formation of an atherosclerotic plaque. In this study, we tested the hypothesis that senescence of human cord blood-derived endothelial cells causes a decrease in cell proliferation and an increase in expression of markers of inflammation, ICAM and VCAM. hCB-ECs were exposed to hydrogen peroxide at a range of concentrations. EdU assays were used to stain cells in S-phase of the cell cycle. Phase contrast images were taken to determine morphological changes in ECs. Fluorescent staining of ICAM and VCAM were performed to determine levels of cellular adhesion molecules. Results show that  $H_2O_2$  decreases the percent of cells in S-phase for both younger cells and older cells. However, the younger cells are more resistant to the oxidative stress at lower concentrations ( $p < 0.01$ ). Morphological analysis showed that cell area immediately after exposure to hydrogen peroxide decreased ( $p < 0.01$ ), but increased to pre-exposure levels after a recovery period. hCB-ECs also respond to increasing amounts of oxidative stress by increasing expression of markers of inflammation, ICAM and VCAM. The results of this study demonstrate that the age of hCB-ECs alters their response to oxidative stress in terms of decreased proliferation, decreased cell area, and increased expression of inflammatory markers.

**Devon Gagliardi**

***The Effects of Introversion and Extraversion on Ego-Depletion***

Research Advisor: Tanya Chartrand

Psychology and Neuroscience

The study presented in this paper will examine the differences found in introverts and extraverts and their levels of ego-depletion after a conversation with a stranger. Although the assumptions that introverts become deflated and extraverts become inflated after social interactions are widely accepted, they have never been experimentally tested. Introversion and extraversion are considered some of the best predictors of a person's happiness. If social interactions are more depleting for introverts than extraverts, it would be important to develop ways to reduce this fatigue. In this study participants filled out the HEXACO-PI-R self report form, which tested their personality before entering the lab. Upon entering the lab, participants completed a base-line Stroop task. Next, each participant took part in an 8-10 minute conversation with a stranger (a confederate). Finally, they completed the Stroop task a second time to measure depletion. The results of the above procedure are not significant ( $p = 0.29$ ) but show a slight downward sloping trend. This trend supports our hypothesis that introverts become more depleted after a conversation with a stranger compared to extraverts. The trend shows that as a person's extraversion score becomes larger, there is less difference between the scores on Stroop 1 and Stroop 2. The implications of this study display the importance of developing ways for introverts to engage in social interactions while decreasing the effects of ego-depletion. Previous research has shown that mimicking may be a low risk way for introverts to affiliate with a stranger and reduce fatigue.

**Ryan Gimple**

***The Ring Gland: Katanin-p60 in the Development of the Nervous System in Drosophila melanogaster.***

Research Advisor: Nina Sherwood

Biology

Microtubules are an important element of cytoskeleton and are critical for cellular processes including mitosis, meiosis, and cellular transport, as well as for maintaining cellular structure. In neurons, microtubules play crucial roles in the development, stability, and function of dendrites as well as in axon guidance and synapse formation. Katanin-p60 (Kat60), the canonical member of the microtubule severing protein family, interacts with and shapes the structure of microtubules. While some work has been done to describe the function of Kat60 in vitro, a complete model of the in vivo effects has yet to be developed. Deletions of Kat60 have been associated with abnormal brain development during metamorphosis as well as adult stage lethality. To address the mechanism behind these features, I showed that the reintroduction of Kat60 in the ring gland rescues lethality associated with homozygous deletions of Kat60, suggesting that microtubule-severing activity is important for the function of this critical endocrine gland. To investigate further, I attempted to rescue Kat60 lethality by performing an ecdysone feeding assay; however the addition of this important ring-gland derived hormone failed to rescue Kat60 associated lethality. Next, I studied the subcellular microtubule localization within the ring gland, but identified no greatly significant differences in microtubule structure within this region. These studies contribute to a comprehensive model for the in vivo function of Kat60 in the Drosophila nervous system, but more investigation is necessary to define the precise cellular role of this key microtubule severing protein.



**Jacob Golan**

***Phylogeographical Effects of Pleistocene Glaciations:  
Genetic Variation in Eastern North America Sphagnum***

Research Advisor: Jonathan Shaw

Biology

Pleistocene glaciations in the northern latitudes of North America created extremely harsh conditions for plant populations limited by immobility. In the face of such extreme environmental change, plants may migrate to more suitable regions, adapt, or go extinct. Adaptations for survival in refugial centers of the genus *Sphagnum* (peat moss) are poorly described in eastern North America. It is of interest to know if *Sphagnum* populations survived periods of extreme climatic conditions south of glaciated northern latitudes in eastern North America. *Sphagnum capillifolium* can be found in high moisture environments throughout eastern North America, both north and south of the maximum Pleistocene glacial boundary. Ten microsatellite markers were amplified using *S. capillifolium* samples from across eastern North America. Genetic diversity does not vary latitudinally and there appears to be little genetic differentiation between samples taken north and south of the maximum glacial front. Bayesian cluster analyses suggest that two groups of microsatellite genotype can be resolved among the samples included in the study. The genotype groups appear to be randomly distributed across eastern North America, and some individuals are admixed for the two groups. These results suggest either continuous inbreeding amongst disjointed populations, recent divergence of populations, or the retention of ancestral genotypes across populations. Genetic evidence from this study does not indicate a concentration of diversity south of the glaciated area, typical of so-called refugial centers.

**Ana Luiza Graneiro**

***Motor Representation in the Somatosensory Cortex: The Effects of Learning on the Duration and Magnitude of Neuronal Firing***

Research Advisor: Miguel Pais-Vieira

Neurobiology

Techniques that allow recording neural activity have seen significant technological advances in the last two decades. Among such techniques is the use of multi-electrode arrays that allow extracellular recording of multiple cortical and subcortical regions in real-time, while animals are performing various tasks. One of the most studied regions in rodents is the somatosensory cortex (S1), an area that has been mostly associated with tactile information processing. Here we describe S1 activity during a motor oriented task. Arrays of electrodes were implanted in the S1 of rats and neuronal activity was recorded during a food grasp task. Specifically, the rat learned to extend its forepaw through a narrow aperture in order to obtain a food reward. Patterns of activity recorded from S1 were characterized by both increases and decreases of activity around the time of arm movement. Additionally, comparison of sessions performed during the initial and late stages of learning further indicated that magnitude and duration of neuronal firing rates had changed as learning occurred. These results suggest that S1 may have a fundamental role in sensory as well as motor related tasks in rodents.

**Ian Harwood**

***How University Decision-Makers Select Sexual Violence Prevention Programs***

\*Service Opportunities in Leadership Project

Research Advisor: Joel Rosch

Public Policy

Sexual violence on college campuses occurs at epidemic proportions, with approximately one in five women experiencing sexual assault during their college years alone. Yet universities' prevention efforts rarely match the scope of the problem. Through interviews with eight decision-makers at four universities, I identified six key factors that influenced decision makers. I then distributed a survey to explore these factors with a larger sample, reaching 59 participants from 26 states through a national list serv for sexual assault prevention practitioners. Surveys revealed that the programs selected most often by program coordinators were not the programs they found most effective. The factors guiding decision makers partially explain this disconnect: To avoid law suits or negative media attention, universities sometimes discouraged prevention work that drew attention to the problem of sexual violence. However, in the wake of negative public attention, this pressure worked in the opposite direction. Research and expert advice sometimes influenced program selection, as did Student input. Program coordinators ended programs or limited the scope of programs based on the amount of resources allocated. Prevention work sometimes depended on dedicated individuals who went above and beyond their job description. Decision makers' beliefs about perpetrators and victims influenced program design. Policy implications include offering more specific federal guidelines for Title IX compliance that emphasize program effectiveness, using program effectiveness as a guide for program selection at the university level, and coordinating prevention efforts across departments to implement a comprehensive approach.

**Kelly Heo**

***Moving Outside the Hermit Kingdom: Policies and Programs that Aid North Korean Adolescent Refugees***

Research Advisor: Hwansoo Kim

Religion

Currently, there are over 20,000 North Korean refugees in South Korea with at least 2,000 entering each year. North Koreans hope to experience freedom and comfort in their new home but tend to find only poverty and discrimination. With growing public dissent towards unification, policy makers have turned to adolescent refugees' education in hopes of refuting South Koreans' negative stereotypes as well as to nurture the future leaders of unification. As a result, several groups outside of the government have opened alternative schools that cater to these young refugees. After conducting interviews with sixteen refugee students and six teachers/school administrators, this study will identify as well as analyze policies and programs that aid North Korean refugees in being academically and acculturatively successful.

**Andrew Hickey**

***HIV-associated Hepatic Tuberculosis***

Research Advisor: Christina Meade

Global Health

A worldwide resurgence of tuberculosis (TB) has coincided with the acquired immunodeficiency syndrome (AIDS) pandemic. Rates of infection had dropped precipitously prior to this pandemic, but in 2011 there were 8.7 million new cases of TB and 1.4 million TB deaths. TB is the leading cause of death in AIDS patients, accounting for one quarter of their mortality. Co-infection of TB and human immunodeficiency virus (HIV), the cause of AIDS, provides a host of complications that increase morbidity and mortality. One important complication is the development of extrapulmonary TB (EPTB). EPTB is infection occurring outside the lungs, which are the primary site of TB infection in the majority of cases. Typically in EPTB cases, tuberculous bacilli have disseminated from the lungs to other organ systems. It is estimated that 50% of HIV-positive patients co-infected with TB have EPTB. Given the complications of diagnosing and treating EPTB, an understanding of TB in all its forms is a necessity, especially in regions where HIV and TB are highly prevalent. Manifestation of TB in the liver is known as hepatic TB. Hepatic TB has previously been considered to be rare and has not been well described in the medical literature. This study presents 20 confirmed cases of hepatic TB diagnosed at King Edward VIII Hospital in Durban, South Africa, in the heart of the lethal TB/HIV syndemic.

**Brendan Huang**

***Separation and Nitric Oxide Quantification of Hemoglobin Variants in Umbilical Cord Blood***

Research Advisor: Timothy McMahon

Medicine- Pulmonary

The vasodilator nitric oxide (NO) can be bound to hemoglobin (Hb) in the form of an S-nitrosothiol (SNO) functionality. When the partial pressure of O<sub>2</sub> is low, red blood cells (RBCs) release NO equivalents from SNO-Hb to enhance blood flow and increase O<sub>2</sub> delivery. Newborn babies have two different variants of hemoglobin, adult (Hb A) and fetal (Hb F). Since Hb F binds O<sub>2</sub> more tightly than Hb A and SNO-Hb is associated with oxygenated Hb, we hypothesize that Hb F may also bind a higher concentration of NO. Our laboratory aimed to measure the NO/SNO content of Hb F and Hb A and establish basal levels for each in normal term deliveries. We report the development of an ionic exchange chromatographic (IEX) method to completely separate Hb F and Hb A in human umbilical cord blood. Decreasing the particle size of the IEX exchange media from the range of 45-165 micrometers to 34 micrometers greatly enhanced the separation efficiency, as predicted by chromatographic theory. An increasing ionic strength gradient of pH 8.4 Tris buffer through the 34 micrometers particle-filled IEX column allowed for complete separation of Hb A and Hb F. This method allows for each Hb variant to be isolated and analyzed independently for their NO/SNO levels in order to establish their respective basal levels during birth. The ability to assay HbF-specific NO/SNO has the potential, to provide a biomarker, for example in decision-making relevant to the selection and titration of NO-based therapies such as inhaled NO.

**Mariah Hukins**

***Do sex differences affect behavioral thermoregulatory strategies in lemur species?***

Research Advisor: Leslie Digby

Evolutionary Anthropology

Thermoregulation is the ability for an animal to maintain its internal body temperature. Due to the high costs of regulating temperature physiologically, behavioral thermoregulation is more energy efficient. While previous studies have characterized thermoregulatory behaviors in mammals, few have examined how sex differences influence thermoregulatory behaviors. Sex differences in energy costs can be attributed to the contrast in male and female parental investment. Females endure more energetic costs while pregnant as well as costs of lactation. Males on the other hand acquire smaller energetic costs for sperm production and male-male competition during the breeding season. Lemurs have relatively low metabolic rates and clear sex differences in parental investment. Here we test the hypothesis that females will exhibit greater use of thermoregulatory behaviors than males using 21 individuals from 3 species of lemurs (*Lemur catta*, *Eulemur flavifrons*, *Eulemur mongoz*) housed at the Duke Lemur Center. Data collection involved scan samples recording behavior, sun or shade exposure, substrate, individual identification, ambient temperature, wind and humidity. Males and females both showed use of thermoregulatory behaviors through decreasing energy conserving behaviors as temperature increased. In some instances, females also displayed patterns opposite of what was expected. Data was further distinguished between breeders and non-breeders but no clear patterns were found. Overall, these results suggest no clear sex difference of behavioral thermoregulation.

**Taylor Jackson**

***The Effect of HIV and Cocaine on Impulsivity and Functional Connectivity***

Research Advisor: Christina Meade

Global Health

There is a well-documented link between cocaine abuse and HIV/AIDS. Given their prevalent comorbidity and their joint association with impaired decision making, understanding the ways in which both alter brain and behavior is an issue of great clinical importance. In this study, the effects of HIV and cocaine on impulsivity were assessed using two behavioral measures: the Balloon Analogue Risk Task (BART) and delay discounting. The behavioral performances were also correlated to resting state fMRI functional connectivity. The results of the study showed a significant group difference between delay discounting performance of the three experimental groups: HIV-positive individuals with cocaine dependence, HIV-positive individuals without cocaine dependence, and HIV-negative individuals with cocaine dependence. Additionally, an effect of HIV on BART performance and an effect of cocaine dependence on delay discounting were found. There were also differences in functional connectivity as a result of cocaine dependence and HIV. The results of the study have demonstrated an effect of both HIV and cocaine on functional connectivity and changes in impulsivity. These results could have implications for future treatment and understanding of the pathology and behaviors associated with both disorders.



**Ryan Johnson**

***Don't Worry Be "Happy": Mother-Child Emotion Talk  
During a Picture-Book Task***

Research Advisor: Makeba Wilbourn

Psychology and Neuroscience

Emotions are an important tool for effective communication between humans of all ages. Humans have evolved the ability to use not just their words, but also their faces as communicative tools. Even young infants are capable of expressing and recognizing certain salient emotions. However, little is known about how infants develop the ability to label these emotions. While they learn to label objects early on in infancy, they take longer to acquire labels for emotions. This could be due to the greater cognitive load required to process these more complex social cues. This study qualitatively investigates the mechanisms of emotion word learning using an interactive picture book task, a methodology that is useful in assessing socialization of emotion and parental language input. We used an original wordless picture book containing pictures children displaying prototypical emotional expressions (e.g. sad, angry, happy, disgusted, scared) as well as neutral expressions. Parents were instructed to read through the book naturally with their child. The videos from each session were transcribed and coded for labeling of emotion, use of emotion proxies, elaborativeness, explanatory language, demographic, and home reading behavior information. Results indicate that infants whose mothers who use more emotion words during the picture book task have higher emotion vocabularies. Furthermore, differences emerged in how mothers label different emotions based on the age of her child and differences in elaborations that mothers use for different emotions (i.e. mothers use more elaborations for disgust). Results from this study highlight the developmental progression of emotion label learning.

**Eun Won Kang**

***Unpacking Achievement: A Richer Exploration of the Relation between Achievement and Motivation***

Research Advisor: Lisa Linnenbrink-Garcia

Psychology and Neuroscience

Students' motivation to do well in classes and their academic achievement operate in a cyclical manner. However, achievement does not simply refer to obtaining a high grade at the end of the semester; achievement can be the overall learning experience a student receives through numerous feedbacks on their academic performance. The current study analyzed how first-year engineering students' exam scores, gender, and exam-to-exam grade changes predicted students' future motivation in engineering under the expectancy value theory. This study was exploratory in analyzing these achievement-related variables; one of the study's central objectives was to shed more light on conceptualizing achievement as a dynamic construct. While first exam grades and gender were found to be predictors of several motivational variables, exam-to-exam grade changes were not. This has important implications for the educators: students seem to value their first exam performance more strongly than the overall experience of mastering the engineering material.

**Agata Kantorowska**

***Fetal Membrane-Associated Bacteria in Preterm Delivery and Premature Rupture of Membranes***

Research Advisor: Patrick Seed

Pediatrics-Infectious Diseases

Rupture of the membranes (ROM) of the amniotic sac and chorion is usually a normal event associated with labor. However ROM may occur at inappropriate times relative to labor and the time of pregnancy. When ROM occurs prior to 37 weeks of gestation, it is referred to as preterm premature rupture of membranes (PPROM). PPRM carries significant risk of maternal and neonatal morbidity and mortality from infection, preterm labor, umbilical cord compression, and placental abruption. There are many risk factors associated with PPRM, one of which is subclinical intrauterine infection. Identification of major bacterial species correlated with PPRM could lead to more effective strategies for its prevention. Fetal membrane samples were collected from women at the Duke University Medical Center experiencing term and preterm delivery, with and without premature ROM and associated chorioamionitis. Total DNA was extracted from fetal membrane samples, and PCR was performed using primers against a portion of the bacterial 16S ribosomal DNA. Preliminary sequence analysis demonstrated a high level of bacterial diversity within the membrane samples. Two bacterial genera were notably associated with preterm birth and PPRM. *Ureaplasma* has previously been connected to chorioamionitis and appeared to dominate when present in a sample. A novel association was found between PPRM samples and *Methylobacteria*, which had known associations with cases of UTI in normal hosts and invasive disease in the immunocompromised. Future studies will evaluate additional samples and quantitative measurements to further strengthen associations between specific bacterial types and pregnancy outcomes including PPRM.

**Alice Kim**

***The Precious Littles: Destruction of a Creation,  
Creation of a Destruction***

Research Advisor: Raquel Salvatella de Prada

Art, Art History, Visual Studies

What is destruction? What does it mean to destroy something? And what is destruction's particular relationship to art? The expansive notions of creation and destruction have been frequent concerns and themes of art since the very beginning and have given rise in recent years to a near-obsessive need to document and preserve this art at all costs. I seek to better understand the often-interdependent relationship of the yearning to create and the capacity to destroy. I will explore this through the context of destruction of art, destruction in art and creation and destruction as broad implications of cultural and social norms. It is important to note here that destruction of art and destruction in art are not one and the same, but rather imply specific and distinct purposes, desires, limitations and traditions. I will also examine myself and my own affinity, or lack thereof, for destruction, the creation, and ultimate destruction of my own work of art.

**Skylar Klager**

***Increasing Signal Longevity: Conspecific response to odorant mixing and decay in ring-tailed lemurs***

Research Advisor: Christine Drea

Evolutionary Anthropology

Male ring-tailed lemurs (*Lemur catta*) typically mix the secretions from their brachial and antebrachial glands by rubbing the two glands together, then 'wrist-marking'; however, the reason for this mixing of the glandular secretions has remained unknown. Based on the different chemical compositions and volatility of the two secretions, we hypothesized that much of the information content from wrist-marking derives from the volatile antebrachial secretions, whereas the brachial secretions, composed primarily of the heavy nonvolatile 'adhesive' squalene, function mainly as a fixative to prolong the antebrachial signal. We investigated if this chemical mixing serves to extend the signal by presenting 11 male lemurs with both 'natural' and 'synthetic' experiments, using both fresh odors and 24-hour decayed odors. While the natural experiment used antebrachial and brachial gland secretions, the synthetic trial used squalene in place of brachial secretion to mimic the proposed fixative function. The time the animals spent smelling the odorants indicated that they were significantly more interested in the two mixtures (antebrachial plus brachial and antebrachial plus squalene) under the 24-hour delayed condition than for antebrachial alone, with a slight preference for the natural mixture over the synthetic mixture. We also found that mixed antebrachial plus brachial presentations obtained significantly more interest than antebrachial secretion alone in the fresh condition. These findings support our hypothesis that the mixing of the two secretions serves to prolong the scent signal, and indicates that brachial secretion likely contains additional chemical information beyond squalene that is of interest to lemurs.

**Jeong Hoon Ko**

***Mechanochemically activated polymeric system for triggered release of molecules***

Research Advisor: Stephen Craig

Chemistry

Mechanochemistry offers a tool for site-specific activation of molecules that may be otherwise inaccessible. Current mechanochemical toolset provides systems that undergo cleavage of specific bond to yield two macromolecules, but there is no system that can release a small molecule upon mechanical activation. Anthracene is a fluorescent molecule that easily undergoes Diels-Alder reaction with many different dienophiles. By inserting a Diels-Alder adduct of anthracene with a dienophile in a polymer and applying mechanical force along the polymer backbone, it may be possible to trigger retro Diels-Alder reaction and cause dissociation of the small molecule dienophile from the polymer. To test this hypothesis, we developed Diels-Alder adducts of anthracene-poly(methyl acrylate) with maleic anhydride and 4-phenyl-1,2,4-triazoline-3,5-dione. Atom transfer radical polymerization (ATRP) was used to add methyl acrylate monomers to the anthracene-dienophile adduct as an initiator and obtain polymer with molecular weight around 120 kDa. Ultrasound was used to provide mechanical energy for retro Diels-Alder reaction, and release of the small molecule was observed by measuring recovery of anthracene fluorescence. The proposed system may have potential applications in self-healing materials, biomimetic transducer, and drug delivery.

**Nelly-Ange Kontchou**

***A Comparative Sociological Investigation of the Conceptions and Perceptions of Mental Health and Illness in Arica, Chile and Rome, Italy***

Research Advisor: Luciana Fellin

Romance Studies

This comparative study aimed to discover the principal factors that influence the perceptions that citizens of Arica, Chile and Rome, Italy have about mental illness. Specifically, the study aimed to investigate how these perceptions affect the societal acceptance of mentally ill individuals and to identify different sources of stigma. In both cities, mental health services exist for free use by citizens, but stigma makes the use of these services and the acceptance of those who use them somewhat taboo. Past studies on the topic of mental health stigma have investigated the barriers to accessing mental health services, the inception and effects of Basaglia's Law, strategies to combat stigma and images of mental illness in the media. To discover Aricans' opinions on mental health and illness, personal interviews were administered to five mental health professionals, and a 20-question survey was administered to 131 members of the general population. In Rome, 28 subjects answered an 18-question survey as well as an interview, and 12 professionals participated in individual interviews. From these interviews and surveys, the lack of economic, structural and human resources to effectively manage mental health programs was gleaned. Moreover, most participants recognized the presence of stigma and opined that mentally ill patients are barely accepted by their respective societies. Stigma stems from multiple concurrent sources, but efforts to reduce it must differ according to the specific society's needs. Stigma prevents people from caring for their mental health and from integrating those with mental illness into one cohesive community.

**Allison Kratka**

***The Effects of Obesity Stigma: How media explanations for the causes of obesity impact weight bias***

Research Advisor: Laura Richman

Psychology and Neuroscience

The current study involved an examination of the impact of messages regarding the causes of obesity on anti-fat stigma (implicit and explicit) and self-esteem, while also examining internalization of the thin ideal as a mediating variable between explicit anti-fat bias and self-esteem. These messages include four explanations: the built environment, pollution, personal control, and a prime condition. The overall research question was how do various health messages regarding the causes of obesity (environmental v. pollution v. personal responsibility) affect implicit and explicit anti-fat stigma, self-esteem and internalization of the thin ideal in undergraduates who self-identify as normal weight and overweight? 90 students from a school in the Southeastern United States participated in the study. They first read a newspaper prime detailing the causes of obesity and then responded to a variety of measures examining implicit and explicit anti-fat bias, self-esteem, internalization of the thin ideal and several manipulation check questions. Results indicated no significant differences in levels of implicit or explicit anti-fat bias between conditions, although all participants' levels of bias increased from a pre-screen to a study time measure of explicit anti-fat stigma. Additionally participants in the pollution condition agreed significantly less with their prime article than did participants in other conditions, and all participants exhibited extremely high levels of anti-fat attitudes. Several explanations for these results are discussed, as are future directions for research.



**Charles Kuang**

***Role of PAR Proteins in Anchor Cell Invasion***

Research Advisor: David Sherwood

Biology

During cell invasion, a cell travels through the basement membrane (BM), a dense and highly cross-linked extracellular matrix structure that functions as a barrier separating tissue. This behavior has profound consequences in many normal developmental processes and in cancer metastasis. Anchor cell (AC) invasion during vulval development in *C. elegans* is the first in vivo model for studying the invasion of a cell through a BM at single cell resolution. In wild type animals, the AC initiates connection between the uterus and vulva by breaching through two BMs. We isolated a novel mutant in which the entire AC – “over-invades” through the BMs, whereas in wild type animals only the basal portion of the AC invades. We have mapped this mutation to a heterochronic gene, *lin-29*, encoding a transcription factor. This over-invasion phenotype suggests that LIN-29 positions the AC and controls the depth of the AC invasion. Given a number of cell-cell junctions and adhesions formed between the AC and neighboring cells, one possible explanation for the *lin-29* over-invasion phenotype is that defects in cell-cell junction and adhesion allow for the AC to leave its original niche, thereby invading too far. Thus, my research focuses on examining the expression pattern and localization of members of the PAR protein family, a group of major cell polarity regulators that plays key roles in cell-cell junction and adhesion. PAR-2, PAR-3, and PAR-6 are among the proteins studied in *lin-29* mutants using corresponding translational reporters with confocal microscopy imaging techniques along with RNA interference.

**Tyler Lacy**

***Affinity Probe Synthesis for a Cancer Stem Cell Toxin  
(Compound 302)***

Research Advisor: Qiu Wang

Chemistry

In efforts to discover small molecules with novel anti-cancer properties, compound 302 (C302) was found to selectively eliminate “stem-like” cancer cells over their "normal" counterparts. The goal of my summer research was to develop a viable affinity probe for use in identifying the biological cellular targets of C302. I accomplished this through synthesizing C302-based affinity probes. The probes were later tested and it was confirmed through cell proliferation inhibition experiments that the probe retains potency and selective toxicity towards “stem-like” cancer cells. The developed affinity probe will be used for future cellular pulldown experiments and target identification efforts to reveal novel biological targets regulating cancer stem cells. This knowledge will lead to a better understanding of cancer and enable the development of more effective cancer therapy to address this global health problem.

**Carmen Lai**

***Top-Down Modulation of the Influence of Regret on Decision Making***

Research Advisor: Kevin LaBar

Psychology and Neuroscience

We often hear the advice, “Be rational,” or “Don’t let your emotions cloud your judgment.” People seem to view the ability to compartmentalize or remove emotions from decision making as a way to improve decisions and promote success. However, human decision making is inherently colored by emotions, which lead to behavior that deviates from economic models and biases in decision making. The current study looks at whether cognitive emotion regulation, or altering emotional response by changing the way one thinks about decisions, can modulate the influence of emotions, such as regret, on decision making. In the ‘Individual’ manipulation, subjects are instructed to consider each decision in isolation of others, focusing on each decision as if it were the only one. In the ‘Multiple’ emotion regulation manipulation, subjects will be instructed to consider a run of decisions as a portfolio, focusing on the context of multiple decisions. We will measure emotional response during decision deliberation phase and outcome phase at the behavioral, physiological and experiential levels using participant choice data, skin conductance response, and subjective confidence and happiness ratings, respectively. We suspect that the ‘Multiple’ manipulation will lead to more consistent choice behavior, more positive valence experiential ratings, and decreased physiological response in decision making. An emotion regulation strategy that broadens one’s mindset in decision making may lead to decreased incidence and influence of regret on decision making, and could potentially lead to more consistent or adaptive behavior.

**Rachel Leng**

***Tongzhi Tales in Mainland China: Gay Male Subjectivities  
in Online Comrade Literature***

Research Advisor: Carlos Rojas

Asian and Middle Eastern Studies

This study considers Comrade Literature (*tongzhi wenxue*), a genre of contemporary Chinese homosexual (*tongzhi*) fiction, as it has emerged online in Mainland China. Although Comrade Literature first emerged in Hong Kong and Taiwan in the 1980s, it was only after the mid-1990s with the advent of the internet that these gay-themed fiction were disseminated online in Mainland China. There are now hundreds and thousands of stories designated as “Comrade Novels” archived on various Chinese websites. This study contends that online Comrade stories are not simply an expression of an underground Chinese gay culture; they are a site of queer resistance facilitating the intersection of homosexual and heterosexual subjectivities. In addition to providing a catalyst for China’s *tongzhi* subculture, online Comrade fiction capitalizes on new media platforms to present same-sex desire to the broader public. An analysis of four online Comrade stories focuses on the representation of male same-sex relations and the logics of these texts as *tongzhi* write out of a heteronormative milieu. The three chapters in this thesis will each examine distinct aspects of China’s Comrade Literature: gender performance in same-sex romance narratives, homosexual abjection in Comrade bildungsromans, and the continuum of homosocial and homosexual intimacy in military Comrade fiction. Collectively, these four works span a stylistic and temporal timeline that reflect developments in the *tongzhi* subculture on the Mainland. They renegotiate the boundary between heterosexual and homosexual behaviors, establishing a unique *tongzhi* identity that is at once assimilated into yet differentiated from mainstream Chinese heteronormative society.

**Rebecca Leylek**

***In Vivo Roles for the Arp2/3 Complex and Ninein***

Research Advisor: Terry Lechler

Cell Biology

A cell's cytoskeleton gives it a characteristic shape and drives cell migration. The cytoskeleton consists of microtubules, actin filaments and intermediate filaments. In this work, I have examined the physiological role of two proteins involved in the organization of the cytoskeleton, the Arp2/3 protein complex and ninein. The Arp2/3 protein complex nucleates actin filaments to form  $\gamma$ -shaped branches, which is important for cell migration. In this project, I found an unexpected inflammatory response in Arp2/3 conditional knockout mice. Immunofluorescence imaging showed an increased presence of immune cells in the dermis of inducible adult knockout mice indicating a link between regulation of the actin cytoskeleton, inflammation, and the atopic dermatitis-like phenotype. Arp2/3 has been previously shown to have a role in fibroblast cell migration. For this project I conducted in vitro experiments as a model for wound healing and found that Arp2/3- keratinocytes also had impaired cell migration, indicating an additional role for Arp2/3 in epithelial tissue. The other protein investigated in this work, ninein, is a centrosomal protein involved in the anchoring of microtubule minus-ends. Observation of the specialized arrangement of microtubules in cells of the inner ear led us to investigate a possible effect of ninein knockout in mice on the structure and function of the cells that make up the sensory epithelia of the cochlea. Imaging and comparing the organ of Corti in wild type and ninein knockout mice has been an ongoing goal of this project, with exciting prospects for understanding its role in this tissue.

**Daniel Li**

***Accounting for Concomitant Variables: Lipid Adjustment for Chemical Exposures***

Research Advisor: David Dunson

Statistical Science

Some environmental chemical exposures are lipophilic and need to be adjusted by serum lipid levels before data analyses. There are currently various strategies that attempt to account for this problem, but all have their drawbacks. Some methods are prone to bias while other methods are unable to account for varying chemical exposure effects for varying serum lipid levels. To address such concerns, we propose a new method that uses both Box-Cox transformations and a simple Bayesian hierarchical model to adjust for lipophilic chemical exposures. We compared our Box-Cox method to existing methods in simulation studies. We ran simulation studies in which increasing lipid adjusted chemical exposure levels did and did not increase the odds of having a disease, and we looked at both single exposure and multiple exposures scenarios. We also analyzed an epidemiology dataset that examined the effects of various chemical exposures on having birth defects. Compared to existing methods, our Box-Cox method produced unbiased estimates, good coverage, similar power, and lower type I error rates. These results were observed in both single and multiple exposures simulation studies. Results from analyzing the birth defect data differed from those of the existing methods. Our Box-Cox method is a novel and intuitive way to account for the lipophilic nature of certain chemical exposures. It addresses some issues with existing methods, is easily extendable to analyzing multiple exposures, and can be used in any analyses that involve concomitant variables.

**Courtney Liu**

***Feasibility of a Dance Intervention for Children Exposed to Intimate Partner Violence***

Research Advisor: Timothy Strauman

Psychology and Neuroscience

Statistics on the amount of children who have been exposed to intimate partner violence range from 3.3 million to as many as 10 million in the United States. Exposed children are at risk for many adverse outcomes including low self-worth and low-self esteem. In the past dance interventions have successfully improved the self-concept of disadvantaged children and adolescents, but an intervention does not exist for children exposed to domestic violence. Along with increasing the self-concept of participants, a dance intervention has the potential to build community and foster a fun environment in a shelter or support group setting for families experiencing domestic violence. A dance intervention is particularly useful for children who suffer from low self-concept but do not qualify for mental healthcare through Medicaid because their symptoms are not severe enough to warrant a diagnosis. Therefore, the current study seeks to develop the Dance for Domestic Violence Intervention (DDV) in conjunction with a local Latina domestic violence support group. The study will adapt the intervention to the needs of exposed children, demonstrate the feasibility of dance interventions for domestic violence, and generate hypotheses for future trials.

**Courtney Liu**

***Trauma and Mental Health Services for Domestic Violence Survivors: Barriers to Services and Potential Solutions for the Greater Durham Area***

\*Service Opportunities in Leadership Project

Research Advisor: Timothy Strauman

Psychology and Neuroscience

Domestic violence is the use of psychological, physical, sexual, and financial abuse to control one's intimate partner. Domestic violence is the number one cause of physical injury for women ages 15-44 (NIH) and 1/3 of female homicide victims are killed by a romantic partner (NCADV). The psychological effects of Domestic Violence have been well documented. Golding's (1999) meta-analysis found that 47.6% of survivors experience depression, 63.8% have PTSD symptoms, 17.9% exhibit suicidality, and 8.9% live with substance abuse problems. However, 69% of centers are operating with less than 20 paid staff members and 42% of programs operate with a budget of less than \$500,000 per year. Mental health programs are the first to be cut because emergency safety and legal services take precedence. Therefore, it is important for psychologists to consider the resource scarcity of domestic violence support programs if they hope to see their research disseminated in ways that benefits survivors.



**Carmen Lopez**

***Modeling the Folate Pathway in Escherichia coli***

Research Advisor: Fred Nijhout

Biology

Folates are a class of metabolites that are essential to living cells across all life. Because they are especially important in aiding cell division, they are targets for antibiotics, such as trimethoprim. I aim to model the pathways of folate production and interconversion in *Escherichia coli*. I began my work by assessing a previously published mathematical model of the *E. coli* folate pathways, published by Kwon and Rabinowitz, which explored the effects of trimethoprim. I explored the model in depth and found ways to improve upon it. My model produced some improvements and laid the foundation for future work. I was able to see how the parameter values changed over time under the treatment of trimethoprim. In the future, this model can be expanded and be used to model a variety of other experimental conditions under the effect of trimethoprim.

**Madeline Lyons**

***Selective Highlighting***

Research Advisor: Elizabeth Marsh

Psychology and Neuroscience

Highlighting is among one of the most popular study strategies for learning text, but its utility and function are poorly understood. Past research suggests that at best, highlighting moderately improves retention of material. Previous data from our lab indicates that those subjects who naturally highlight fewer words perform better on subsequent testing that requires them to integrate knowledge from the entire text and apply it to a novel problem. In this study, we investigated the potential of constraining the amount of information that a subject highlights and the subsequent effect on retention of material and ability to solve problem solving questions. We expected that those that were asked to highlight only 15% of the text would be able to better solve novel problems than those who were asked to freely highlight or those who simply read the material with no active study strategy. However, there were no significant differences between the constrained highlighting, free highlighting, and read only groups. This suggests that highlighting, either freely or constrained, is at best no better for learning material needed for problem solving than simply reading a text.

**Shamaita Majumdar**

***Oncogenic Behavior of Long Noncoding H19 RNA in Ovarian Cancer***

Research Advisor: Susan Murphy

Gynecology Oncology

Abnormal noncoding RNA (ncRNA) expression of the imprinted H19 gene is postulated to be involved in ovarian carcinogenesis. It remains unknown whether H19 functions as an oncogene versus a tumor suppressor, considering it has been paradoxically cited as having both attributes according to relevant research. Little is understood about the molecular etiology of ovarian cancer and this project is anticipated to shed light on potential targets for therapeutic interventions. The proposed research will explore the role of H19 using gene silencing techniques in cancer tissue, normal tissue, and control fetal tissue, and then record phenotypic changes that occur in these cell lines after H19 knockdown. We will utilize molecular techniques such as short hairpin RNA (shRNA) technology to silence expression of H19 long non-coding RNA using a human ovarian cancer cell culture model. After confirming repression of H19 transcripts, we will then compare gene expression levels using expression microarrays and phenotypic endpoints in immortalized normal fallopian tube fimbriae epithelium (ovarian cancer precursor cell type) to those in ovarian cancer cells. We will evaluate cell proliferation, cell-doubling times, anchorage-independent growth capacity, invasiveness, cell migration, and sphere formation. Our results will supplement existing literature to determine whether this gene functions as an oncogene or tumor suppressor and provide valuable information regarding the capacity to exploit H19 as a therapeutic target in ovarian cancer.

**DeDe Mann**

***Anxieties of Power: Pierfrancesco Riccio and the Politics of Art***

Research Advisor: John Martin

History

In mid-16th century Florence, Italy, politics and art collided. At this moment in history, Florence was undergoing one of the most noteworthy political ideological shifts of all time, reverting from a republic to a duchy. Pierfrancesco Riccio was the primary secretary of Duke Cosimo I de' Medici, the ruler of Florence during this time period. Riccio played an instrumental role in the daily operations of Cosimo's court. After spending a month this past summer studying letters and other primary documents from this court housed in the Archivio di Stato in Florence, I chose to examine the power dynamic of the court through the lens of artistic commissions. Many of the letters I studied indicate Riccio's involvement with artistic commissions during Cosimo's rule. He was often the intermediary between the court and the artist. Riccio helped to shape, define, and enforce the message that the artistic commissions of the court were designed to communicate. This message was one of legitimacy, designed to convey that Duke Cosimo I de' Medici was the rightful ruler of Florence. Those affected by this message ranged from the people of Florence all of the way to the most powerful rulers of Europe. My examination of Riccio and his all-encompassing influence in Cosimo's court marks one of the first in-depth examinations of Riccio and his effect on the visual expressions of power of this court.

**Jackson Matteucci**

***Analysis of Z Boson Decays Involving Photon Emissions***

Research Advisor: Alfred Goshaw

Physics

My primary research has consisted of using 2011 and 2012 ATLAS data from the Large Hadron Collider at CERN to analyze Z boson decays involving photon emissions. By directly comparing data generated by theory predictions with the observed ATLAS data, we are able to determine the accuracy and validity of the standard model. Particularly, I have examined the possibility of a charge interior structure to the Z boson, challenging the standard model's claim that the Z boson is a non-charged elementary particle. I have conducted all of my analysis in ROOT and have collaborated with Professor Goshaw, his electroweak team, as well as the  $Z\gamma\gamma$  ATLAS subgroup during the course of my analysis. While my research is still ongoing, preliminary results, from both 2011 and 2012 ATLAS data, suggest that the standard model correctly predicts these  $Z\gamma$  and  $Z\gamma\gamma$  interactions. There appears to be no indication of interior charged structure to the Z boson, although we are still in the process of fully investigating all of the contributions to the observed interactions. While these results are promising, there is still much work to be done in fully measuring and calculating the errors associated with these cross sections.

**Emily Mendenhall**

***Development and the Moroccan Artisanal Fishing Sector***

Research Advisor: Michael Orbach

Nicholas School of the Environment

As climate change and overexploitation plague Morocco's productive Canary Current ecosystem, the Moroccan government has redefined its focus from industrial and deep-seas fleets to development of the vast artisanal fishing sector operating close to shore. Through domestic and international ventures the Moroccan government increased its support for marine research, education and technical training, marine environmental protection, and enhancement of the artisanal sector. The contributions of the United States and Japan, in particular, have helped to transform rudimentary landing sites all along the Moroccan coast into embankment facilities and fishing villages and to improve inland fish markets, previously existing port facilities, and wholesale and vendor resources. While these developments either have been completed or continue to unfold, I traveled to a sampling of Morocco's southern fishing villages and ports to research the effects of these developments on the lives of the artisanal fishers and the businesspeople associated with artisanal fishing. Over the course of one month, I visited two large ports in Casablanca and Agadir and three fishing villages—Tifnit, Immsouane, and Imi Ouaddar. Through interviews with fishermen, policy officials, fish vendors, local consumers, and fishing cooperative representatives, I collected varying perspectives of the dynamic life of Moroccan artisanal fishers and the people and policies that have and continue to determine its current situation and future.

**Wilma Metcalf**

***Enhancing the Learning Environment: Supporting Students at the Urban Assembly School for Criminal Justice***

\*Service Opportunities in Leadership Project

Research Advisor: Alma Blount

Public Policy

During the summer of 2012, I researched the issues facing students at the Urban Assembly School for Criminal Justice in Brooklyn, New York and how the school could respond to these problems. I found that students were struggling with issues of sexual identity, bullying, parental apathy, involvement with illegal activities, and general feelings of helplessness in the face of these problems. While these responses are predictable of high school females, the school needs to provide them with additional support. The school should: 1) provide teacher and family training sessions on issues of sexuality, bullying, gang activity, and the intersection of these, 2) incorporate a curriculum of acceptance and tolerance into the school, and 3) create an after-school "safe space" where students can express concerns, fears, and problems and then create strategies to help address them. In turn, these measures will enhance student success and well-being.

**Brandon Metra**

***Functional Neuroimaging of HIV-Associated Effects on Delay Discounting in a Cocaine-Using Sample***

Research Advisor: Christina Meade

Psychology and Neuroscience

Despite widespread access to antiretroviral therapy, people living with HIV often suffer from a syndrome of virus-mediated neurocognitive impairment. Additionally, substance abuse is often a comorbidity in people living with HIV and presents its own detrimental effects on the brain. This study examined the effect of HIV infection on a task measuring impulsive decision making, using a matched sample of 8 HIV-positive and 8 HIV-negative adults, all presenting with current cocaine dependence. Participants underwent a classical delay discounting task outside and inside a functional magnetic resonance imaging scanner, with data collected regarding behavioral impulsivity trends and neural substrates underlying participants' processing in the scanner. Compared to cocaine-using HIV-negative participants, cocaine-using HIV-positive subjects did not display a significant difference in choice impulsivity. However, the two groups presented differences in task-related activation of brain regions as a result of the task, including increased activation for HIV-negative subjects in the dorsolateral prefrontal cortex and anterior cingulate cortex and increased activation for HIV-positive participants in the occipital cortex. These functional activation differences may indicate neural damage and compensatory mechanisms associated with chronic HIV infection and extend previous neuroimaging findings into drug-using populations. Additionally, these findings may imply directions for future research concerning neural and behavioral substrates of HIV infection.



**Michelle Michelson**

***Analysis of song sharing in an eastern population of song sparrows, *Melospiza melodia****

Research Advisor: Rindy Anderson

Biology

Songbirds learn their songs by listening to adult males in their population. In song sparrows (*Melospiza melodia*), song learning leads to song type sharing among males who learned songs from the same adult tutors. Song sharing allows song sparrows to communicate through ‘song type matching,’ a common behavior during aggressive interactions. Previous research has suggested that whole song sharing is more prevalent in west coast populations compared to east coast populations. Recently however, it has been suggested that the difference in song sharing between populations is due to the methods used by different researchers to assess song sharing, and that if the same method was applied song sharing would be similar in and east and west populations. To address this question I determined whole song sharing among males inhabiting Forest Hills Park in Durham using the ‘common method’ approach. I recorded each bird’s song repertoire, and mapped its territory to determine whether neighbors share more songs than non-neighbors. I also compared song sharing among males in 2013 with males in the park in 2010, which were collected for an experiment. Because birds that currently occupy Forest Hills Park may have immigrated from different surrounding areas, I predicted that sharing will be lower in 2013 compared to 2010. These data will contribute to the debate over whether song sharing differs between populations, and more broadly, will aid our understanding of birdsong function and the evolution of learned communication systems in animals.

**Sami Natour**

***Characterizing the role of serine-threonine kinase 24a during gut morphogenesis using transcription activator-like effector nucleases (TALENs) in zebrafish***

Research Advisor: Michel Bagnat

Cell Biology

Most internal organs consist of epithelial layers organized into tubes that surround a fluid-filled lumen. To uncover cellular processes controlling lumen formation, the Bagnat lab uses the zebrafish (*Danio rerio*) gut as a model system. The zebrafish gut is made from a solid rod of endodermal cells that differentiate to form an epithelial cell layer encompassing a single intestinal lumen. Because in this system lumen formation occurs de novo, proteins involved in this process must either be expressed or differentially regulated during lumen formation. A gene expression profile was created from isolated epithelial cells from transgenic fish expressing a gut-specific, GFP-tagged membrane protein. Topping this list of genes upregulated during lumen formation was *stk24a*, a gene encoding a serine-threonine kinase (STK24 in humans). Analysis by in situ hybridization confirmed *stk24a* transcripts to be highly gut-specific and enriched in the gut during lumen formation. To characterize the role of this kinase during gut development, a reverse-genetics approach was taken using transcription activator-like effector nucleases (TALENs) to generate homozygous *stk24a* mutants. Crossing these mutants into a line of fish expressing f-actin tagged with GFP (Tg(*gata5:la-GFP*)) and analyzing gut morphogenesis from the embryo-stage to adulthood by confocal fluorescence microscopy and whole-mount imaging will provide further insight into the cellular and physiological roles of this kinase during gut morphogenesis.

**Jasmine Nee**

***sTBRIII promotes neuronal differentiation and reduces proliferation in neuroblastoma***

Research Advisor: Gerard Blobe

Pharmacology & Cancer Biology

A current therapeutic strategy for the pediatric cancer neuroblastoma (NB) is neuronal differentiation. The membrane-bound type III TGF-beta receptor (TBRIII) is a proteoglycan co-receptor that binds TGF-beta and fibroblast growth factors (FGFs), among other ligands, and may be released in a soluble form. In this study, we investigated the ability of soluble TBRIII (sTBRIII) to promote neuronal differentiation, the ability of sTBRIII to reduce proliferation, and the effects of TBRIII on localization of phosphorylated extracellular signal-related kinases (ERK 1/2) using three NB cell lines: SH-SY-5Y, SHEP, and SK-N-AS. Through western blotting for signaling and differentiation markers, we found that sTBRIII treatment promotes neuronal differentiation and enhances FGF2-induced differentiation in NB cells, both of which are similar to effects of expression of membrane-bound TBRIII. This finding also supports the proposed binding interaction between FGF2, FGF2 receptors, and sTBRIII. Additionally, through thymidine assays, we confirmed that sTBRIII treatment decreases proliferation of NB cells, which corroborates the observed increase in neuronal differentiation. Lastly, through immunofluorescence, we found that TBRIII expression enhances subcellular, nuclear localization of activated phosphorylated ERK 1/2, which provides further insight into the mechanism for how TBRIII promotes differentiation. Demonstrating that the soluble sTBRIII has the ability to both promote neuronal differentiation and reduce proliferation may help in designing molecularly targeted therapies for this pediatric cancer.

**Matthew Nemoy**

***Dopamine Influence on Cognitive Flexibility and Stability***

Research Advisor: Tobias Egner

Psychology and Neuroscience

The Val158Met single nucleotide polymorphism codes for two different versions of the Catechol-O-Methyltransferase (COMT) enzyme that degrades dopamine in the prefrontal cortex, and individual differences in allelic composition of this polymorphism have previously been linked to individual differences in measures of cognitive flexibility (task-switching). Specifically, individuals with the Val/Val genotype (i.e. relatively lower levels of prefrontal dopamine) have been found to be more cognitively flexible, as reflected by smaller switch costs, than Met/Met individuals (i.e. higher levels of prefrontal dopamine). The present work investigates whether this enhanced cognitive flexibility comes at the cost of reduced stability, as reflected in a greater susceptibility to interference from task-incongruent distracting stimuli, especially during switch trials. A cohort of genotyped healthy volunteers completed a task-switching paradigm designed to measure both cognitive flexibility (task-switching) and stability (task-interference). Response time and accuracy were analyzed as a function of COMT (Val/Val vs. Met/Met), task transition (repeat vs. switch) and distracter congruency (congruent vs. incongruent). Results indicated a three-way interaction between these factors: in line with predictions, the Val/Val group displayed small switch costs on congruent trials but greatly slowed responses for incongruent switch trials, compared to the Met/Met individuals who displayed moderate switch costs for both congruent and incongruent conditions. These findings show that the greater flexibility in changing task sets in Val/Val carriers comes at the price of reduced protection of ongoing task-sets from distracters. More broadly, our results are consistent with the proposal that prefrontal dopamine levels mediate the balance between cognitive stability and flexibility.

**Emily Ngan**

***The role of microglia in addiction***

Research Advisor: Staci Bilbo

Psychology and Neuroscience

Microglia, the immune cells of the brain, have traditionally been studied for their immunological functions. Here, we suggest novel involvement of microglia in addiction. In response to drugs of abuse such as morphine, microglia shift to an activated state that involves upregulated release of cytokines and chemokines, the small cell-signaling protein molecules of the immune system. Previous work in our laboratory has demonstrated that increased expression of anti-inflammatory cytokine, IL-10, inhibits morphine-induced glial proinflammation within the nucleus accumbens, and prevents morphine relapse. We seek to translate these findings to a mouse model in order to further our research through transgenic manipulations. Through this project, we verify the viability of a mouse model through investigation of the molecular response to morphine administration in mice. We identify the optimal time point (e.g. 60 minutes) for identifying the molecular profile of morphine administration. Additionally, important patterns of cytokine expression observed in rat studies involving toll-like-receptor (TLR)4, CCL4, and neuronal fractalkine, are reproduced in mice. TLR4 has been implicated as a major player in addiction; therefore, we tested the learning and memory abilities of TLR4 knockout (KO) mice through a fear-conditioning paradigm since addiction is closely related to cognition. TLR4 KO behavior analysis shows no significant difference in fear conditioning between male TLR4 wild-type (WT) and KO mice. Densitometry analysis also shows no difference in microglia density, morphology, or distribution within these animals. Collectively, these results confirm the viability of a mouse model in continuing our research, investigating the role of microglia in addiction.

**Amanda Nickens**

***Gender differences in career aspirations of college science students***

Research Advisor: Lisa Linnenbrink-Garcia

Psychology and Neuroscience

Women are less likely than their male peers to major in a science, technology, engineering, or math (STEM) discipline. In 2006, approximately 30 percent of male freshmen compared with 15 percent of female freshmen planned to major in STEM. The current study draws on previous research focused on achievement motivation and the factors influencing an individual's achievement-related choices, including undergraduate education choices and occupational aspirations. Studies using Eccles' (1983) expectancy-value model of achievement motivation have demonstrated that individuals' expectancies for success (i.e., competence beliefs) and perceived value of the task influences performance, persistence, and educational and occupational choices. The current study seeks to explain how the four components of subjective task value and expectations for success relate to students' ideal and expected career beliefs. Specifically, this study extends prior research by Frome et al. (2006) by focusing on the discrepancies between first year undergraduate science students' ideal and expected career beliefs, and how males and females are similar or different in these discrepancies. Results revealed that students' perceptions of their ideal and expected career are related to differences in their valuing of science and expectations for success in science. One notable finding was that gender moderated this relationship, particularly among students who had a discrepancy between their ideal and expected occupation.

**Adrienne Niederriter**

***Development of in vivo models for the genetic dissection of craniosynostosis***

Research Advisor: Erica Davis

Cell Biology

Craniosynostosis, or premature cranial suture fusion, is a common birth defect in humans, affecting ~1 in 2,500 live births, and is associated with more than 100 clinically distinct entities. Although many of these syndromes have been associated with specific genes, the interpretation of genetic information and assignment of predictive clinical value continues to represent major problems in medical genetics. These studies aim to better our functional interpretation of alleles associated with disease, promote enhanced accuracy of diagnosis, and potentially generate models to conduct rapid therapeutic screens. To accomplish this, we are developing physiologically relevant, highly sensitive and specific in vivo assays for interpreting nonsynonymous changes detected in patients. By harnessing the experimental tractability of a zebrafish model, we can rapidly assay an allelic series of previously reported missense mutations by methods of gene overexpression and knockdown in the developing zebrafish embryo to model gain-of-function and loss-of-function mutations. Here, we present data for variants in Fibroblast Growth Factor Receptor 2 (FGFR2), a transcript mutated frequently in Apert, Crouzon, and Pfeiffer Syndromes. By querying a total of about 100 mutant alleles across five or more genes, we expect to establish a system to compare the zebrafish and human craniosynostosis morphologies and elucidate key commonalities and differences between their developmental pathways.

**Hunter Nisonoff**

***Combining Optogenetics with Bioluminescence***

Research Advisor: Ute Hochgeschwender

Neurobiology

In optogenetic manipulations of neurons genetically addressable opsins are activated by physical light sources, resulting in stimulation or silencing of neuronal activity. We set out to use a biological light source to activate opsins by combining a light-generating protein (luciferase) with a light-transducing protein (opsin). Our strategy was to fuse the blue light-generating luciferase from the marine copepod *Gaussia princeps* to a light-sensitive ion channel, channelrhodopsin, yielding a bioluminescent channelrhodopsin, or luminopsin. This allows the channelrhodopsin moiety to be activated by light produced by the luciferase moiety upon application of its substrate, coelenterazine (CTZ). In proof-of-concept experiments we showed that responses to CTZ were detected in cultured neurons expressing luminopsins, yielding photocurrents and membrane potential depolarizations. However, to become a widely used tool, we needed to improve the performance of luminopsins. To this end we systematically investigated mutant variants of both the luciferase and the channelrhodopsin molecules in order to identify the fusion protein with the best dose response. By combining a *Gaussia* luciferase variant which produces more bioluminescence with *Volvox* channelrhodopsin 1 which is more sensitive to blue light, we were able to generate action potentials in cultured neurons. Furthermore, we expanded this approach to light sensing proton pumps to allow inactivation of genetically-defined neuronal populations. We generated new luminopsin constructs by fusing the *Gaussia* luciferase variant to the blue-light sensing proton pumps, Arch-T and Mac. Application of CTZ to cultured neurons expressing these constructs resulted in silencing of neuronal activity.



## Crystal Owens

### *How plants respond to light: Formation of photobodies in Arabidopsis thaliana*

Research Advisor: Meng Chen

Biology

When plants receive light, seedlings undergo photomorphogenesis. Hypocotyl elongation is repressed (slowing growth), chloroplasts develop (turning green), and leaves develop. In *A. thaliana*, intercepted red light causes a molecular-level conformation change in one of its five photoreceptors, phytochrome B (phyB). phyB is converted from an inactive (Pr) to an active (Pfr) form causing phyB to translocate from the cytoplasm into the cell nucleus. When exposed to far red light, phyB reverts to the inactive form and relocates to the cytoplasm. In normal plants, active phyB dimers presumably form photobodies within the nucleus. These photobodies initiate numerous responses to light interception including hypocotyl growth. Light intensity alters the size and number of photobodies. How photobodies form is not known. To study their formation during light exposure, two phyB mutants, one with constitutionally active functional photobody (YH-YFP line) and a second with constitutively nonfunctional photobody (PhyB-Cterm-YFP line) were crossed with a line of plants that overexpresses phyB (phyB-CFP (PBC)). Offspring were grown for 96 h under four different levels of red continuous light. Hypocotyl length was measured and photobody morphology was imaged by fluorescent microscopy. Just one functional copy of phyB as a dimer was adequate for nuclear import and for formation of a photobody. However, photobody function required both parts of the dimer to be functional. This observation provides new insight into how photobodies form and their function.

**Arin Pamukcu**

***Neurotrophic effects of astrocyte-secreted proteins Hevin and SPARC***

Research Advisor: Cagla Eroglu

Cell Biology

Investigation on the role of astrocyte-neuronal signaling in the regulation of synapse formation, maturation and stabilization is crucial for a better understanding of how synapses normally develop, as well as how synapses degenerate under pathological conditions. Matricellular proteins secreted by astrocytes, such as hevin and SPARC, regulate synaptic development and modulation in rodent CNS. Here we show the neurotrophic effect of hevin and SPARC in the neuronal development in neuronal survival and neurite outgrowth using a purified retinal ganglion cells culture system. We then verify the possibility of using the modified version of the traditional cortical culture system to emulate the limitations in the RGC culture method. Finally we investigate the hypothesis that Hevin interacts with non-compatible isoforms of neurexin and neuroligin by performing an ELISA Assay with different Fc-tagged splice isoforms of neurexin. Due to the importance of hevin's interaction with trans-synaptic cell adhesion molecules in synaptic development as well as synaptic connectivity processes that are impaired in neuropsychiatric disorders, we will further develop methods to study the role of hevin's interaction with neurexin and neuroligin in promoting spine formation, maturation and stabilization using the modified cortical neuron culture system.

**Arin Pamukcu**

***How did the situation of domestic violence change after the November 2011 earthquake in Van, Turkey?***

\*Service Opportunities in Leadership Project

Research Advisor: Alma Blount

Public Policy

This project is executed in collaboration with Van Women's Association (VAKAD), a local independent feminist NGO that works on women's education and advocacy. The project aims to investigate the change in the situation of domestic violence towards women in Van, Turkey after the November 2011 earthquake. Following the earthquake, there has been a large migration to and from Van causing a transformation in the demographics of the city, a change in the trust amongst the community to the governmental and non-governmental institutions and an alteration in the meaning of "family", all of which caused an increase in physical domestic violence towards women. This project uses a survey performed on a random sample of 500 women currently living in Van's various neighborhoods and container housing areas, temporary housing sites for families whose houses have become uninhabitable. The project hopes to illuminate the personal side of the change in domestic violence in Van after the earthquake by conducting one-on-one surveys with women currently living in the Kevenli container-housing area. One-on-one interviews are conducted with VAKAD volunteers who have been women's right volunteers in Van, a psychiatrist from the local State Hospital specializing on PTSD cases and a lawyer specializing on women's cases, in order to get an account of the observed change. The statistical data will also be used in preparing a booklet with current information of the situation of domestic violence in the area. The interviews will be used to find a way to reduce the high levels of domestic violence towards women in the area.

**Fernando Revelo La Rotta**

***Archaeology in the Holy Land: A Weapon of History,  
Representation and Politics***

\*Service Opportunities in Leadership Project

Research Advisor: Alma Blount

Public Policy

The struggle for control over the archaeological sites in the Holy Land is another key aspect of the Israeli-Palestinian conflict. Three of the world's largest religions have roots, specifically Jerusalem. For Judaism, Jerusalem holds the remains of the temples of the Jewish King Solomon. For Christianity, the city was the stage for a large part of Jesus's life. For Muslims, Jerusalem is the location of Muhammad's night journey (memorialized by the Dome of the Rock) and the city served as the first Qibla or direction of prayer before Mecca. However, since the Israeli occupation archaeology has been a political weapon manipulated by the Israeli and Palestinian states. Israeli organizations, such as the Jewish National Fund, the Jewish Antiquities Authority and the Nature and Parks authority, are in charge of the regulation and maintenance of the many archaeological sites within the state of Israel. As a result, any interpretations of these sites is controlled by the Israeli state and attempts to establish legitimate evidence for the Israeli occupation by location historical evidence. Through this attempt, the Arab-Palestinian heritage is being destroyed and manipulated. There is also a lack of funding for the excavation of Islamic sites, due to their irrelevance to the establishment of Jewish roots in the Holy Land. Both states manipulate and control the historical sites to adapt them to a beneficial political narrative. For Israel, it is a way to establish legitimate evidence for their occupation of the Holy Land, while for Palestine it serves as a way to remind the worldwide public of their marginalization.

**Faith Robertson**

***Elucidating the Role of Cell Metabolism in the Development of Lapatinib Resistance in Breast Cancer***

Research Advisor: Neil Spector

Pharmacology & Cancer Biology

Gene amplification/overexpression of the oncogenic HER2 receptor tyrosine kinase occurs in 15-20% of breast cancers. HER2 overexpression predicts for an aggressive clinical phenotype and poor outcome. Consequently, HER2 is an attractive therapeutic target. Despite FDA approval of four HER2 targeted therapies, the development of therapeutic resistance remains a significant problem limiting their therapeutic efficacy. I sought to elucidate the biological mechanisms underlying therapeutic resistance to lapatinib, an FDA-approved HER2/EGFR kinase inhibitor. To test the hypothesis that perturbations in tumor cell metabolism contribute to resistance, I examined the effect of metabolic stresses on the growth and survival of isotype-matched pairs of human HER2+ breast cancer cell line. Differential responses to these stresses in parental *versus* lapatinib-resistant cells prompted further analysis of cell metabolism and redox state using 2-photon microscopy to determine expression of metabolites. These studies suggested that a switch in the regulation of cell metabolism had occurred from glycolysis in parental cells, to beta oxidation in resistant cell counterparts. Preliminary studies indicate that resistant cells up-regulate anti-oxidants, which may protect cells from the deleterious effects of reactive oxygen species generated as a byproduct of beta oxidation. Elucidating how tumor cells exploit non-glucose carbon sources may inform rationally designed treatment strategies to overcome or prevent the development of therapeutic resistance to lapatinib.

**Ashley Ruba**

***18-month-old Infants Discriminate and Categorize Anger and Disgust Emotional Expressions***

Research Advisor: Makeba Wilbourn

Psychology and Neuroscience

Emotional expressions are powerful social signals, capable of quickly communicating socially significant messages. These expressions are especially salient for infants, who use others' emotional expressions to inform their behavior. However, little is known about how infants transform these specific facial features into decision-making information. For several decades, the literature has disagreed on whether emotional knowledge is innate or learned. Unfortunately, much of the extant research on this question has tested children and adults, who rely on emotional labels (i.e. –happy”) to demonstrate emotional comprehension. One consistent result of these studies is that children and adults confuse the emotion disgust with anger. Researchers have suggested that infants would also struggle with these emotions, although no studies have tested this hypothesis. For this reason, the current studies assess 18-month-olds ability to discriminate (Experiment 1) and categorize (Experiment 2) anger and disgust emotional expressions. Results indicate that when tested in a visual habituation task, 18-month-old infants can discriminate between anger and disgust expressions. In a similar task, 18-month-olds can also categorize anger expressions when habituated to disgust; however, infants cannot categorize disgust expressions when habituated to anger. Gender differences suggest that females are more proficient at noticing changes in emotion. Results are discussed in terms of infant perceptual abilities and evolutionary emotion function.

**Anirudh Saraswathula**

***A Systematic Review of Racial and Ethnic Diversity of Hepatitis C Virus Clinical Trials***

Research Advisor: Andrew Muir

Gastroenterology

Hepatitis C Virus (HCV) infection is more common in African Americans. Early treatment trials were criticized for poor enrollment of African-Americans patients leading to uncertainty about treatment outcomes. Our objective was to evaluate the racial/ethnic diversity within recent HCV clinical trials in the United States and Europe. A systematic literature review of HCV randomized controlled trials (RCT's) in the United States and Europe from 2000-2011 was identified 588 HCV trials. Of the 315 (54%) meeting inclusion criteria, only 126 (40%) reported race. While 78% of RCT's conducted only in the United States reported race, 14% of RCT's conducted only in Europe reported race. There was a 5-fold increase in racial reporting among European trials after 2005. The ethnicity analysis focused on US studies, and 81/111 (73%) did not report ethnicity. Although overall racial and ethnic diversity in RCT's is higher within the United States, the percentage of African-Americans represented within HCV trials is statistically significantly lower than the expected amount given the burden of this disease in the African American population. African Americans represent approximately 23% of the US population with HCV, but 11% of HCV clinical trial participants. The burden of HCV within black populations within the United States and Europe is not reflected in the diversity of clinical trial participants. Accurate assessment of clinical trial diversity was impacted by inaccurate reporting of race in many trials.

**Evan Schwartz**

***The effects of small molecule MEK1/2 inhibitors on vaso-occlusion in sickle cell disease.***

Research Advisor: Rahima Zennadi

Hematology

Patients with sickle cell disease have reduced life expectancy and are profoundly disabled due to progressive multi-organ damage caused by acute vaso-occlusive crises. Unfortunately, current therapeutic approaches to prevent vaso-occlusion remain unsatisfactory, with most only achieving symptomatic relief. Thus, there is an unmet need for effective therapies to prevent and curtail the acute and chronic/recurrent complications that result from vaso-occlusion. Vaso-occlusion is largely promoted by abnormal sickle red cell adhesion to vascular endothelium. Recent work has shown that the mitogen-activated protein kinase ERK1/2 and its upstream effector MEK1/2 are expressed in red cells. However, ERK1/2 is active in sickle but not in normal red cells. I therefore hypothesized that inhibition of ERK1/2 signaling in sickle red cells prevents adhesion and vaso-occlusion. Here, I show that sickle red cell treatment with inhibitors of MEK1/2 reduced adhesion to activated-endothelial cells using in vitro assays. While activated-sickle red cells promoted neutrophil adhesion to non-activated endothelial cells, MEK1/2 inhibitors reduced the ability of activated-sickle red cells to activate neutrophil adherence. These results suggest that ERK1/2 activation in sickle red cells is required for adhesion to endothelium and activation of leukocyte adhesion. Importantly, treatment of human sickle red cells with MEK1/2 inhibitors ex vivo decreased their adhesion to enflamed venules and prevented vaso-occlusion in nude mouse models in vivo. MEK1/2 inhibitor infusions to nude mice also both prevented and reversed vaso-occlusion. These data identify small molecule inhibitors of MEK1/2 as potential therapy for patients with sickle cell disease to prevent painful vaso-occlusive crises.



**Claire Sorrenson**

***Playing with Power and Narrative Process in Kenya and Senegal***

Research Advisor: Catherine Admay

Public Policy

This thesis questions the viability of theatre as a development intervention by exploring the contested realities of its execution on the ground. Ethnographic investigations contrast NGO-directed –theatre for development” initiatives in Senegal with community-directed theatre projects in Kenya. In Senegal, a theatre troupe’s implementation of top-down theatre fails to align with the ideals of the participatory –forum theatre” approach on which the troupe models itself. In Kenya, the process of creating forum theatre uncovers problematic moral attitudes. An open process of collaboratively created theatre conversely replicates and even reinforces pre-existing power dynamics. Ultimately, the thesis argues for a better understanding of the limitations of theatre as a tool for development before practitioners attempt to implement theatre-based interventions. Theory and practice align in the final chapter, which provides adaptable insights for hopeful and questioning practitioners and practitioners-to-be.

**Alexis Spieldenner**

***Do El Sistema-inspired music education programs enhance the development of underprivileged youth?***

\*Service Opportunities in Leadership Project

Research Advisor: Scott Lindroth

Music

Founded in 1975 by José Antonio Abreu, *El Sistema* is a revolutionary movement for music and social change that seeks to transform the lives of children living in poverty. Though its roots are in Venezuela, the movement has since become a worldwide phenomenon. In my community-based research project, I sought to examine the academic, social, and behavioral development of students in KidZNotes, an *El Sistema*-inspired program in Durham, NC. KidZNotes currently serves 200 Durham Public School students in four Title-1 elementary schools, as well as one charter school. The racial composition of students in KidZNotes is approximately 43% Hispanic and 52% African American. Students receive 10 hours of intensive classical music instruction and also frequently perform in the local Durham community. I conducted interviews with KidZNotes parents over a period of six weeks. My results indicated that there was a high correlation between KidZNotes involvement and improvements in students' social and behavioral development. In particular, parents observed an increase in their children's self-confidence, discipline, focus, responsibility and interaction with their peers. The majority of parents also expressed that music was not perceived as an extracurricular, but rather a fundamental part of their children's lives. These results demonstrate the significance of music education programs, especially for underserved youth. *El Sistema*-inspired programs have the potential to lift the spirit of those in poverty with the riches of classical music.

**Alexis Spieldenner**

***Examining the Transformation of the Japanese Canadian Community from First-Generation to Fourth-Generation***

Research Advisor: Leo Ching

Asian and Middle Eastern Studies

Today, Japanese Canadians represent the smallest and, statistically, most “assimilated” visible minority in all of Canada. The transformation of *Nikkei*, or individuals of Japanese descent, in Canada from first-generation Issei to fourth-generation Yonsei is astounding to consider. Though once deemed “inassimilable,” Japanese Canadians currently have the highest rate of out-group pairings with an intermarriage rate surpassing 70 percent. In order to examine the reason behind this phenomenon, I explore the transformation of the Japanese Canadian community in three distinct stages. The first chapter of my thesis examines the arrival of the first-generation *Issei* and the creation of a transnational community in Canada. The second chapter explores the destruction of the transnational community, using the internment experience during World War II as a distinct event responsible in large for the distancing of Japanese Canadians from their Japanese roots. Lastly, the third chapter examines how the Canadian government’s “resettlement or repatriation” policy forcibly dispersed the community and accelerated their assimilation into Anglo-Canadian society. As a fourth-generation Japanese, I have always been fascinated with my ancestral roots. My thesis will explore how my family’s experiences intersect with the larger historical narrative. In addition to my family’s oral histories, I utilize archival material from the National Archives of Canada (Ottawa), the Ontario Provincial Archives (Toronto), and McMaster University.

**Nandini Srinivasan**

***Do Humanities Still Have a Place in Education? Evaluating the role of humanities in modern society.***

Research Advisor: Alma Blount

Public Policy

For college students, the high rates of unemployment and limited job opportunities highly dictate educational decisions. Driven by the need to secure their financial future, students consistently pursue majors that deliver the technical skills future employees desire. This has resulted, on the pre-collegiate and university levels, in a shift away from the traditional liberal arts education that encourages the humanities to one composed solely of science, technology, engineering, and mathematics (STEM). Supported by the US Department of Homeland Security, STEM claims to be linked with economic prosperity, a pipeline to prepare students for the best jobs, and essential to effective citizenship. Throughout this study, I will not dispute that science, technology, engineering, and mathematics provide a student with necessary skills. However, I would like to challenge the loss of the humanities as a result of STEM and the notion that they cannot continue to coexist. This need to conform to the economic marketplace's standards not only deprives humanities students from a comprehensive education but also reflects a fundamental shift in education.

**Charlotte Stoute**

***Effects of stress on weight loss success: A review of prospective associations between stress and weight trajectory***

Research Advisor: Gary Bennett

Psychology and Neuroscience

Stress is highly implicated in the development of obesity. A growing body of evidence indicates that stress also affects common challenges in obesity treatment, such as resistance to weight loss and weight regain that often follows weight reduction. Although the association between stress and weight change has been investigated, no systematic reviews have yet addressed the question of how stress is associated to weight trajectories in weight management programs. The aim of this systematic review is to provide a narrative synthesis of extant evidence regarding prospective longitudinal associations between stress and weight change in the context of weight loss/maintenance. Search syntax was created and applied to various databases. Study eligibility criteria include: analyses of adult participants classified as obese/overweight at baseline, enrolled in a weight management program or intervention, use of validated stress measure and objective weight calculation assessed at baseline and after 6months. Studies will be appraised using a tool designed for the present study and synthesis methods will model those outlined by PRISMA and other validated guidelines. Expected limitations include high variability (statistical analyses, stress assessment, study design) and publication/reporting bias. Findings may further our understanding of the how stress influences weight outcomes, suggest new intervention targets and help determine whether measuring certain types of stress can potentially predict treatment reponse among individuals seeking weight loss.

**Ana Susac**

***Life Script for Bosnian Croats – A Culture of War Survivors***

Research Advisor: David Rubin

Psychology and Neuroscience

Life scripts are shared cultural representations of how a prototypical life in a certain culture should look. They have been researched in several countries and have proven to be present cross-culturally. A total of 86 people aged 18 to 74 ( $M = 39.17$ ,  $SD = 14.28$ ) from two cities in Bosnia and Herzegovina completed the standard life script and life story questionnaire, as well as a selection of measures of emotional distress. The results indicated that a recent cultural traumatic event – the Bosnian war in this case – does not have an effect on the valence of the script, nor does it significantly influence cross-generational differences in expected life events. The script consisted of predominantly positive events coming mostly from the period between 15 and 30 years. This provided further support for existence of cultural life scripts that are stable and do not rely on personal experiences but on common cultural expectations. Measures of emotional distress (BDI, PCL) were correlated with valence of the life story, but also with valence and typicality of the script, suggesting that people who do not internalize the cultural expectations as well tend to also be more emotionally distressed.

**Divya Taneja**

***Implicit Self-Regulation***

Research Advisor: James Shah

Psychology and Neuroscience

Goals are the foundation of human self-regulation. At any given time, there is a limit to how many of our goals are the level of conscious awareness. Therefore, the unconscious plays a large role in how our goals are organized and prioritized in order to regulate our behavior. This project focuses on unconscious goals, and how regulating our exposure to cues in our environment can bring particular goals to the conscious level. We call this psychological process self-priming. In our study, we seek to find out to what degree people might be regulating their exposure to primes, even unconsciously. Also, we hope to find out what the potential consequences of self-priming are for individuals' ongoing self-regulation. To study this, we have designed a study with a 2x2 factorial design. The first manipulation is a health prime. To see whether participants self-prime, the second factor is foreknowledge of an eating task. We expect that those primed with a health goal and with the foreknowledge that there will be an eating task will self-prime. To measure this, we will have participants choose 6 posters from a set of 12 to place on the wall in front of them. 3 of these posters show unhealthy logos, 3 show healthy logos, and 6 show neutral logos. Depending on which posters are selected, we can see if participants self-prime. We will measure the effectiveness of the initial prime and the self-prime in the eating task, where we will record how much each participant eats.

**Ishan Thakore**

***E-Learning Program Evaluation for the SEWA Manager Ni School, Gujarat, India***

\*Service Opportunities in Leadership Project

Research Advisor: Alma Blount

Public Policy

This project details the role of Information and Communication Technologies (ICTs) in empowering rural women entrepreneurs in India. ICTs include computers, the Internet, mobile phones and other technologies, and are common in developed nations. However, a “digital divide” still persists between developed and developing nations: half of our planet, 3.5 billion people, lacks or only has limited access to a computer and the Internet. Within developing nations like India, a “gendered” digital divide also exists, as women exhibit significantly less usage of ICTs than men. This divide persists in rural areas, as millions of rural women entrepreneurs cannot take advantage of ICTs to become computer literate, bolster their business or gain skills to become hired by employers. With a stable income, these women can perpetuate the “girl-effect,” whereby educating and supporting women can drastically reduce poverty. This project questions approaches to ICT implementation in India for grassroots women entrepreneurs, and demonstrates that access is not enough to guarantee use. It questions why rural entrepreneurs have not reaped substantial benefits from ICTs. I also present a case-study of ICTs through a program evaluation conducted at the Self Employed Women’s Association (SEWA) in Ahmedabad, India in 2012. The program evaluation explores the benefits of a computer-based E-Learning platform for rural women entrepreneurs.



**Trevor Thomas**

***God in the Brain: a review of neurotheology***

Research Advisor: Keith Brodie

Psychology and Neuroscience

Neurotheology is a novel area of neuroscience that attempts to explain RSMEs (religious, spiritual, or mystical experiences) in neuroscientific terms. As yet another unique albeit controversial interdisciplinary hybrid in neuroscience, neurotheology is swelling with popularity among scientists and laypeople alike. However, published scientific works in this field have occurred sporadically since the 20th century. Research in neurotheology could have remarkable societal significance, given the importance of religion in the world, and it should be encouraged appropriately. This presentation will offer a review of spiritual neuroscience, including key studies and events, and propose several ideas to increase the volume of research published in this field. Attention will also be given to the criticisms and theoretical implications of neurotheology if it further provides empirical explanations for phenomena typically regarded as nonphysical and separate from the material world.

**Matt Truwit**

***Evaluation of a Summer Enrichment Program: Effects on Self-Concept and Motivation For Middle and High School Students***

Research Advisor: Harris Cooper

Psychology and Neuroscience

Today's educational climate places an important emphasis both on facilitating the achievement of every individual student and on minimizing the achievement gap. Summer programs have been demonstrated as effective means of doing so, particularly for low-performing students from low socioeconomic status backgrounds. However, little research has been conducted to assess what factors mediate this effect. This study aims to investigate how motivation and self-concept change for this specific population of students after attending a summer enrichment program. Analyzing the results obtained from a survey administered at both the beginning and the end of the program, this research found that over the course of the summer, some students experienced significant change in their levels of endorsement of particular goal orientations, a motivational construct that explains why students adopt achievement behaviors, which differed by gender, grade, and ethnicity. However, there was insufficient evidence to conclude that students' self-concepts and levels of intrinsic motivation differed at the end of the summer from at the beginning. Implications of the current study's findings for educational policy and suggestions for future research are discussed.

**Christine Tsai**

***Characterizing expression of gut specific zebrafish genes during lumen formation using in situ hybridization***

Research Advisor: Dr. Michel Bagnat

Cell Biology

During embryogenesis, many internal organs form through tubulogenesis of polarized epithelial cells, a process required for proper development. To dissect the molecular components controlling epithelial polarization, the Bagnat Lab uses the zebrafish gut as a model system. Zebrafish larvae are transparent and develop rapidly, allowing for the observation of tube formation and epithelial polarization in vivo. To identify genes involved in lumen formation, our lab isolated fluorescently labeled gut cells during the stage when polarization and lumen formation occur and analyzed the gene expression profile in relation to cells from the entire body. Using this microarray approach, we generated a list of genes that are gut specific or enriched in the gut during lumen formation. I utilized several techniques to validate five strong candidates from our microarray. Each gene was amplified from cDNA and subcloned into a plasmid for in situ probe generation. I then performed in situ hybridizations for *ap1s3a*, *ap2b1*, *rab11fip1a*, *rab11a*, and *myo5b* to determine whether the strong candidates are gut specific genes. In subsequent work, I plan to generate fluorescent transgenic reporters to examine protein localization for genes that are most gut specific. With expression and localization data, I will further analyze gene functions by using transcription activator-like effector nucleases (TALENs) to generate mutants for each gene to determine if their function is required for lumen formation. These studies will identify novel components involved during the formation of the zebrafish gut.

**Ezgi Ustundag**

***The Influence of Islamic Centers on the Formation of Muslim-American Identity***

Research Advisor: Jen'nan Read

Sociology

With an estimated population of 6 million, the American Muslim population is one of the fastest-growing and most diverse religious minorities in the U.S. Although many of them are immigrants from Muslim-majority regions like South Asia and the Middle East, a growing fraction of the American Muslim population is comprised of the second-generation—American Muslims with immigrant parents who were themselves born and raised in the United States. Unlike their parents, who grew up attending mosques in Muslim-majority countries, the second generation received its religious education from a wide array of sources and cultivated its own unique identity: Muslim-American. The aim of this study is to investigate one of the sources of religious education, Islamic centers, and their influence on the formation of Muslim-American identity. Islamic centers vary from mosques in several important ways, including private ownership; recreational and social activities beyond daily prayers; and an emphasis on fundraising and volunteerism that also characterizes other American congregations. This study analyzes the responses of four American Muslims to a series of interview and survey questions about their faith and participation in the activities of the Islamic Association of Raleigh (IAR). Two of the participants are second-generation Muslim immigrants and two are first-generation. Their responses suggest the IAR's diversity and emphasis on "pure" rather than "cultural" Islam led to the strengthening of each participant's faith.

**Chirag Vasavda**

***E-cadherin polarity is determined by a multi-function motif mediating lateral membrane retention through ankyrin-G and apical-lateral transcytosis through clathrin***

Research Advisor: Vann Bennett

Biochemistry

A highly conserved motif in the E-cadherin juxtamembrane domain determines apical-lateral polarity by conferring both restricted mobility at the lateral membrane and transcytosis of apically mis-sorted protein to the lateral membrane. Mutations causing either increased lateral membrane mobility or loss of apical-lateral transcytosis result in partial mis-sorting of E-cadherin in MDCK cells. However, loss of both activities results in complete loss of polarity. Residues required for restricted mobility mediate retention at the lateral membrane through interaction with ankyrin-G, while dileucine residues conferring apical-lateral transcytosis act through a clathrin-dependent process and function in an editing pathway. Ankyrin-G interaction with E-cadherin is abolished by the same mutations resulting in increased E-cadherin mobility. Clathrin heavy chain knockdown and dileucine mutation of E-cadherin both cause the same partial loss of polarity of E-cadherin. Clathrin knockdown causes no further change in polarity of E-cadherin with dileucine mutation, but does completely randomize E-cadherin mutants lacking ankyrin-binding. Dileucine mutation, but not loss of ankyrin-binding, prevented transcytosis of apically mis-sorted E-cadherin to the lateral membrane. Neurofascin, which binds ankyrin but lacks dileucine residues, exhibited partial apical-lateral polarity that was abolished by mutation of its ankyrin-binding site but was not affected by clathrin knockdown. The polarity motif thus integrates complementary activities of lateral membrane retention through ankyrin-G and apical-lateral transcytosis of mis-localized protein through clathrin. Together, the combination of retention and editing function to ensure a high fidelity steady state localization of E-cadherin at the lateral membrane.

**Alissa Wall**

***Dysfunction of 60S ribosomal protein (RPL10) is associated with X-linked microcephaly***

Research Advisor: Erica Davis

Cell Biology

Autism spectrum disorders (ASD) are clinically heterogeneous neurodevelopmental defects, which demonstrate partial phenotypic overlap with clinical entities including microcephaly and intractable seizures. Emerging evidence from both mutational screening and copy number variant analysis in humans has demonstrated that a common genetic basis underscores ASD and microcephaly. Here we report preliminary studies which further substantiate the possibility that in some instances ASD and microcephaly are allelic variants of the same disorder. Using a candidate gene approach in a large multigenerational family in which three male individuals demonstrated microcephaly, seizures, and developmental delay, we identified a novel missense variant in the locus encoding 60S ribosomal protein L10 (RPL10); this K78E change segregated with disease under an X-linked recessive paradigm. Consistent with this model, all females in the pedigree were unaffected and carriers of the RPL10 variant demonstrated skewed X-inactivation. To examine further the functional consequences of this ubiquitously expressed component of the translation machinery and relevance to severe neurodevelopmental defects in this pedigree, we are utilizing zebrafish models to test the effects of *rpl10* suppression on head size in the developing zebrafish embryo. We will assess pathogenicity of K78E and two nonsynonymous variants altering the C-terminal end of RPL10 (L206M and H213Q), reported to be associated with ASD. Taken together, these studies will further elucidate both the molecular basis of neurodevelopmental defects, and exemplify an X-linked locus that may be a minor contributor to the biased ratio of 4:1 males:females in ASD.

**Catherine Wang**

***Role of IDH mutations in development and progression of gliomas***

Research Advisor: Hai Yan

Pathology

IDH1 and IDH2 mutations are present in the vast majority of progressive gliomas, including oligodendrogliomas, astrocytomas, and secondary glioblastomas. However, the role of IDH in these tumors, as well as how it cooperates with other mutations, remains largely unknown. The goal of this research is to develop and use mouse models to further study the roles of these mutations alone and in combination with other common mutations. By breeding mice with conditional IDH1/2 mutations to mice with conditional knock-in or deletion of other genes commonly altered in progressive gliomas, we will have a more genetically faithful model in which to study the initiation and development of these gliomas. Histological analysis will then allow us to screen for features such as increased cellularity, abnormal nuclei, angiogenesis, and endothelial hyperplasia, which are commonly associated with tumor formation. This genetically faithful model can be further used to assess treatment response to drug therapies in human gliomas.

**Jessica Wang**

***Cone-specific ablation of RanBP2 causes rod death by a distinct mechanism***

Research Advisor: Paulo Ferreira

Ophthalmology

In neurodegenerative diseases, neurons die autonomously from intrinsic defects or non-autonomously from damage in nearby cells. Understanding the molecular events underlying autonomous and non-autonomous cell death is critical to our knowledge of human neurodegenerative disorders. Photoreceptors serve as great models for understanding these cell death processes as cones and rods interact intimately but possess distinct gene expressions. While rod-specific mutations are known to elicit non-autonomous death in cones and rods, much remains unknown about the impact of cone-specific mutations. This study sought to reveal the role of Ran-binding protein 2 (RanBP2), an essential protein linked to necrosis and neuroprotection, in neuron viability through the genetic ablation of Ranbp2 in cone photoreceptors. A combination of immunohistochemistry and confocal microscopy was used to identify the molecular markers and describe the cell death pathways in cones and rods. My results showed that cone-specific ablation of Ranbp2 promotes autonomous, non-apoptotic death of cones along with non-autonomous, apoptotic death of neighboring rods. Cone degeneration was accompanied by transient activation of caspase 3 and 7, while rod degeneration was characterized by early activation of Parp1 and caspase 9. These results point to a novel progression of photoreceptor degeneration whereby cone-specific loss of Ranbp2 induces secondary rod death through cell-type specific intrinsic mechanisms.



**Archer Wang**

***In Search of Chineseness***

Research Advisor: Eileen Chow

Asian and Middle Eastern Studies

My research centered on ghost stories from pre-Tang dynasties, a period spanning from 3rd century AD to 6th century AD. It was a historical period rife with domestic unrest, political conspiracies, and military coups, but it also has left posterity a multitude of collections of ghost stories, fairy tales, and eerie folktales, which I believe to be reflective of social practice, religious beliefs, political climate, and shared mentality. The shifts in social, religious, political, and economic realms enter the domain of ordinary life with significant influences on human condition and are consequently embedded in narratives. The grant also enabled me to conduct the research by studying the readership of Chinese literature. Through drawing parallels between Chinese ghost stories and similar folktales from other cultures, I was able to analyze the characteristics unique to Chinese culture and civilization. The aggregation of these characteristics, surfacing in my study, is something we can define as “Chineseness.” This question and this kind of study is of profound importance to understanding contemporary Chinese culture, since it is a civilization with geographical, social, and cultural continuity. The Chinese diaspora and the cultural variety and geographic scope of Chinese communities make this issue very complicated. My research endeavors to draw a connection between Ancient text and popular culture and sheds a light on the popular conception of Chinese cultural identity. The conclusion shows a high relevance and correlation across chronological, geographical, and even ethnic boundaries.

**Joshua Weiss**

***Therapeutic Targeting of CALM-AF10 Leukemia by Iron Chelation***

Research Advisor: Daniel Wechsler

Pharmacology & Cancer Biology

Chromosomal translocations that disrupt the Clathrin Assembly Lymphoid Myeloid leukemia (CALM) gene are recurrent abnormalities in pediatric and adult acute myeloid leukemia (AML), and are found in 5-10% of T cell acute lymphoblastic leukemias (T-ALL). t(10;11) chromosomal translocations lead to fusion of CALM with the AF10 gene and result in leukemias that are associated with a poor prognosis. The Calm protein plays an essential role in clathrin-mediated endocytosis, and is involved in the uptake of cellular iron via transferrin. Clinically, CALM-AF10 leukemias are heterozygous for CALM. The lab has demonstrated that these CALM+/- leukemias have increased expression of transferrin receptor 1 (TfR1), suggesting that they are iron deficient as a result of inefficient iron uptake. While iron chelators have been used to treat a variety of cancers, we hypothesize that CALM+/- CALM-AF10 leukemias have an inherent vulnerability to iron deprivation and may therefore be sensitive to treatment by iron chelation. To demonstrate the specific sensitivity of CALM+/- CALM-AF10 leukemias to iron chelation, we compared their effect on CALM+/+ CALM-AF10 leukemias as well as other clinically relevant leukemias. By using flow cytometry, we were able to demonstrate sensitivity to iron chelation alone in vitro; however, further studies with the Calm wildtype control must be repeated in order to confirm these results. We also tested the potential synergy between iron chelation and chemotherapy in vitro by creating isobolograms. We observed an additive effect of the two drugs on CALM-AF10 leukemia.

**Eli Wilber**

***Investigation of Cell Division Proteins in the Halophilic Archaeon Halobacterium salinarum***

Research Advisor: Dan Kiehart

Biology

All identified living organisms undergo cell division either to procreate or to produce new tissue. This makes the process of cell division a promising place to search for evolutionarily ancient mechanisms that may shed light on the cellular dynamics of early life. We studied three putative homologs of bacterial cell division proteins (FtsZ, minD, and soj) in the halophilic archaeon *Halobacterium salinarum*. We generated a salt-stable yellow fluorescent protein (smVenus) and created fusion proteins with this fluorophore and our target proteins. We identified distinct localization patterns for minD and FtsZ, indicating that these proteins are functional and actively localized within the cell. soj-smVenus fusion proteins did not display a localization pattern distinct from smVenus alone suggesting either that these fusions were non-functional or that soj is not actively localized in *H. salinarum*. minD always localizes to both poles of the cell with a variable number of puncta present along the length of the cell. FtsZ localizes to the midline or poles of the cell, a pattern consistent with its role in the formation of the Z-ring at the site of cell division in bacterial systems. Western blot analysis of cells expressing FtsZ1-smVenus using an anti-GFP antibody revealed a protein of ~80 kDa, providing further evidence that *H. salinarum* FtsZ is the ~55 kDa *H. salinarum* homolog of tubulin identified in previous studies. Overall, these results are consistent with a conserved mechanism of cell division in both Archaea and Bacteria.

**BJ Williams**

***Measuring cell-cycle dynamics in budding yeast at single cell resolution***

Research Advisor: Nicolas Buchler

IGSP

Cyclin-dependent kinase (CDK) is the master regulator of key cell cycle events (DNA replication and mitosis). It is believed that autonomous oscillation in CDK activity drives the eukaryotic cell cycle. However, the Haase lab here at Duke has shown that periodic transcription and budding continue in the absence of CDK activity in *Saccharomyces cerevisiae*. This suggests that there is another oscillator (with similar period to wild-type cell cycle) that can function independently of the canonical CDK-driven cell cycle. My research project attempts to characterize the extent to which this CDK-independent oscillator is autonomous at the single cell level (or an experimental artifact). I collected unsynchronized single-cell data through the analysis of fluorescently tagged proteins and timelapse fluorescence microscopy. This was accomplished using two different yeast strains: (i) 15D (the Haase lab background strain) with an inducible, hyper-stable Sic1 protein (an inhibitor of CDK/Clb activity), and (ii) MMY (Buchler lab background strain) with an inducible, hyper-stable Sic1 protein. Wild-type 15D and MMY strains were used as controls. This was compared with previously collected population data. Further studies will incorporate several new strains I have created that combine fluorescent proteins with the promoters of cell cycle specific cyclins including SIC1, CLB2, and CLN2 along with a PEST degradation tag.

**Kelly Williams**

***Role of CaMKII in the death of SH-SY5Y cells following treatment with organophosphates***

Research Advisor: Bahie Abou-Donia

Pharmacology & Cancer Biology

This is an ongoing project to determine the mode of action of cell death in the treatment of a cocktail of organophosphates, at a subcytotoxic level, on terminally differentiating human SH-SY5Y neuroblastoma cells. Our model mimics the long-term disease organophosphate-induced delayed neuropathy (OPIDN), and thus insights into the in vitro mechanism(s) of cell death caused by organophosphates could lead to further understanding of and possible treatment or prevention of OPIDN. Prior literature has indicated that Calcium-Calmodulin Kinase II (CaMKII) plays a role in the neurodegenerative process, making it a prime target for study of OPIDN. Data has been gathered through western blot analysis of protein expression in two sets of retinoic acid (RA) differentiated SH-SY5Y cells, that were raised in 5% and 10% FBS respectively.

**Sean Wu**

***Phenotypic characterization of candidate antagonists to the DAF-2 Insulin-like receptor***

Research Advisor: Ryan Baugh

Biology

The role of DAF-2/PI3K/DAF-16 signaling pathway has been implicated in the starvation response - L1-arrest - of *Caenorhabditis elegans*. *C. elegans* that demonstrate developmental arrest have an increased lifespan and resistance to stress. The signaling pathway has already been well characterized by previous studies, and the *C. elegans* field have moved into exploring the ligands that bind to DAF-2. The study of antagonistic ligands are a novel field, where until now, there has only been one paper published describing their roles in nutritional response. My research focused on phenotypically characterizing candidate antagonists, which have been determined by Baugh et al, to the DAF-2 insulin-like receptor. Starvation survival assays were performed on loss-of-function mutants in hopes of uncovering any epistatic interactions between antagonists as well as the importance of antagonists in stress-response. The candidate mutants did not produce a noticeable effect on *C. elegans* lifespan and a more sensitive assay may be needed to determine length of L1 arrest.

**Diana Xie**

***The effects of oxytocin on social behavior in rhesus macaques***

Research Advisor: Michael Platt

Neurobiology

Oxytocin (OT) is a neural hormone produced by the hypothalamus and known to play major roles in social behaviors. Studies in birds, non-human primates and humans have shown that OT influences a wide range of behaviors including pair bonding and anxiety. In humans, it is known to influence trust and in-group favoritism during social interactions. In this study, we investigated the impact of OT we in social behavior among male rhesus macaques. We hypothesized that OT would enhance positive social interactions with cagemates and reduce submissive behaviors in subordinate monkeys. We observed and recorded pairwise social confrontations between monkeys in our colony and compared days in which OT or saline control was nebulized to subject monkeys. It was found that nebulizing OT to subjects was associated with an increase of yawning in response to observing other monkeys' yawns during pairwise social confrontations. This phenomenon, known as yawning contagion, has been hypothesized to play a role in social behavior and empathy among humans and non-human primates. In humans and chimpanzees, yawning contagion has been shown to have a positive correlation with social bonding. Our experimental paradigm provides us with a novel way to study the neurobiology and pharmacology of social yawning.

**Jenny Xue**

***Inhibition of Translesion Synthesis for Cancer Therapy***

Research Advisor: Pei Zhou

Biochemistry

Chemoresistance presents a major obstacle to the success of DNA-targeting chemotherapies. Development of chemoresistance has been linked to translesion synthesis (TLS), a DNA repair process that promotes cell survival at the cost of mutagenesis. Recent studies have shown that disruption of this pathway sensitizes cancer cells to DNA-targeting chemotherapeutics and delays the onset of chemoresistance. Rev1, an insertion polymerase that acts as a scaffold, and Rev3/7, an extension polymerase, both play key roles in TLS. Disruption of the critical Rev1-Rev3/7 interaction has been shown to reduce mutagenesis and sensitize cancer cells to treatment. We have solved the structure of the Rev1 C-terminal domain (CTD)-Rev3/7 complex using crystallography, and using this structural information, we have identified the hydrophobic pocket of the Rev1 CTD as a promising target for small molecule inhibitors. An assay that screens for inhibitors of this interaction has been developed, and we have screened several compound libraries to identify 30 initial lead compounds. These compounds will be further characterized and optimized using isothermal titration calorimetry (ITC), NMR and crystallography. Ultimately, we hope to identify a clinically applicable small-molecule compound that can effectively inhibit TLS, thus improving the effectiveness of existing chemotherapeutics.



**Anne Yeung**

***Health Situation and Needs of Beijing Migrant Mothers and their 0-3-year old Children***

\*Service Opportunities in Leadership Project

Research Advisor: Giovanna Merli

Public Policy

Healthy Baby SMS (HBSMS) is a social innovation project that provides free professional health consultation to migrant mothers of children 0-3 years old through weekly text-messages and a texting hotline. To tailor its message content to the specific needs of the migrants, HBSMS needed a deeper understanding of their health situation. This study describes the health situation of migrant mothers and their children, and examines the social factors that influence the mothers' health-related child care behaviors. Data was collected over three weeks using a questionnaire and a respondent-driven sampling method. The most prevalent child diseases were fever, cough/phlegm, sore throat, anemia/iron deficiency, and elevated blood lead levels. The most notable deviations from best practices of health seeking behavior were that 16% of pregnancies did not have regular examinations, 13% did not have at least one checkup in the first trimester, and 31% did not have prenatal screening. Enrichment activities were relatively frequent, with a sample mean parenting involvement score of 3.7/5, 5 being the highest. Most children ate healthier foods more frequently than non-healthy foods, though snack and sugary drink intake was high. Mother's highest educational level, emotional distress, and social support are associated with these behaviors. The most needed health information were "nutrition," "mental/educational development, how to foster intelligence," "preventative care for minor illnesses/fever, how to strengthen a weak immune system," "simple methods to nurse minor illnesses, recommended medications for quick recovery," and "child doesn't like to eat/is picky."

**Sunhay You**

***Mirrored Reflections***

Research Advisor: William Chafe

History

The goal of this research is to bring to life the story of Sara M. Evans, a civil rights and feminist activist who graduated from Duke in 1965. Through interviews, biographical and historical research on Evans' life, I trace her development as a young activist to illustrate how the feminist movement came out of the civil rights movement. The second wave feminist movement that Evans participated in was largely concerned with intersectional activism: how issues of race, class and gender intersected with each other to form multiple and overlapping spheres of privilege and opposition. Ideas that called for racial equality also called for gender equality. While third wave feminism implied a certain departure from second wave feminism, a need to break from Betty Friedan and the popularized portrayal of feminism as having to do with only the needs of white middle-class women, Evans' story illuminates how such a framework greatly simplifies the evolution and close relationship of the two feminist movements.

**Drew Young**

***The Effects of Cocaine on Loss Aversion Decision Making  
in patients with HIV infection***

Research Advisor: Christina Meade

Global Health

The neuroeconomical construct of loss aversion allow for the assessment of an individual's sensitivity to the perceived gains and losses of a decision independently. This important distinction in decision-making is critical to gaining a deeper understanding of risk assessment, particularly in drug users. The current study used a loss aversion task both in a clinical interview setting and in an fMRI scanner to characterize differences in behavioral loss aversion and functional differences that are present in cocaine users compared to non-drug users. Loss aversion is typically viewed as a measure of impulsivity, with decreased loss aversion being viewed as increased impulsive behavior. The results of the current study, however, question the validity of this conceptualization of loss aversion. There is a large body of literature that shows that cocaine users have increased impulsivity, but this study found that cocaine users had significantly higher loss aversion scores, which means that they were less impulsive than the non-drug users by the current interpretation of loss aversion. This was confirmed in the imaging portion of the study, in that cocaine users showed either an increased neural sensitivity to losses or a decreased neural sensitivity to gains, both of which correspond to increased loss aversion. As this study was a pilot study, the results need to be confirmed with further, more in-depth research, but the initial results allude to potentially interesting findings that have implications in the conceptualization of loss aversion and on the interpretation of loss aversion scores.

**Zohair Zaidi**

***Manipulation of Neuronal Activity with Increased Cell-Type Specificity by using Luciferase-Opsin Heterodimers***

Research Advisor: Ute Hochgeschwender

Neurobiology

Investigating the neuronal underpinnings of brain disorders associated with abnormal neural activity involves manipulating these circuits. A popular method includes using channels that open when a light from a physical source is applied (e.g. a fiber optic filament), which may silence or activate these neurons and, in effect, these neural pathways. However, this approach is driven by only a single promoter. Because such manipulation demands higher specificity when seeking to control precise circuits, there is a need for a technique that allows for different promoters to act on the intersections of these neuronal pathways and restrict activation to only the pathway being examined. Previously we designed neural circuit manipulation constructs that combine a channelrhodopsin with a luciferase into a single fusion protein that can be activated both by CTZ application or fiber optic light. This study attempts to utilize this technology to construct and test a new system that splits the channelrhodopsin and luciferase into two separate constructs that will dimerize intracellularly. We predict that this complementation will bring the constructs close enough to replicate the functionality of the previously developed system. This will allow for each construct to be driven by separate promoters, thus increasing subneuronal target specificity.

**Yuqi Zhang**

***Deciphering the Role of Drosophila Beta-Spectrin and Ankyrin in the Morphogenesis of Drosophila melanogaster***

Research Advisor: Daniel Kiehart

Biology

Failure in the processes of cell shape change and cell migration can lead to developmental defects in all organisms. In *Drosophila melanogaster* development, the process of drawing epithelial tissue from the lateral surfaces of the embryo over a dorsal opening is a process termed “dorsal closure”. This project aims to understand some of the molecular mechanisms that are driving this tissue dynamic as the embryo develops or heals following a wounding event. Specifically, we investigated the role of the spectrin protein, a cytoskeletal protein that interacts with actin filaments. Spectrin molecules have ankyrin-binding domains (ABD) that bind to ankyrin, an adaptor protein that acts as a linker between spectrin and the integral proteins of the plasma membrane. The stability of the membrane during morphogenesis depends on the proper assembly of various cytoskeletal-associated molecules. The goal of this project is to disrupt this plasma membrane cytoskeleton interaction and determine if the elimination of the ability of spectrin to bind to ankyrin has a phenotypic effect on dorsal closure. Preliminary data show that there is no phenotypic effect on this process in *Drosophila* embryos when the ABD of human spectrin is expressed. However, this lack of phenotype in flies may be due to a lack of functional homology between the species. Thus, the next stage of this project aims to disrupt the spectrin/ankyrin interaction in the *Drosophila* spectrin homolog to investigate the role of the interaction of the plasma membrane and the actin cytoskeleton during dorsal closure.

**Ruth Zhang**

***Identifying adhesion proteins mediating anchor cell invasion of vulval cells in C. elegans***

Research Advisor: David Sherwood

Biology

Cell invasion through basement membrane (BM), a sheet of specialized extracellular matrix, is a fundamental yet poorly understood process found in both normal development and metastatic cancer. To elucidate the adhesion mechanisms underlying this phenomenon, I explored the cell-cell and cell-BM adhesion molecules required for anchor cell (AC) invasion, a simple in vivo model of cell invasion found in *C. elegans* gonadal development. During AC invasion, the uterine AC breaks through BM and attaches to vulval precursor cells to initiate uterine-vulval connection. Through a screen for genes expressed in the AC, I found that the Fat-like cadherin CDH-3 is localized to the AC invasive membrane specifically after invasion through the BM, where the AC forms nascent attachments with the vulval cells. Genetic removal of *cdh-3*, however, did not disrupt this attachment, suggesting that other adhesion molecules function alongside CDH-3. Since RNA interference knockdown of known adhesion molecules and regulators on a *cdh-3* null background did not produce candidate genes for further study, I performed an EMS mutagenesis screen to identify novel adhesion molecules and regulators of AC invasion, isolating several phenotypes of interest. These experiments clarify the function of cell adhesion molecules in *C. elegans* AC invasion and also serve as a pilot for future AC invasion adhesion screens.

