

## A Presentation of Undergraduate Research

Bryan University Center  
Wednesday, April 20, 2011  
11:30 a.m.-2:00 p.m.

*"Trinity College is committed to increasing opportunities for students to experience firsthand the excitement of the discovery process; to learn something about the ideas, techniques, and methodologies of modern research; and to understand the impact of new knowledge on our daily lives."*

Dr. Alvin Crumbliss, Dean of Trinity College of Arts and Sciences

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

<http://undergraduateresearch.duke.edu/>

### Acknowledgments

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The Duke Undergraduate Research Society  
The Academic Deans of Trinity College of Arts and Sciences  
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# Undergraduate Research Support at Duke University

Duke undergraduates have received support for their research projects from the following College and University programs in 2010-2011:

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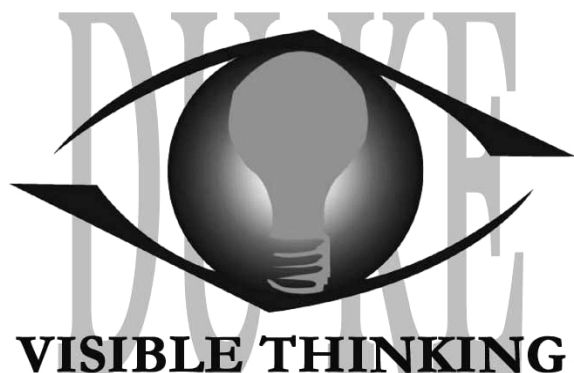
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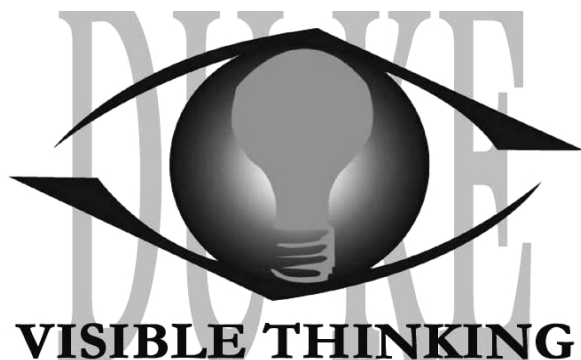


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**11:30 - 12:30 pm**  
**Poster Session I**

Name	Advisor	Field of Research	Project Title
Katherine Filler	Karin Shapiro	Arts & Humanities	The Black Sash
Taylor Hausburg	Alma Blount	Arts & Humanities Service Opportunities in Leadership	A Flamboyant Fiction: LGBTQ Representation in the Media
Nusaibah Kofar-Naisa	Kerry Haynie	Arts & Humanities	Hijab: A Cross-Cultural Examination of the Muslim Woman and Her Veil
Violeta Foreman	Bill Fick	Arts & Humanities	Consumer Imagery
Eanas Aboobakar	Joseph Heitman	Biological Science	The C2-Domain Protein Cts1 Functions With Calcineurin During High-Temperature Stress Response in <i>Cryptococcus neoformans</i>
Farah Dadabhoy	Richard Auten	Biological Science	Adverse Effects Perinatal Exposure to
Claire Daly	John Klingensmith	Biological Science	The Role of Apoptosis and Cellular Proliferation in Mouse Foregut Remodeling
Tina Del Carpio	Leslie Digby	Biological Science	A Comparative Study of Behavioral Thermoregulation in Two Genera: Lemur and Varecia
Lydia Greene	Christine Drea	Biological Science	Sending Mixed Signals; Olfactory Communication in the Coquerelâ€™s Sifaka, <i>Propithecus coquereli</i>
Steven Hafner	Rebecca Cuddahee	Biological Science	The Role of Non-dietary Abrasives in the Evolution of Molar Morphology of <i>Theropithecus</i>
Kathryn Hudak	Elizabeth Ramsburg	Biological Science	Mastoparan derivatives as potential antiviral agents
Han Jun Kim	Miguel Nicoletis	Biological Science	The Effect of Acetylcholine On Micro Arousal-Like Sleep Structure
James Lee	Paulo Ferreira	Biological Science	Studying the dynamics of mitochondria by kinesin and RANBP2 using time-lapse microscopy
Nicholas Mei	Sally J. York	Biological Science	Assessment of dose and time dependent damage to mitochondrial DNA by 5- Fluorouracil in <i>Saccharomyces Cerevisiae</i>
Miki Nishitani	David McClay	Biological Science	The Regulatory Role of ActivinB in the Early Signal of Endomesoderm Specification in Sea Urchin <i>Lytechinus variegatus</i>
Katherine Patellos	Brian Hare	Biological Science	Effects of short term interaction on trust formation in domestic dogs ( <i>Canis familiaris</i> )
Sandeep Prasanna	Brian Hare	Biological Science	Let's talk: why do we cooperate?

Alena Reich	Christine Wall	Biological Science	Comparative Evolutionary Morphology of the Primate Rhinarium and Clinical Correlates
Kerri Rodriguez	Brian Hare	Biological Science	Can Lemurs Remember? A Comparison of Spatial Memory Skills Across Four Strepsirrhine Primates
Arun Sharma	Gerard Blobbe	Biological Science	The Role of Endothelial Receptor Endoglin in Mediating (TGF- $\beta$ ) Smad Signaling
Bo Sun	Meta Kuehn	Biological Science	Mechanisms of Outer Membrane Vesiculation in Escherichia coli
Amy Xu	Jerry Eu	Biological Science	Cell Surface Toll-like Receptors Induce Pro-survival Responses in Mouse Bone Marrow Derived Macrophages
Jordan Jarrett	Alan Boudreau	Physical Science	Origin, Petrography and Formation Theory of Intrusive Veins at the Stillwater Complex
Ashton Lai	Pei Zhou	Physical Science	A Structural Study of Rev1 Translesion Polymerase in Complex with Pol zeta
Jason Lou	Eric Thomson	Psychology	Basal Forebrain Neuron Properties During Whisker-Dependent Tactile Discrimination Task
David Estrin	Alma Blount	Social Science Service Opportunities in Leadership	Financial illiteracy among millennial youth: how can we foster beneficial decision-making?
Caitlin Gorback	Charles Becker	Social Science	Trailer Park Economics
Ji-Hyeun Kwon	Alma Blount	Social Science Service Opportunities in Leadership	Evaluation of Grupo Venancia's Campaign on Sexual and Reproductive Rights: 'Antes de Cargar con Otros, Hacete Cargo de Vosá'
Jenessa Malin	Lisa Linnenbrink-Garcia	Social Science	Self-handicapping and Gifted Ability Messages : Motivational Processes Influencing Gifted Underachievement
Sharon Mei	Christina Gibson-Davis	Social Science Service Opportunities in Leadership	Nutritional Deficiencies of the Mangyan Indigenous Children of Puerto Galera
Aishlinn O'Connor	Alma Blount	Social Science Service Opportunities in Leadership	Political Participation in Cape Coast, Ghana
Dayo Oshilaja	William Darity	Social Science	Investigating the Academic Performance of Black Undergraduates at Duke
Avni Patel	Anirudh Krishna	Social Science Service Opportunities in Leadership	Assessing the Educational and Occupational Aspirations of Adolescents at P.R. Thakkar Vidyavihar
Michael Pell	Kristen Goss	Social Science Service Opportunities in Leadership	The Farmhouse Blues: Reconciling Neo-Traditional American Farming Practices with Labor Regulations

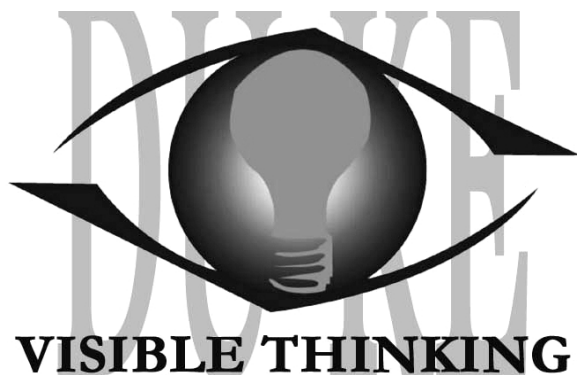


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**12:00- 1:00 pm**  
**Poster Session II**

<b>Name</b>	<b>Faculty Advisor</b>	<b>Field of Research</b>	<b>Project Title</b>
Felix Wibergh	Vicki Russell	Arts & Humanities	We No Speak Americano: Understanding International Students' Writing
Margaret Eckman	David Malone	Arts & Humanities	The Empire Writes Back: Shattering High Schoolers' Misconceptions About Colonialism and Imperialism
Julius Jones	Raymond Gavins	Arts & Humanities	I shall not be moved: Civil Rights Activism in Portland, Oregon's African American Community, 1945-1959
Hannah Peckham	Alma Blount	Arts & Humanities Service Opportunities in Leadership	The University and The Church: Searching for the Heart and Soul of Civic Engagement
Anthony Alberti	John Supko	Arts & Humanities	A Study in Music Composition and Vocal Performance
Ross Canlas	Christine Drea	Biological Science	The Chemical Composition of Eulemur Secretions
Yi Dong	Hiroaki Matsunami	Biological Science	An in vitro odorant receptor expression system that mimics ligand selectivity and sensitivity of olfactory sensory neurons expressing the corresponding receptors
Erin Good	Leslie Digby	Biological Science	Sex differences in thermoregulatory behavior in Coquerel's sifakas ( <i>Propithecus coquereli</i> ) and ringtailed lemurs ( <i>Lemur catta</i> )
Huang Huang	Gerard Blobe	Biological Science	The Role of Transforming Growth Factor (TGF)-beta Type III Receptor in Multiple Myeloma
David Jung	Eric Spana	Biological Science	Molecular Characterization and mapping of "curved," a 100-year-old mutation, in <i>Drosophila melanogaster</i>
Michael McAdams	Amy Schreier	Biological Science	Roles of adult males in the social development of juvenile male Coquerel's sifaka ( <i>Propithecus coquereli</i> )
Alvin Shi	David Sherwood	Biological Science	Identification of mutants of anchor cell invasion in the worm <i>C. elegans</i> from a ZMP-1 enhancer screen.
Julia Sun	Robert Wechsler-Reya	Biological Science	c-Myc Oncogene, Neural Stem Cells, and Medulloblastoma
Trevor Thomas	Benjamin D. Sachs	Biological Science	Investigating the Mechanisms Underlying the Antidepressant-like Effects of Desipramine
Charles Saadeh	Eric Toone	Physical Science	Towards a Tandem FRET Model for use in Processive Enzyme Kinetic Assays

Tim Zhang	Benjamin J. Wiley	Physical Science	Silver-Coating Copper Nanowires for Transparent, Flexible Electrodes
Jade Miller	Gary G. Bennett	Psychology Graduation with Distinction Candidate	The Influence of Sleep Duration and Quality on Weight Loss Outcomes of Overweight and Obese African-American Women in Behavioral Weight Loss Intervention
Lauren Powers	Ahmad Hariri	Psychology Graduation with Distinction Candidate	Neural Correlates of Neuroticism in a Healthy Population
Allison White	Kevin LaBar	Psychology Graduation with Distinction Candidate	Fear Generalization in PTSD
Laura Anderson	Makeba Wilbourn	Psychology Graduation with Distinction Candidate	To Abide or Override? Exploring Infants's™ use of the Mutual Exclusivity Bias with Verbal and Gestural Labels
Margaret Baughman	Laura Richman	Psychology Graduation with Distinction Candidate	Can Facebook Use Increase Belonging After Rejection
Taylor Damiani	Rick Hoyle	Psychology Graduation with Distinction Candidate	Does Depleting Self-control Affect Forgiveness?
Maria Paula Daneri	Makeba Wilbourn	Psychology Graduation with Distinction Candidate	Executive Function in Dual Immersion Students
Meredith Mechanik	Makeba Wilbourn	Psychology Graduation with Distinction Candidate	At a Loss for Words: Exploring 18-Month-Olds' Willingness to Apply the Mutual Exclusivity Bias to Gestural Labels
Kendra Hinton	Timothy Strauman	Psychology Graduation with Distinction Candidate	Anger Attacks and Depression in a Non-Clinical Sample: Difficulties in Emotion Regulation, Anger Discomfort, and Subthreshold Symptomatology
Louis Bonacorsi	Amy Joh	Social Science Graduation with Distinction Candidate	Determining Toddler's Ability to Discriminate Information about Rigidity
Megan Fields	Steven Asher	Social Science Graduation with Distinction Candidate	Beliefs About Friendship
Kimberly Gajewski	Rick Hoyle	Social Science Graduation with Distinction Candidate	Two Forms of Self-Control and their Emotional Signatures
Kathleen Ghio	Makeba Wilbourn	Social Science Graduation with Distinction Candidate	The Impact of Second Language Learning and Language Use on Language Abilities and Executive Function in Bilinguals
Joshua Greenberg	Alessandro Tarozzi	Social Science	Impact Evaluation of Rainwater Harvesting in Rural Uganda
Linda Peng	Alma Blount, Lori Leachman	Social Science Service Opportunities in Leadership	Engaging student microfinance organizations in domestic microfinance initiatives in the U.S.
Ashley Ruba	Vicki Russell	Social Science	Riding the Technological Wave: The Advent of the iPad
Jason Wong	Alessandro Tarozzi	Social Sciences Service Opportunities in Leadership	Optimizing Rainwater Harvesting Installation in Kashongi, Uganda: Sustainable Rural Water Supply, Collective Action and Institutions



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**Poster Session III**

Name	Faculty Advisor	Field of Research	Project Title
Brendan Szulik	Elisabeth Benfey	Arts & Humanities	Campus Security: TV Pilot
Michelle Kim	Kristin Goss	Arts & Humanities Service Opportunities in Leadership	Prostitution: an industry of victims, not criminals
Sarah Goetz	David Gatten	Arts & Humanities	Memory through Media
Natalie Como	Nina Tang Sherwood	Biological Science	Chromatin Remodeling Factor Mi-2 Transcriptionally Regulates the Microtubule-Severing Protein Katanin60-Like1 in the Drosophila Nervous System
Nathan Eivaz	John McCusker	Biological Science	Recovery of prephenate dehydrogenase (tyr1 <sup>+</sup> ) mutants of Saccharomyces cerevisiae after amino acid starvation
Sapna Gupta	Amy Schreier	Biological Science	Female Sex-Typing in Juvenile Ring-Tailed Lemurs ( <i>Lemur catta</i> )
Caroline Hadley	Mark Dewhirst	Biological Science	The effects of ionizing radiation and subsequent oxidative stress on endothelial gap junctions and vascular structure in radiation-induced pulmonary toxicity.
Kenneth Hoehn	Mohamed Noor	Biological Science	Is there gene flux along a meiotically driven inversion segment in <i>Drosophila persimilis</i> ?
Shan Jin	Pei Zhou	Biological Science	Characterization of Catalytically-Impaired Point Mutants of CTD Phosphatase Ssu72
Hyesung Kim	Paulo Ferreira	Biological Science	Molecular bases of disease expression of syndromic visual dystrophies by RPGR-dependent and differential subcellular sorting and processing of RPGRIP1a1
Grant Meeker	Nicole Griffin	Biological Science	Three-Dimensional Quantification of Anterior Cruciate Ligament Geometry: A Validation Study
Si Won Oak	Michael Frank	Biological Science	The Influence of Sialylated IVIG on Various Complement Pathways
Rachna Reddy	Brian Hare	Biological Science	Do lemurs comprehend what others can perceive?
Alexandra Shams	Christine Drea	Biological Science	Hormonal and Observational Effects of Medroxyprogesterone Acetate on Two Species of Eulemur
Clara Starkweather	Richard Mooney	Biological Science	Cortical deafening: Using Birdsong to Assess Auditory Effects of
Faith Villanueva	David Sherwood	Biological Science	Formin-driven actin regulation during cell invasion in <i>C. elegans</i>

Kristie Vu	Gerard Blobel	Biological Science	The Role of T-beta-RIII Ectodomain Shedding in TGF-beta Signaling Regulation in Human Breast Cancer Cells
Donna Webb	Christine Drea	Biological Science	The Use of GnRH Analogues as a Tool for Captive Management
Katherine Xu	Susan Gurley	Biological Science	Kidney Cross-Transplantation: The Role of ACE2 in Blood Pressure Regulation
Jing Zhang	Joseph Heitman	Biological Science	Calcineurin Signaling in <i>Candida albicans</i> & <i>C. lusitanae</i>
Ian Ballard	Alison Adcock	Physical Science	Dorsolateral Prefrontal Cortex Drives Mesolimbic Dopaminergic Regions to Initiate Motivated Behavior
Esther Lee	Jun Chen	Physical Science	The effects of galectin-1 on the differentiation of human umbilical cord mesenchymal stromal cells (HUCMSCs) in vitro
Manu Mysore	Alvin Crumbliss	Physical Science	Iron Exchange Between A Siderophore Carrier and A Small Molecule Bidentate Chelator: A Kinetic Analysis
Eugene Park	Pei Zhou	Physical Science	A Unique Type Three Secretion System Chaperone
Kseniya Benderskaya	Charles Becker	Social Science	Suburbanization in St. Petersburg: The Socioeconomic and Spatial Ramifications of Residential Deconcentration in the 21st Century
Christine Hall	Cheryl Lin	Social Science	DIMENSIONS OF TRUST: A STUDY ON THE DECLINE AND DRIVERS OF TRUST IN BRAND-CONSUMER RELATIONSHIPS
Allyson Helmers	Alma Blount	Social Science Service Opportunities in Leadership	Restricted access to abortion and family planning services for Low-income women
Rui Jiang	Alma Blount	Social Science Service Opportunities in Leadership	Obesity in populations with lower socioeconomic status: How to make healthy foods accessible and affordable?
Maxwell Kigerman	David Walmer	Social Science	Pre and Post Earthquake Analysis of the Healthcare Infrastructure of Leogane, Haiti Using GIS Technology
Young Soo Kwon	Cherly Lin	Social Science	Study of New Segmentation of Chinese Consumers
Julie Rivo	Kathy Walmer	Social Science	Health seeking behavior of pregnant women in Leogane, Haiti
Malini Veerappan	Tammy Watkins	Social Science	The prevalence of infectious and chronic disease in NgÅbe seeking health care in Costa Rica
Naima von Ritter Figueres	Anne Martin-Staple	Social Science Service Opportunities in Leadership	Rings of Fire: Assessing the Use of Improved Cook-stove in Rural Guatemala



## VISIBLE THINKING 2011 – Abstracts in Alphabetical Order

**Eanas Aboobakar**

***The C2-Domain Protein Cts1 Functions With Calcineurin During High-Temperature Stress Response in Cryptococcus neoformans***

Research Advisor: Joseph Heitman, MD, PhD  
Molecular Genetics and Microbiology

Calcineurin is a Ca<sup>2+</sup>/calmodulin-dependent phosphatase that is essential for virulence in the fungal pathogen *Cryptococcus neoformans*. The phospholipid-binding protein Cts1 was previously identified as a multicopy suppressor of a calcineurin *cta1*<sup>Δ</sup> mutant in *C. neoformans*. Here, we further characterize the function of Cts1 and the links between Cts1 and calcineurin. Microscopic analysis of GFP-Cts1 reveals localization to cytoplasmic puncta and co-localization with the endosomal marker FM4-64. The *cta1*<sup>Δ</sup> mutant shows a distinct FM4-64 staining pattern, suggesting involvement of Cts1 in endocytic trafficking. In large budded cells, GFP-Cts1 localizes transiently at the mother-bud neck as a single ring that undergoes contraction. Mcherry-Cts1 co-localizes with GFP-Cna1 at 37°C, suggesting collaboration during high temperature stress response. GFP-Cts1 was detected by Western blot analysis, which revealed slower electrophoretic mobility in cells grown at 37°C compared to cells grown at 24°C and a shift to even higher molecular weight in the presence of the calcineurin inhibitor FK506. In vitro treatment with CIP phosphatase restored faster electrophoretic mobility to GFP-Cts1, suggesting that Cts1 is phosphorylated during high temperature stress and may be dephosphorylated in a calcineurin-dependent manner. GFP-Cna1 was also co-immunoprecipitated with mcherry-Cts1, with stronger binding detected at 37°C compared to 24°C. Taken together, these findings reveal a role for Cts1 in membrane trafficking and cytokinesis and suggest that Cts1 may be a substrate of calcineurin during high temperature stress response.

**Anthony Alberti**

***A Study in Music Composition and Vocal Performance***

Research Advisor: John Supko  
Music

As a composer and vocalist, I decided to research the compositional techniques of solo voice music. My studies began this past summer with a trip to the New York Public Library for Performing Arts, borrowing recordings of art song and opera, with a focus on Bel Canto opera, a broad category that applies mainly to

19th century Italian opera. The reason for this direction was my admittance to the Bel Canto Institute: Vocal Summer Program in Florence, Italy, directed by Bel Canto opera coach Jane Klaviter. For four weeks I took intensive voice lessons and coachings as well as studied scores and recordings in master classes. I applied what I learned compositionally in the songs I present here, and I applied my vocal training in performing them. While my writing is naturally 21st century, I desired to create vocal lines conducive to the singer, a strong element in Bel Canto music that is often missing in newer vocal works. I feel that my position as a singer, and my more recent instruction in composition, has put me in a prime position to create songs that both the composer and the performer will enjoy.

**Laura Anderson**

***To Abide or Override? Exploring Infants' use of the Mutual Exclusivity Bias with Verbal and Gestural Labels***

Research Advisor: Makeba Wilbourn  
Psychology

Many studies have established that toddlers as young as 17 months attribute novel labels to novel rather than familiar objects, a bias known as mutual exclusivity (ME; Markman, 1991). Toddlers' assumption that each object has only one label may be instrumental in indirect word-learning situations. However, ME does not appear to be an absolute constraint and can be overridden in bilingual contexts (Au & Glusman, 1990). For instance, toddlers will accept another label for an object if it is presented in a different language (Au & Glusman, 1990). Given that ME is a fundamental component of language development, it is surprising that few studies have explored its utility in forms of communication other than verbal language. Do toddlers apply this assumption if the label is presented in a different modality? To explore this question, Suanda and Namy (in prep) used a forced-choice task. They found that 18-month-olds interpreted words and symbolic gestures differently in response to an ambiguous referent. While toddlers abided by ME with novel words and only mapped novel words onto novel objects, they were able to override this bias and mapped symbolic gestures onto familiar objects. It is possible that the ambiguous symbolic gesture coupled with the cognitive and physical requirements of the forced-choice task played a role for the 18-month-olds. Thus, the purpose of this study was to examine 18-month-olds' implicit looking behaviors to determine whether

or not they would abide by ME when presented with a gestural label.

**Ian Ballard**

***Dorsolateral Prefrontal Cortex Drives Mesolimbic Dopaminergic Regions to Initiate Motivated Behavior***

Research Advisor: Alison Adcock  
Psychiatry

How does the brain translate information signaling potential rewards into the motivation to get them? Motivation to obtain reward is thought to depend on the midbrain, (particularly the ventral tegmental area, VTA), the nucleus accumbens (NAcc), and the dorsolateral prefrontal cortex (dlPFC), but it is not clear how the interactions amongst these regions relate to reward-motivated behavior. To study the influence of motivation on these reward-responsive regions and on their interactions, we used Dynamic Causal Modeling (DCM) to analyze functional magnetic resonance imaging (fMRI) data from humans performing a simple task designed to isolate reward anticipation. The use of human fMRI permitted the measurement of multiple regions simultaneously while participants anticipated and prepared to respond to rewards, thus allowing characterization of how reward information affects the physiology that underlies motivational drive. Further, we modeled the impact of external reward cues on causal relationships within this network, thus elaborating a link between physiology, connectivity, and motivation. Specifically, our results indicated that dlPFC was the exclusive entry point of reward information in this network, and that anticipated reward caused VTA activation only via its effect on the dlPFC. Anticipated reward thus increased dlPFC activation directly, whereas it influenced VTA and NAcc only indirectly, by enhancing intrinsically weak or inactive pathways from the dlPFC. Our findings of a directional prefrontal influence on dopaminergic regions during reward anticipation suggest a model in which the dlPFC integrates and transmits representations of reward to the mesolimbic and mesocortical dopamine systems, thereby initiating motivated behavior.

**Margaret Baughman**

***Can Facebook Use Increase Belonging After Rejection***

Research Advisor: Laura Richman  
Psychology

Previous research has found that when social rejection is construed as unfair, an individual is more likely to show an antisocial response, for example, aggression. However, reminders of tangible or intangible social connections and engaging in prosocial behavior can

help restore feelings of belonging and decrease aggression. Facebook is a representation of one's social network and therefore should serve as a reminder of social connections. It is also an avenue through which one can engage in prosocial behavior, even when another person is not present, for example, by writing on a friend's "wall." The goal of this study is to investigate whether signing onto one's facebook page will increase feelings of belonging and decrease aggression after a rejection manipulation.

**Kseniya Benderskaya**

***Suburbanization in St. Petersburg: The Socioeconomic and Spatial Ramifications of Residential Deconcentration in the 21st Century***

Research Advisor: Charles Becker  
Economics

The Iron Curtain separating the formerly socialist Eastern and Central European states and their Western counterparts made the spatial evolution of a socialist city an almost ignored subject in modern urban literature (Nedovic-Budic et. al. 2006; Boren 2005; Axenov et al. 2006). Though Russia is the largest of the post-socialist states in Europe, its nascent suburbanization pattern is also one of the most unstudied by foreign and Russian scholars alike. The purpose of this study is to mitigate the dearth of empirical work and theoretical research on this topic with a field-based analysis of Russia's suburbanizing populations. As one of the state's fastest growing economic centers, St. Petersburg offers a window into the particular characteristics of post-Soviet residential deconcentration in Russia's metropolises and the changing morphology of its fringe towns and settlements. Based on data from a survey of 210 suburban and urban households in/outside of St. Petersburg proper, this paper constructs a multi-dimensional image of Russian suburbanites. Using both descriptive statistics and a logistic regression model, this investigation assesses the prevalent social characteristics of the suburbanizing groups and the key factors affecting their decision to reside outside of the city.

**Louis Bonacorsi**

***Determining Toddler's Ability to Discriminate Information about Rigidity***

Research Advisor: Dr. Amy Joh  
Psychology

Past research has demonstrated that children are adept at gathering haptic information in infancy and using this information in early childhood for goal-directed

actions. There is, however, a limited understanding of what happens during this transition. The goal of this study was to design a novel matching paradigm to determine whether 30-month-old children are capable of discriminating one particular type of haptic information, information about rigidity, and how this ability compares to the ability to discriminate visual information such as color. The results suggest that although some 30-month-olds are capable of discriminating rigidity, this ability develops slower and later than the ability to discriminate color. Additionally, the findings demonstrate that the proposed paradigm is age-appropriate and engaging for young children.

**Ross Canlas**

***The Chemical Composition of Eulemur Secretions***

Research Advisor: Christine Drea  
Evolutionary Anthropology

Scent profiles serve many purposes, including species recognition or differentiation in sex. Previous research has already been done concerning olfactory communication in lemur species, however, the classification and identification of these chemicals is little-known. In order to gain a better understanding of these variations, the identification of the chemicals present in the secretions is vital. In this project, we used gas chromatography/mass spectrometry (GC/MS) to compare the chromatograms of synthesized fatty acid esters with secretions of Eulemur lemurs. The richness and complexity of glandular semiochemical profiles vary between species, sexes, and gland types in Eulemur, so the chemical composition of perianal and genital secretions in eight separate Eulemur species adults were analyzed. The samples used were collected from 49 animals (representing approximately 2-4 members of each sex) at the Duke Lemur Center. We compared sample chromatograms using the compound's retention time, mass spectrum fragmentation, and molecular weight. Over 150 semiochemicals ranging in molecular weight from 108 to 522 g/mol were found to be present. The Eulemur species and sexes differed in semiochemical richness and complexity, and analyses of chemical profiles indicated that the presence and abundance of certain semiochemicals are species, sex, or gland specific.

**Natalie Como**

***Chromatin Remodeling Factor Mi-2 Transcriptionally Regulates the Microtubule-Severing Protein Katanin60-Like1 in the Drosophila Nervous System***

Research Advisor: Nina Tang Sherwood  
Biology

Microtubule (MT) severing proteins are important for many cellular processes necessary for development of a functional nervous system. Our lab studies the role of three MT severing proteins in the Drosophila nervous system: Spastin, Katanin60, and Katanin60-Like1 (Kat60-L1). Results from our lab show that genetic loss of function kat60-L1 larvae exhibit reduced branches in dendritic arbors of class IV sensory neurons, as well as corresponding nocifensive behavior defects. To learn more about how Kat60-L1 might function, we performed a screen for genetic interactors using the Gal4/UAS system to overexpress genes on the third chromosome concomitantly with kat60-L1 in the eye. The screen revealed Mi-2 as a potential genetic interactor. Mi-2 is a transcriptional repressor and functions in a histone deacetylase complex to affect chromatin remodeling. We have shown that kat60-L1 transcript levels are dramatically reduced in mi-2 loss of function mutant animals, suggesting Mi-2 regulates Kat60-L1 at the transcriptional level. Further, mi-2 and kat60-L1 double mutant analysis suggests this interaction occurs at the biologically relevant site of class IV sensory neurons. One copy of the mi-2 mutation in a kat60-L1 loss of function background rescues the kat60-L1 single mutant phenotype of reduced branches, restoring wild-type dendritic arbor morphology. In addition, we have begun to show that adding one copy of the mi-2 mutation into the kat60-L1 loss of function background also rescues behavioral nociception defects normally observed in kat60-L1 mutants. These results suggest Mi-2 could be an important transcriptional regulator of Kat60-L1 in the Drosophila nervous system.

**Claire Daly**

***The Role of Apoptosis and Cellular Proliferation in Mouse Foregut Remodeling***

Research Advisor: John Klingensmith  
Cell and Molecular Biology

Esophageal Atresia/ Tracheoesophageal Fistula (EA/TEF) is a severe organ development defect that occurs when the trachea and esophagus fail to remodel from the common foregut tub. When Noggin, a BMP antagonist, is removed from mouse embryos, EA/TEF arises, making this an excellent model to study foregut development. It has been hypothesized that cellular proliferation and/or apoptosis may play an important

role in foregut remodeling due to the important role these processes play in the development of many other organs. This hypothesis was tested using wildtype and noggin mutant embryos whose foreguts had just begun to separate into the trachea and esophagus. Cellular proliferation and apoptosis were quantified in the mesenchyme surrounding the foregut and the epithelium of the foregut. Statistical analysis of this data revealed little difference between wildtype and mutant proliferative activity and an overall decrease in epithelial apoptosis in noggin mutants. Due to the lack of localized proliferative and apoptotic activity, it was concluded that proliferation and apoptosis are unlikely to play central roles in noggin foregut development. Instead, future research into foregut remodeling should focus on alternative mechanisms and the altered gene expression seen in noggin mutants.

#### **Taylor Damiani**

##### ***Does Depleting Self-control Affect Forgiveness?***

Research Advisor: Dr. Rick Hoyle  
Psychology

A study was designed to examine the influence of self-control depletion and positive mood induction on forgiveness. In a controlled experiment, 123 undergraduates played a computer game in which they were led to believe that they were mistreated by an opponent. Participants' forgiveness of the opponent was measured using the Transgression-Related Interpersonal Motivations inventory after a self-control manipulation (self-control depletion or no depletion) and a subsequent mood induction manipulation (positive or neutral mood). As expected, self-control depletion negatively affected avoidance motivation (a subcategory of forgiveness) such that depleted individuals showed higher avoidance motivation on average. Positive mood induction, however, had no effect on forgiveness levels. These findings suggesting that, to a degree, forgiveness requires self-control.

#### **Maria Paula Daneri**

##### ***Executive Function in Dual Immersion Students***

Research Advisor: Makeba Wilbourn  
Psychology and Neuroscience

Although executive function advantages have been found in native bilinguals, there is little evidence describing the development of executive functions in children whose exposure to a second language begins later in childhood. In this study, we investigated executive function abilities in two-way immersion students, whose exposure to a second language began in Kindergarten. Students ages 5 to 10 enrolled in a two-way immersion program or a traditional monolingual

program completed vocabulary measures and two executive function tasks. Native English speakers achieved the highest English vocabulary scores, followed by traditional students, with Spanish natives in the two-way immersion program achieving the lowest scores. As a group, two-way immersion students significantly outperformed traditional students in the executive function tasks when controlling for vocabulary, exhibiting both higher accuracy and faster reaction times. These results provide evidence supporting the development of cognitive processing advantages in children whose exposure to a second language begins in childhood.

#### **Tina Del Carpio**

##### ***A Comparative Study of Behavioral Thermoregulation in Two Genera: Lemur and Varecia***

Research Advisor: Leslie Digby  
Evolutionary Anthropology

Lemurs face serious environmental challenges including highly variable and seasonal weather in Madagascar. Therefore maintenance of body temperature is an important energetic cost for lemurs. Despite being endotherms, some species have shown behavioral patterns of regulating temperature similar to ectotherms. While these behaviors may help minimize these costs, there is a limited body of research on how the lemurs use behavioral thermoregulation. This study focuses on three species: ringtailed lemurs (*Lemur catta*), red ruffed lemurs (*Varecia rubra*), and black and white lemurs (*Varecia variegata*) with an emphasis placed on species comparisons. Preliminary results show that all three species did display patterns of behavioral thermoregulation as predicted. Additionally, species differences are shown in sun usage with *L. catta* making the most use of direct sun in cold weather, and *V. variegata* showing the most dramatic change in resting postures affecting size to volume ratios as temperatures increased.

#### **Yi Dong**

##### ***An in vitro odorant receptor expression system that mimics ligand selectivity and sensitivity of olfactory sensory neurons expressing the corresponding receptors***

Research Advisor: Hiroaki Matsunami  
MGM

Odorant receptors (ORs) respond to a wide variety of odorous ligands. The process of matching odors with a particular mammalian OR has been made more convenient with the advent of in vitro techniques using transfected culture cells. Though in vitro data predict odor perception and are mostly consistent with data

obtained using in vivo models, potential concerns remain regarding whether data obtained through in vitro systems can match the data describing responses of olfactory sensory neurons (OSNs) in vivo. Here we demonstrate the efficacy of utilizing a single in vitro system based on cAMP-mediated reporter assays with five mouse ORs which had their ligand specificities elucidated using transgenic mouse models. Plasmid DNA encoding each OR was transfected into Hana 3A cells with plasmids encoding RTP1S and muscarinic receptor M3 as well as luciferase reporters. Luciferase assay was run after odor stimulation. Dose-response curves of tested odors were compared to the previously published data, obtained with the same odors, which were derived from calcium imaging of dissociated OSNs and patch clamp recording of intact OSNs that expressed the corresponding OR. We found that the in vitro ligand selectivity of each OR matched closely with that of the previous studies. Our data suggest that use of the in vitro system represents a valid method of determining OR function.

**Margaret Eckman**

***The Empire Writes Back: Shattering High Schoolers' Misconceptions About Colonialism and Imperialism***

Reading fiction is an often under-utilized yet effective learning tool for high school students. By critically reading novels from a particular time period, students can explore civilizations, values, ideologies, and other facts and concepts found in novels. Research suggests that fictional stories help children develop a richer and more nuanced understanding of a particular culture and historical time period; children's stories (as opposed to others instructional methods) can make concepts (such as ideology) more accessible to learners (McGowan 204). My research service-learning project seeks to answer the question: Can children's fiction be effectively used in high school to dispel misconceptions that students often have about colonialism and imperialism? This project, which connects work on an English honors thesis on children's literature with my minor in Education, utilized British literature focused on colonial India. I analyzed educational psychology literature on misconceptions and the use of stories in teaching. I developed a series of lessons for high school teachers wishing to explore colonial India and broader issues of colonialism and imperialism. I tested the efficacy of the lessons in a high school classroom and with Duke seniors who are preparing to become teachers. Preliminary results indicated that stories can be a powerful way to engage high school students in developing deeper understandings of difficult concepts in all subject areas, including social studies, math, science, and the humanities.

**Nathan Eivaz**

***Recovery of prephenate dehydrogenase (tyr1) mutants of Saccharomyces cerevisiae after amino acid starvation***

Research Advisor: Dr. John McCusker

Molecular Genetics and Microbiology - Duke Medical Center

We have found that *S. cerevisiae* amino acid auxotrophs vary greatly in their ability to proliferate post-starvation. Starved cells can exist in three possible states; 1) viable and culturable; 2) in a viable but nonculturable state (VBNC); or 3) inviable/dead. Relative to many other amino acid auxotrophs, tyrosine auxotrophs, created by deletion of the TYR1 gene, demonstrated very low (2.1% viability) recovery after 72 hours of starvation. We hypothesized that tyrosol, which structurally resembles tyrosine but does not satisfy tyrosine auxotrophy, may have a protective effect on starved *tyr1* mutants. Indeed, the addition of tyrosol to starving cells resulted in a 5x higher recovery. Interestingly, two other tyrosine analogs, D-tyrosine and L-tyrosinol, also increased the recovery of tyrosine starved cells. Our current work is aimed at revealing whether the signal for the death of starving *tyr1* mutants is the absence of tyrosine, as suggested by our tyrosine mimic results, or the presence of uncharged tyrosine tRNAs.

**David Estrin**

***Financial illiteracy among millennial youth: how can we foster beneficial decision-making?***

Research Advisor: Alma Blount

Public Policy

A majority of millennial youth face a crisis in a lack of financial literacy, and our leadership has thus far failed to identify, agree upon, and implement solutions that should empower the rising generation to lead financially secure and stable lives. To grasp this complex issue and determine plausible components of a comprehensive solution, I ask: how can we foster beneficial, financially literate decision-making habits among millennial youth who live in the United States's ever-evolving, predatory, and credit-dependent financial marketplace? Through a review of the literature and an interview with a practitioner, I have four key findings: first, Generation Y's financial illiteracy is a result of the United States's devolution from a nation of savers to a nation of spenders due to the rise of the consumer credit society; second, in the wake of this social and cultural revolution, the JumpStart Coalition set unreasonable standards and expectations for youth financial literacy;

third, no convincing, comprehensive strategy to address the financial literacy crisis exists except for mandated k-12 education, which has been ineffective to date; fourth, some initiatives have creatively overcome the challenges of engaging kids and creating “sticky” behavior that could be integrated into a larger national or state-based financial literacy strategy. Based on the literature, I recommend an early start in asset accumulation paired with personal finance education.

### **Megan Fields**

#### ***Beliefs About Friendship***

Research Advisor: Steven Asher  
Psychology and Neuroscience

This project focuses on college students’ representations of the friendship relationship. The specific purposes are to create an improved measure of friendship beliefs, an improved measure of friendship quality with a ‘Self’ and ‘Friend’ dimension, and to examine how beliefs about friendship relate to various indices of social-emotional adjustment, including the social anxiety, concern for self-presentation, loneliness, and the quality of one’s friendships.

### **Katherine Filler**

#### ***The Black Sash***

Research Advisor: Karin Shapiro  
History

I examine the history of the Black Sash, a women’s organization in South Africa that protested apartheid, from its beginnings in 1955 until the end of apartheid in 1994, studying how a group of women changed their racial beliefs and attempted to change those of the white communities in which they live. The Sash’s approach to racial issues evolved in tandem with the evolution of apartheid itself. The limits of liberalism constantly impeded the Sash, as they protest the apartheid and its policies, but for decades were unwilling to work to truly integrate their membership or deviate from organized, gradual change. Nevertheless, the Black Sash women voluntarily stepped outside of their comfortable lives to aid Africans, protest apartheid laws, and, with their prolific records, attempt to document and expose atrocities of apartheid that extreme government censorship kept secret. The Sash provided women with an opportunity join a public political debate. Eventually this women’s organization took on a significant role in advocating for women’s rights in South Africa. Reacting to the political developments over a span of several decades the Sash provides a voice for dynamic women too radical for the white mainstream and too submissive for the black majority in South Africa. This history of the

Black Sash is one of gender, race, and social movements in South Africa.

### **Violeta Foreman**

#### ***Consumer Imagery***

Research Advisor: Bill Fick  
Visual Arts

As the industrial revolution converted western societies from agrarian to industrial in the 18th and 19th centuries, photography, and lithography contributed to the boom of the advertising industry that integrated typography and imagery together on the page. The resulting increasingly simplified ideograms and emblems began to proliferate the market. It is no coincidence that the rise of logotypes coincided with development of the middle class, as it became progressively more important to command mass recognition, rather than deliver exclusivity. Mass appeal, of course, is the staple of consumerism and a result of the broadening opportunities of the middle class. By the twentieth-century logotypes became ubiquitous icons that came to navigate consumer spending. In this particular work I have I have manipulated the Target icon, morphing it into a multicolor landscape of circular shapes. While conceptually it is the ultimate logo of consumerism that literally targets mass appeal, aesthetically the painting explores color theory introduced by Josef Albers.

### **Farah Dadabhoy**

#### ***Adverse Effects Perinatal Exposure to***

Research Advisor: Richard Auten  
Pediatrics DUMC

Perinatal exposure to urban traffic related air pollutants, specifically ozone and diesel, induce inflammatory cytokine expression within the placenta, lung, & brain (unpublished, personal communication). Previous work done by Auten et al. suggests that an inflammatory response is generated within the dam, and transferred to the fetuses via the placenta, with subsequent effects on lung and brain inflammation (unpublished, personal communication). The agent(s) being transferred are not known, but may not be the cytokines themselves (unpublished, personal communication). In this paper we investigate the effects of this pollutant induced inflammatory response on respiratory and neurocognitive outcomes.

**Kimberly Gajewski*****Two Forms of Self-Control and their Emotional Signatures***

Research Advisor: Rick Hoyle  
Psychology

Despite an upsurge of interest in self-control by social scientists, there is no widely accepted definition of the concept. Most definitions are descriptive rather than grounded in well-articulated theory and empirical evidence. These definitions, by and large, focus exclusively on self-control as an act of overriding an immediate desired behavior in favor of a greater long-term outcome. These acts, which we refer to as inhibition, are clearly self-control. However it is equally apparent that self-control is required to perform an immediate undesired behavior in support of long-term goal pursuits. We refer to this form of self-control as initiation. Drawing on existing models of self-regulation, we offer a new model of self-control that incorporates both inhibition and initiation. As a first test of the model we conducted a web-based study in which participants wrote about both types of self-control. Emotional content was analyzed in order to determine whether different emotions typically attend the two types of self-control. Situations that required inhibition resulted in significantly higher emotional arousal ratings than situations that required initiation. Additionally, people were more likely to be present during successful initiation events than unsuccessful ones, suggesting that the presence of others is critical for successful initiation. The ease with which respondents were able to describe both types of self-control and the distinctions highlighted by the analyses strongly support the new model of self-control.

**Kathleen Ghio*****The Impact of Second Language Learning and Language Use on Language Abilities and Executive Function in Bilinguals***

Research Advisor: Makeba Wilbourn  
Psychology

Previous research has highlighted the role of language proficiency and exposure in the bilingual advantage in tasks involving executive functions. However, both proficiency and exposure are impacted by functionality or the use of language. The current study measured executive function and linguistic ability in four groups of bilinguals with varying degrees of functionality, proficiency, and experience with a second language. Young adult bilinguals completed a computerized inhibitory control task and several standardized language measures assessing vocabulary and phonological awareness. Results revealed that,

bilinguals with formal second language instruction and a high level of functionality, possessed advanced linguistic abilities yet less advanced inhibitory control relative to their peers. Conversely, crib bilinguals demonstrated enhanced inhibitory control, yet diminished linguistic abilities. These findings suggest a possible trade-off between linguistic abilities and executive functioning in developing bilinguals. Thus, a more nuanced view of the relationship between second language learning and executive function is needed.

**Sarah Goetz*****Memory through Media***

Research Advisor: David Gatten  
Arts of the Moving Image

Memory through Media is a multimedia exploration of our externalized memories and collective histories. It has resulted in many URS funded projects, emerging from an initial research project filming imagery of nostalgia in Italy and Romania and growing into two Graduation with Distinction Projects. The first, in Visual Studies, is an installation art piece made from encyclopedias, questioning the nature of truth in the archive. This piece, a Gentle Brainwashing, is currently on display in Perkins Library. The second, a hand-developed, hand-edited film, is a meditation on the empty spaces in our memories and seeks to disrupt our trust of nostalgic imagery. I will be presenting on the inspiration, academic research, process, and products of these research opportunities.

**Erin Good*****Sex differences in thermoregulatory behavior in Coquerel's sifakas (*Propithecus coquereli*) and ringtailed lemurs (*Lemur catta*)***

Research Advisor: Leslie Digby  
Evolutionary Anthropology

Thermoregulation is a critical biological process by which organisms maintain their core body temperature (Romanovsky 2006). To reduce the energetic costs of physiological thermoregulatory processes, some endotherms may also utilize behavioral strategies. These include altering body posture and relative exposure to solar radiation in response to changing weather. I investigated differences in thermoregulatory behavior between two strepsirrhine species, *P. coquereli* and *L. catta*, and between sexes within these species. Behavioral data was collected concurrently with weather data. Preliminary results indicate that both species thermoregulate behaviorally as expected but there were few differences in patterns observed between species and between sexes. *L. catta* were more likely to exhibit both sunning and tree hugging

behaviors (with males exhibiting more sunning postures at colder temperatures and females more tree hugging at warmer temperatures) than *P. coquereli*. Females of both species appear to feed more at colder temperatures than do males, a behavior associated with higher energetic needs. No relevant differences in sun exposure trends were found between species or sexes.

**Caitlin Gorback**  
***Trailer Park Economics***

Research Advisor: Charles Becker  
Economics

In this project, I explore the various reasons behind the development of the American institution of trailer parks. The first two models arise in equilibrium, the last two respond to housing shocks. Models include 'Bad Tenants' in which tenants and landowners contract to protect against bad neighbors, a basic 'Capital Constraints' model in which tenants and landowners share the burden of capital costs, Uncertain Growth in which landowners respond to boom and bust economic growth, and 'Long vs. Short Run Growth' in which landowners must decide how to invest on their land given rates of land appreciation. By testing these models, I hope to pinpoint key reasons behind the development of trailer parks, and provide guidance for more comprehensive understanding of the institution.

**Joshua Greenberg**  
***Impact Evaluation of Rainwater Harvesting in Rural Uganda***

Research Advisor: Alessandro Tarozzi  
Economics

An estimated 1.1 billion people in the world lack access to an improved water source. While many interventions exist to increase access to clean water, there is a surprising dearth of rigorous literature evaluating such programs. Based on evidence from rural Uganda, this paper presents what to my knowledge is the first methodologically rigorous evaluation of a rainwater harvesting program. Utilizing a treatment-control strategy to measure the intervention's impact on *E. coli* and total coliform contamination levels in household water samples, the evaluation is based on data collected through pre- and post-intervention surveys of over 1600 randomly selected households across 82 villages. I use a difference-in-differences model to estimate the average treatment effect of the intervention on bacteria levels. Using ordinary least squares regression, I also estimate the average treatment-on-the-treated effect. In both cases, however, I observe a minimal impact. Although there are several possible explanations for this result, I mainly attribute it

to the short time period separating the intervention from the follow-up survey. Despite the absence of an observed impact, I find that households that reported in the baseline survey that they used surface water as the most contaminated type of water source were significantly more likely to adopt the intervention.

**Lydia Greene**  
***Sending Mixed Signals; Olfactory Communication in the Coquerel's Sifaka, *Propithecus coquereli****

Research Advisor: Dr. Christine Drea  
Evolutionary Anthropology

The importance of olfactory communication in primates is best appreciated among strepsirrhines; however, certain phylogenetic and socioecological patterns in lemur scent signaling require further explanation. Coquerel's sifakas (*Propithecus coquereli*) have a complex scent-marking repertoire and an exceptional socioecology for their clade. Therefore, they represent an interesting species for the study of olfactory signaling. To assess if various olfactory signals convey sex, social status, or reproductive state, the scent-marking behavior of adult sifakas (8 males, 7 females) was observed across three reproductive seasons. Additionally, the chemical composition of odorants was characterized using gas and liquid chromatography/mass spectrometry. Rates of scent marking, overmarking, and mark investigation were greater in males than females, in dominant males than subordinate males, and in the pre-breeding and breeding seasons than in the post-breeding season. Males overmarked more using their sternal than genital glands. The genital secretions of both sexes were often mixed with urinary signals, but contained a unique mixture of alcohols, squalene, cholesterol, and fatty acid esters that varied significantly by sex and season, but not by rank. Nonetheless, the sternal secretions of males contained relatively polar, low-molecular-weight compounds that may reflect rank. Given differential odorant usage and the distinct chemical profiles of urinary, sternal, and genital signals, the various scent sources likely serve different functions related to the advertisement of sex and reproductive state, and to male intrasexual competition.

**Sapna Gupta**  
***Female Sex-Typing in Juvenile Ring-Tailed Lemurs (*Lemur catta*)***

Research Advisor: Amy Schreier  
Evolutionary Anthropology

It is commonly accepted that the human period of juvenility is crucial for social development. Without exposure to social norms and role models during the



juvenile period, humans cannot grow to adopt their appropriate adult roles in society. An extended period of juvenility, however, increases vulnerability and likelihood of death before reproductive age. It is likely, therefore, that the extended periods of juvenility in other primates are also important for social learning. I hypothesized that the juvenile years are important particularly for sex-typing, or the role-modeling of same-sexed adults that develops gender identity. I predicted that juvenile females would interact preferentially with adult females rather than adult males. I studied a group of six Lemur catta housed at the Duke Lemur Center. I recorded their interactions (e.g. nearest neighbor, grooming) using scan-sampling and compared juvenile-adult dyads by proportions of time. I found that juvenile females do interact with adult females more preferentially than they do with adult males. Juvenile females were nearest to an adult female 23.34% of the time, while they were nearest to an adult male 9.34% of the time. While this does not in itself prove that the juvenile females are using the adult females as gender-specific role models, it does support the theory that their interactions are a particularly significant aspect of the juvenile period of female primates.

**Caroline Hadley**

*The effects of ionizing radiation and subsequent oxidative stress on endothelial gap junctions and vascular structure in radiation-induced pulmonary toxicity.*

Research Advisor: Mark Dewhirst  
Pathology/Radiation Oncology

Radiation (RT)-induced pulmonary toxicity limits patient quality of life and the maximum therapeutic radiation dosage. Vascular damage plays a role in acute and long-term normal tissue injury, but the mechanism of this damage is not well understood. Within days to weeks following radiation exposure, there is an observed decrease in perfusion followed by the development of tissue hypoxia. There is an increase in oxidative/nitroxidative stress that begins at the time of initial exposure, which continues to escalate during the progression of tissue hypoxia and the period of decreasing perfusion. We hypothesize that there is a cyclical interaction between vascular dysfunction, development of hypoxia, and oxidative/nitroxidative stress beginning at the time of the ionizing event and continuing throughout the time of disease progression. Endothelial cells communicate via gap junctions composed of transmembrane connexin (Cx) proteins. Of the four Cx isoforms in vascular walls, Cx43 is likely the most important in vasomotor tone and myoendothelial junctions. Phosphorylation of Cx43

regulates its participation in gap junctions. Hypoxia, vascular endothelial growth factor (VEGF), and reactive oxygen species (ROS) have been observed to affect phosphorylation of Cx43 in hypoxic tumor environments, disrupting endothelial cell communication. We believe that changes in Cx43 phosphorylation also occur in irradiated lungs because of similar changes in the microenvironment. Protection of functional gap junctions may therefore preserve vascular function, minimizing pulmonary injury and widening the therapeutic window for RT. Here we evaluate the hypothesis that ionizing radiation and subsequent oxidative stress alter Cx43 phosphorylation, resulting in vessel remodeling, changes in vascular networks, and angiogenesis. FVB/N mice expressing endothelial-cell specific GFP received 12.5 Gy whole thoracic irradiation. Mice were sacrificed and lungs were excised at two endpoints: 24 hours, when ROS levels first increase and 8 weeks, when pneumonitis is maximal. Changes in vessel perfusion, gap junction phosphorylation, and vascular remodeling will be evaluated

**Steven Hafner**

*The Role of Non-dietary Abrasives in the Evolution of Molar Morphology of Theropithecus*

Research Advisor: Rebecca Cuddahee  
Evolutionary Anthropology

In the study of primate evolution, dental analysis can shed light on both morphological and behavioral adaptations in the overall response of a species to changing ecology. The evolutionary history of the primate genus *Theropithecus* is particularly revealing in this regard in that it (1) displays distinct changes in dental morphology during the Plio-Pleistocene (ca. 4.5 – 1.5 million years ago) and (2) inhabits an area of great ecological variability characterized by soil erosion and flux as the result of climatic changes. Furthermore, fossil specimens of this genus are widespread throughout East Africa and are found at many sites that also bear hominid fossils. Through analysis of changes in occlusal surface area in the lower third molar of this genus, this research seeks to answer questions of how the environment and environmental changes relate to evolutionary responses among diverse mammalian taxa, including *Theropithecus* and early hominids, inhabiting East Africa during the Plio-Pleistocene.

**Christine Hall*****Dimensions of Trust: A study on the decline and drivers of trust in brand-consumer relationships***

Research Advisor: Cheryl Lin  
Sociology

Recent studies have documented a severe erosion in consumer trust towards brands, and a significant body of literature exists that emphasizes the importance of trustworthiness in consumer behavior. The primary purpose of this paper is to develop a model of trust in brands based off past research and current understanding and test it using data from the largest consumer research study in the world, Young & Rubicam's BrandAsset Valuator. We use the validated model to further understand consumer behavior and motivators and conduct further qualitative research that helps build a foundation of understanding for how trust develops and what may be leading to its broad decline in the marketing and advertising field.

**Taylor Hausburg*****A Flamboyant Fiction: LGBTQ Representation in the Media***

Research Advisor: Alma Blount  
Public Policy

The limited portrayal of LGBTQ individuals in mainstream television today contributes to misunderstanding among the American public of, and, in turn, real-world discrimination against the LGBTQ community, which leads to increased rates of hate crimes targeting this community and queer teenage suicides. As a result, I decided to analyze how mainstream media contributes to the American public's misunderstanding of the LGBTQ community, and how media organizations can be encouraged to reevaluate the representation of these individuals in their programming. To do this, I investigated the discourse of morality surrounding non-heteronormativity in America, the relationship between morality and the media, and the current representation of LGBTQ individuals in mainstream television through literature reviews and personal interviews. I concluded that major television networks under-represent LGBTQ individuals or limit their representation to stereotypes and extreme, negative characterizations. Organizations such as the Gay & Lesbian Alliance Against Defamation (GLAAD) that represent and can mobilize the queer community should expand their efforts, encouraging TV networks to increase the visibility and diversity of the LGBTQ community in their programming, and pushing them to mandate training for television content producers and news reporters about LGBTQ issues.

**Allyson Helmers*****Restricted access to abortion and family planning services for Low-income women***

Research Advisor: Alma Blount  
Public Policy

My presentation discusses research on the ways in which legislators restrict access to abortion and other family planning services to the greatest number of people by creating legislation that affects the group most likely to desire these services—low-income women. Such legislation includes mandatory 24-hour waiting periods and the restriction of Medicaid funding for these services. I look at scholarly journal articles, current and past policy changes, and personal stories to investigate the extent to which this legislation disproportionately affects low-income women. I then propose solutions that would address this strategic legislation by separating personal morals and justice.

**Kendra Hinton*****Anger Attacks and Depression in a Non-Clinical Sample: Difficulties in Emotion Regulation, Anger Discomfort, and Subthreshold Symptomatology***

Research Advisor: Timothy Strauman  
Psychology

Introduction: Anger attacks are found in 30-40% of individuals with depression. Much debate exists about the categorization of anger attacks, but most research to date has conceptualized them as an outcome of depression. Study Aims: To determine variables that distinguish between depressed individuals with anger attacks from those without. Methods: Ninety-seven dysphoric college students were recruited. Participants completed the Beck Depression Inventory (BDI), Anger Attacks Questionnaire, State Trait Anger Expression Inventory (STAXI), Difficulties in Emotion Regulation (DERS), Anger Discomfort Scale (ADS), and the Barratt Impulsiveness Scale (BIS). Results: There were significant differences between individuals with anger attacks from those without on the STAXI, ADS, and DERS. A subthreshold anger attacks group was also identified. This group met all criteria except for the minimum of 4 autonomic symptoms. Discussion: Results suggest that individuals with anger attacks differ in clinically

**Kenneth Hoehn*****Is there gene flux along a meiotically driven inversion segment in *Drosophila persimilis*?***

Research Advisor: Mohamed Noor  
Duke University

The Sex Ratio (SR) inversion is a large (approximately 13 million base pairs), naturally occurring inversion on the XR chromosome in the fruit fly *Drosophila persimilis*. It differentiates two varieties, the non-Sex Ratio variety, which is inverted relative to *D. pseudoobscura*, and the Sex Ratio variety, which has the same gene orientation at the XR inversion site as *D. pseudoobscura*. Because single recombination events between inversion heterozygotes are either suppressed or lead to nonfunctional gametes, inversions tend to act as barriers to gene flow between populations. However, due to effects of double crossing over and gene conversion within inversions, at least one theoretical study has predicted that gene flow between two populations polymorphic for a large inversion should be highest at the breakpoint regions, and lowest at the midsection. This prediction has been confirmed by numerous empirical studies. However, previous studies have only tested for gene flow at the breakpoints of the SR inversion and avoided the SR inversion midsegment, an observation that could provide information about gene exchange between these two species. We use a combination of phylogenetic and sequence-based analyses to confirm the presence of gene flow between these species even across this barrier to recombination. This study represents an exclusively intraspecies comparison, and may provide the basis for future studies involving both intra and inter-species effects of inversion differences on gene flow.

**Huang Huang*****The Role of Transforming Growth Factor (TGF)-beta Type III Receptor in Multiple Myeloma***

Research Advisor: Gerard Blobel  
Pharmacology and Cancer Biology

The TGF-beta signaling pathway has an important role in regulating normal hematopoiesis, inhibiting proliferation while stimulating differentiation when appropriate. TGF-beta ligands regulate cellular processes by binding to three high affinity cell surface receptors. Loss of TBR3 (betaglycan) correlates with disease progression and increased tumor grade. Unlike epithelial-derived cancers, multiple myeloma is a hematological malignancy of plasma cells, and the role of TBR3 in this disease has not been investigated extensively. As multiple myeloma pathogenesis is dependent on the cell-cell interactions in the bone marrow microenvironment, the primary goal of the

project is to analyze the effects of TBR3 on adhesion to the extracellular matrix and to bone marrow stromal cells (BMSC), homotypic aggregation among myeloma cells, and cell migration. After being co-cultured with a monolayer of BMSC, RPMI multiple myeloma cells overexpressing TBR3 showed reduced adhesion to BMSC in a time-dependent manner. To further elucidate the mechanisms by which TBR3 stymies myeloma pathogenesis, time-course homotypic aggregation assays were designed. The results demonstrate that RPMI myeloma cells overexpressing TBR3 exhibited a significant increase in homotypic aggregation, thus inhibiting the cells from homing to the bone marrow and participating in subsequent proliferation. Finally, the transwell migration assays revealed that overexpression of TBR3 corresponded with reduced cell motility. Conversely, knock-down of TBR3 promoted migration, thus confirming TBR3's indispensable role in ameliorating multiple myeloma aggression.

**Kathryn Hudak*****Mastoparan derivatives as potential antiviral agents***

Research Advisor: Elizabeth Ramsburg  
Pathology

With the recent outbreaks of viruses such as H1N1 Influenza, broadly effective antiviral sources are of interest. The few broadly effective antivirals in use are expensive and often provide no cure. The common method for developing antivirals is to synthesize or utilize a product that will interfere with the development of the virus rather than destroying the virus. A widely applicable method might be to target processes that are common to many viruses and are essential to their development. One suggested source for a new broad-spectrum antiviral is a group of peptides known as mastoparan-derived host defense peptides. Mastoparan-7 (MP-7) is derived from mastoparan and has shown antiviral activity. Preliminary results have indicated that MP-7 derivatives are successful at inactivating different virus types. In this study, three mastoparan derivatives were tested for antiviral activity against vesicular stomatitis virus (VSV). Immunofluorescence and confocal microscopy were used to determine the degree of colocalization of VSV and the endosomes in mammalian cell lines. The results suggest that inactivation of VSV occurs due to the ability of the peptide to prevent binding of the virus at the cell membrane, preventing endocytosis into the cell.

**Jordan Jarrett**  
*Origin, Petrography and Formation Theory of  
Intrusive Veins at the Stillwater Complex*  
Research Advisor: Alan Boudreau  
Earth and Ocean Sciences

The Stillwater Complex in Montana is a layered igneous intrusion of widespread interest, not only as a large and very old continental pluton, but also as a large source of extractable minerals such as platinum (McCallum 1996). This study looked specifically at the origin, formation, and petrography of intrusive veins found at a particular outcrop located on Picket Pin Mountain in the Middle Banded Series of the complex (Boudreau & McCallum 1986). In their 1997 paper, Meurer, Klüber and Boudreau determined that olivine bodies in Olivine-bearing (OB) subzones III and IV of the Middle Banded Series formed via intrusion of high-heat, silica under-saturated fluids. These conditions properly account for distinctive zoning patterns of the discordant bodies examined in this study, as well as of the mineral composition of the host rock. The present study attempts to apply the same question to intrusive plagioclase and hornblende veins of an outcrop in OB-IV. It was hypothesized that reversed zoning should be evident in plagioclase grains in or surrounding the intrusions. In addition, plagioclase grains should be higher in anorthitic content near the vein versus further away, according to the given formation conditions. Although this was confirmed in one sample submitted for microprobe analysis, greater detail of fluid evolution and vein formation were also concluded. Both high and lower temperature fluid intrusions led to different facies formations in the sample to account for the different mineral assemblages of the veins and varying degrees of alteration.

**Rui Jiang**  
*Obesity in populations with lower socioeconomic status: How to make healthy foods accessible and affordable?*  
Research Advisor: Alma Blount  
Public Policy

In the U.S., over 60 percent Americans are overweight or obese. The high prevalence has led experts to coin the term obesity epidemic. The effects of obesity are seen in increased health risks for type-2 diabetes, heart disease, stroke and other illnesses. In 2008, \$147 billion were spent in obesity related health care expenses. Yet, the populations with the greatest health burdens from obesity in the rural South have limited access to a healthy lifestyle due to constraints of their environment. In order to understand the barriers associated with a

lack of access and availability of healthy foods, I performed literature review as well as practitioner interview to identify the challenges and interventions. Transportation, a lack of grocery stores, rising cost of fruits/vegetables and unwillingness to invest in low-income communities were some of the factors found. However, initiatives could be taken by the community to provide financing for healthy foods and to create jobs by developing new grocery stores, improving current convenient stores, upgrading health education, and promoting use of fruit/vegetable vouchers among WIC and food stamp recipients.

**Shan Jin**  
*Characterization of Catalytically-Impaired Point Mutants of CTD Phosphatase Ssu72*  
Research Advisor: Pei Zhou  
Biochemistry

RNA Polymerase II (Pol II) is a eukaryotic enzyme that transcribes DNA into RNA and also plays an important role in regulating co-transcriptional events through its C-terminal domain (CTD). The CTD consists of multiple heptad repeats (Y-S-P-T-S-P-S) with highly regulated phosphorylation occurring at the Ser2 and Ser5 positions. Different phosphorylation patterns of Ser2 and Ser5 attract distinct sets of transcription factors to the CTD, effectively coordinating the activity of Pol II to mRNA processing, histone modification, splicing, and other processes. Mutations in some of these CTD-binding factors have been linked to certain cancer types, while the hijacking of this transcription machinery by viral enzymes is thought to be a part of infection by viruses like HIV. This project will focus on the S5 CTD phosphatase Ssu72. While Ssu72 is likely involved in termination of mRNAs, a non-functional Ssu72 gene confers lethality in yeast, making it difficult to discern its biological function. For this project, we used the recently-solved structure of Ssu72 to design and characterize catalytically-impaired point mutants with varying levels of phosphatase activity.

**Julius Jones**  
*I shall not be moved: Civil Rights Activism in Portland, Oregon's African American Community, 1945-1959*  
Research Advisor: Raymond Gavins  
History

The end of World War II marked a new era of possibilities for African Americans, who emerged from the conflicted determined to use their near universal loyalty and willingness to serve in the Armed Forces as a means to challenge the nation's racial status-quo. During the war, Portland, Oregon experienced growth

in its African American population on parity with other large urban areas on the West Coast. However, the city's racial climate particularly inhospitable. African Americans who stayed in Portland did not buckle under the pressure of declining employment and discrimination. Rather, the racial climate of the city served as an incubator for civil rights activism, as African Americans and their allies worked together to advance equal opportunity in the state. The civil rights movement in Portland proved to be a back and forth struggle against the status quo of subtle, yet deeply entrenched, racial bigotry. The years immediately following World War II saw a proliferation of interracial civil rights organizations in Portland, including the Albina Community Council, the Committee on Inter-racial Principles and Practices, the United Committee for Civil Rights, the Commission on Intergroup Relations, the Urban League of Portland, and the Portland chapter of the National Association for the Advancement of Colored People. These groups and their members constituted 'The Movement' in Portland, tirelessly advocating for equal rights for all of the city's citizens.

**David Jung**  
*Molecular Characterization and mapping of "curved," a 100-year-old mutation, in *Drosophila melanogaster**

Research Advisor: Eric Spana  
Biology

Over 90 years ago, Calvin Bridges and Thomas Hunt Morgan published detailed descriptions of mutations on the 1st (1916), 2nd (1919) and 3rd (1923) chromosomes. One of these mutations, curved (c), was identified in 1911 by Bridges. Curved is a wing phenotype, in which the wings are concave in an outward direction. Our goal is to identify this mutation, with a focus on molecular characterization and mapping. So far through complementation testing, we have mapped the location of c1 to a region of ~30 kb encoding 8 transcripts. One gene in this region, *Stretch-Mlck*, has mutations of which are reported to be allelic to c1. Sequencing of the *Strn-mlck* gene in curved has revealed a 412 retrotransposon in the vicinity of a splice site of several transcripts. However, multiple inserts in CG8366 and one insert in *Strn-Mlck* fail to complement c1. We plan to perform further complementation testing to determine if the 412 insertion element is a splice-site mutation of 6 of 13 transcripts. We also plan to fully sequence curved.

**Maxwell Kligerman**  
*Pre an Post Earthquake Analysis of the Healthcare Infrastructure of Leogane, Haiti Using GIS Technology*

Research Advisor: Dr. David Walmer

Using GIS data collected on three separate trips to Haiti, this study both maps and analyzes changes to the healthcare infrastructure of Leogane, Haiti as a result of the January 12, 2010 earthquake. The analysis particularly focuses on the availability of medical services for women and children. The report finds that of the 34 clinics functioning prior the earthquake, one year afterwards 29 of these clinics are still functioning. Eight new healthcare providers have also emerged since the quake. One year after the earthquake, the healthcare infrastructure of Leogane is in a very fragmented state, and steps must be made to unite both local and foreign healthcare efforts.

**Hyesung Kim**  
*Molecular bases of disease expression of syndromic visual dystrophies by RPGR-dependent and differential subcellular sorting and processing of RPGRIP1a1*

Research Advisor: Paulo Ferreira  
Duke Eye Center

RPGR and RPGRIP1 play direct roles in syndromic retinal dystrophies by elusive mechanisms. RPGR interacts with the RPGRIP1 via its RHD domain, which is homologous to RCC1, a nucleotide-exchange factor for RAN GTPase. Molecular modeling of RHD of RPGR to RCC1 shows that all disease mutations in RHD map to a distinct contact interface from that found between RCC1 and RAN GTPase. Two-hybrid assays show that disease-causing mutations in RHD or ORF15 domains differentially impair RPGR interaction with RPGRIP1. Cell and time-lapse microscopy assays support that expression of RPGRIP1a1 isoform alone promotes the genesis of aggregates, whereas its co-expression with the RPGR1-19 isoform targets RPGRIP1a1 to the Golgi. Conversely, RPGRORF15 co-expression with RPGRIP1a1 promotes its pan intracellular dispersion and clears out pre-existing RPGRIP1a1 deposits. Mutations singly in *Rpgr1-19*, *RpgrORF15* or *Rpgrip1*, do not affect the colocalization of RPGR1-19 or RPGRORF15 with RPGRIP1a1, whereas co-expression of similar mutations in *Rpgr* variants and *Rpgrip1* abrogates their colocalization and association. RPGRORF15, but not RPGR1-19, prevents the C-terminal proteolytic processing of RPGRIP1a1. Hence, *Rpgr1-19* and *RpgrORF15* exert distinct effects on RPGRIP1a1 sorting and processing and they are

necessary but not sufficient to the coupling to, and subcellular targeting of, RPGRIP1a1.

**Han Jun Kim**

***The Effect of Acetylcholine On Micro Arousal-Like Sleep Structure***

Research Advisor: Miguel Nicolelis  
Neurobiology

An important brain structure, the hippocampus, has been a center of interest to scientists for a long time as it plays an important role in learning and memory. On the other hand, memory consolidation has been proposed as one of the functions carried out by sleep. Therefore, understanding hippocampal activities and states may further our understanding on the functions of sleep and memory. During sleep, hippocampus alternates between two main physiological states that each displays unique pattern of neural activities revealed by electroencephalogram (EEG). The slow-wave (non-dreaming) sleep is mostly dominated by large-amplitude irregular activities (LIA) with characteristic sharp waves. The REM (dreaming) sleep is characterized by theta frequency (7-12Hz) activities. During slow-wave sleep, an additional physiological state characterized by small-amplitude irregular activities (SIA) interrupts the LIA state frequently, but with very short durations (Jarosiewicz and Skaggs, 2004). The mechanism behind SIA generation remains unknown and the function of such transient arousal states remains largely obscure. On-going research in Nicolelis Lab suggests that putative cholinergic neurons promote the appearance of SIAs during slow-wave sleep. In line with such hypothesis, a recent study (Lena et al., 2004) suggests that the nicotinic receptors are involved in the regulation of SIAs. Based on these converging lines of evidence, we propose that the neurotransmitter acetylcholine (ACh) is involved in the modulation of SIA epochs. Specifically, we hypothesize that ACh release in hippocampus promotes the appearance and/or duration of SIA states, through nicotinic receptors.

**Michelle Kim**

***Prostitution: an industry of victims, not criminals***

Research Advisor: Kristin Goss  
Public Policy

On any given day in the Chicago metropolitan area, there are 16,000 women and girls are involved with prostitution. Research shows that the plight of prostitutes is not changing: women are still facing violence by pimps and customers and their poor conditions remain the same because very little is being done for them by people who can help them. I am

trying to paint a human face on a prostitute that contradicts the preconceived attitudes of many outsiders who view prostitutes as immoral and criminal. I wanted to know why prostitutes were being trapped in the sex trade once they fell in and what sorts of progressive policies could help women escape prostitution. My research methods includes data analysis of records and literature from the Department of Women's Justice Services in Chicago and interviews with former prostitutes and community members affected by the sex trade. I found that changing the attitudes towards prostitution is slow moving and difficult but we are taking right measures in trying to change laws and institutions. The media is taking more initiatives through efforts such as plays to inform the public. One of my strongest recommendations is more funding into rehabilitation programs and education efforts for young girls before they enter prostitution because it is both cost-effective and has the biggest influence in keeping women out of prostitution.

**Nusaibah Kofar-Naisa**

***Hijab: A Cross-Cultural Examination of the Muslim Woman and Her Veil***

Research Advisor: Kerry Haynie  
Political Science

This research project aimed at examining the individual reasons Muslim women give for wearing the headscarf. The paper compared responses given by woman in Cairo, Egypt to those given by women in the United States. Findings illustrate that explanations for wearing the headscarf are largely tied to cultural themes. As a result, reasons given by Muslim woman, although connected to religious beliefs, are largely shaped by one's community and cultural background and include a wide variation across locations.

**Young Soo Kwon**

***Study of New Segmentation of Chinese Consumers***

Research Advisor: Cherly Lin  
Department of Sociology

Purpose of this research is to study the most updated characteristics of Chinese consumers using modified questions from Geert Hofstede's scale of cultural dimensions as well as other consumer behavior questions regarding green-environment movement and corporate social responsibility. Because economic and sociological condition in China is rapidly changing, managers of firms operating in China will benefit from this most up-to-date study's result that may show different result from prior research that was taken in the past.

**Ji-Hyeun Kwon*****Evaluation of Grupo Venancia's Campaign on Sexual and Reproductive Rights: 'Antes de Cargar con Otros, Hacete Cargo de Vosá'***

Research Advisor: Alma Blount  
Public Policy

According to the Guttmacher Institute, Nicaragua has the highest adolescent pregnancy rate in Latin America and the Caribbean with 119 births per 1000 women aged 15-19 (2008). This high adolescent pregnancy rate is a societal problem because adolescent mothers and their babies face negative health and economic consequences. In order to address this issue, Grupo Venancia, a women's NGO in Matagalpa, Nicaragua, has launched a campaign on adolescents' sexual and reproductive rights. The objective of this campaign is to allow adolescents to recognize their capacities and responsibilities so that they take responsibility for their lives, take conscious decisions on their sexuality and delay the age of first childbirth (Grupo Venancia, 2009, p. 2). Therefore, this report examines the impact of Grupo Venancia's campaign on the understanding and perception of adolescents and adults on adolescents' sexual and reproductive rights. Three different populations, secondary school students, their parents, and their teachers, answered questionnaires. Even though the definite impact of the campaign on the perception and understanding of adolescents and adults about adolescents' sexual and reproductive rights is inconclusive, the campaign is going in the right direction as many participants understood the objective of the campaign. The researcher recommends that the organization change its marketing method, portray contraceptives differently, and elaborate and clarify certain topics covered in the campaign in order to be more effective.

**Ashton Lai*****A Structural Study of Rev1 Translesion Polymerase in Complex with Pol zeta (Rev 7/3)***

Research Advisor: Dr. Pei Zhou  
Department of Biochemistry

The study of translesion synthesis is important in understanding the mechanics of DNA replication and repair as well as genome stability. The interaction between two translesion polymerases, Rev1 and Rev7/3, has recently been implicated in acquired chemoresistance in recurrent cancers. This interaction between Rev1 and Rev7/3 is thought to mediate translesion bypass of chemical chelators, allowing the tumor cell to survive. Here, we present a structural approach to understanding the interaction interface between Rev1 and Rev7/3 that is crucial for translesion

bypass. Polyacrylamide gel electrophoresis under native condition suggested a weak interaction between the C-terminus of Rev1 with Rev7/3. This result was confirmed in the observation of peak perturbations in a 1H-15N Heteronuclear Single Quantum Coherence (HSQC) spectrum. In addition, the chromatograph of the suggested Rev1-Rev7/3 complex in a size exclusion column exhibited a different peak migration from that of the two single components. This structural approach to understanding the protein-protein interaction provides a framework for structure-based drug development that could potentially be useful for clinical treatment of acquired chemoresistant cancers.

**James Lee*****Studying the dynamics of mitochondria by kinesin and RANBP2 using time-lapse microscopy***

Research Advisor: Paulo Ferreira  
Eye Center

The microtubule-based motor proteins, kinesins and dyneins, mediate the intracellular trafficking of mitochondria. Kinesins generally move cargoes toward the periphery of the cell, but the regulation of the assembly/disassembly of cargoes onto/from kinesins and regulation of kinesins' motor activity by their cargoes is not understood. The Ferreira laboratory found that a tripartite domain of RAN-binding protein 2 (RANBP2) is sufficient to activate directly the conventional kinesin, KIF5B, to levels close to those seen in vivo. In addition, uncoupling of the interaction of RANBP2 with KIF5B in cell culture lines promotes the perinuclear clustering of mitochondria. Yet, the precise and primary effects of RANBP2 in mitochondria trafficking and dynamics preceding the clustering event are not understood. To address this issue, I am employing time-lapse microscopy and imaging analyses to measure and discern several biophysical parameters of mitochondria dynamics in real-time upon uncoupling RANBP2 from KIF5B in culture cell lines. I expect the outcome of this study to provide new insights into the immediate effects of RANBP2 in the regulation of intracellular transport steps of mitochondria and a subset of kinesin members.

**Esther Lee*****The effects of galectin-1 on the differentiation of human umbilical cord mesenchymal stromal cells (HUCMSCs) in vitro***

Research Advisor: Jun Chen  
Biomedical Engineering

Intervertebral disc (IVD) degeneration is a major contributor to lower back pain and spine-related disability, with enormous socioeconomic consequences.

An avenue of great interest involves cell supplementation to herniated or degenerated IVDs to promote tissue regeneration and inhibit progression of disc pathology. Recently, mesenchymal stem cells (MSCs) have been studied as a potential source for such purposes. Our previous work showed that nucleus pulposus (NP) cells express specific laminin isoforms and laminin-binding receptors as well as galectin-1, a laminin-adhesive carbohydrate protein. Using these unique phenotypic markers, we evaluate human umbilical cord mesenchymal stromal cell (HUCMSC) regeneration into NP-like cells and matrix in a laminin-rich pseudo-3D culture system. HUCMSCs from umbilical cord Wharton's jelly were seeded (106/well) on top of Matrigel™ pre-coated Transwell inserts and cultured in differentiation media containing galectin-1 (1 $\mu$ g/ml) and 2.5% Matrigel™ under 2% hypoxia conditions. Cell morphology, matrix production and expression of laminin and laminin-receptors were analyzed at days 6 and 21 of culture. HUCMSCs treated with galectin-1 maintained a cell clustering morphology similar to that of immature NP cells in situ. Expression of NP cell surface markers (integrin 3 & 6, CD239) as well as NP matrix markers (laminin 10/11, type II collagen, aggrecan) was confirmed via flow cytometry analysis and immunohistochemistry. Thus, galectin-1 may promote HUCMSC differentiation into NP-like cells in a laminin-rich pseudo-3D culture environment.

**Jason Lou**

***Basal Forebrain Neuron Properties During Whisker-Dependent Tactile Discrimination Task***

Research Advisor: Eric Thomson  
Neurobiology

The primary somatosensory cortex (S1) is a highly studied part of the neocortex that is linked with tactile sensory input such as touch. For the rat model, the S1 can be assessed through use of the Krupa Whisker-Dependent Tactile Discrimination Apparatus, in which rats must use their whiskers to discriminate between wide and narrow tunnels. In the Krupa Apparatus, rats are given a water reward with a correct discrimination. It was shown that rats quickly learned to discriminate between the wide and narrow tunnels, and that their performance was directly proportional to the number of whiskers intact on the rat. Lesions to the S1 after the rats revealed that the rats could no longer perform the task, demonstrating that this region is critically involved in this tactile behavior. In contrast to the S1, the basal forebrain (BF) is a relatively understudied part of the brain. Because the BF is a neuromodulatory nucleus, it acts as a sort of "sprinkler system", sending signals across the entire cerebral cortex and putatively affecting how the brain processes incoming

sensory information. My study will combine uses of the water reward system of the Krupa Apparatus and single unit recording to explore the response properties of neurons in the Basal Forebrain, and to explore the effects of the BF on the primary somatosensory cortex.

**Jenessa Malin**

***Self-handicapping and Gifted Ability Messages: Motivational Processes Influencing Gifted Underachievement***

Research Advisor: Lisa Linnenbrink-Garcia  
Psychology

Messages about the malleability of ability have the potential to influence academic underachievement. Ability feedback may be particularly salient in reference to gifted populations who endure high pressure and competitive environments. The current study seeks to investigate the impact of messages about giftedness as fixed or malleable and success/failure experiences on two forms (claimed and behavioral) of self-handicapping behaviors among undergraduates. Claimed self-handicapping occurs when an individual provides, whether truthfully or not, excuses for poor performance. Behavioral self-handicapping occurs when an individual actively creates an obstacle or engages in a behavior to impede performance. All participants were told they qualified for a gifted version of the study. A 2 (theories of intelligence message: entity, incremental) x 2 (experience: success, failure) between-subjects design was utilized to test the effect of ability message and success/failure experience on (DVs). 92 participants were recruited from the psychology subject pool at an elite private university. Participants who experienced failure were significantly more likely to engage in both behavioral and claimed self-handicapping than participants who experienced success. Experiencing failure (regardless of ability malleability message) made participants significantly more likely to engage in claimed self-handicapping. The effect of failure on behavioral self-handicapping varied as a function of message about ability malleability. Implications for researchers and educators are discussed.

**Michael McAdams**

***Roles of adult males in the social development of juvenile male Coquerel's sifaka (Propithecus coquereli)***

Research Advisor: Amy Schreier  
Evolutionary Anthropology

After weaning, primates begin an unusually long period in their development in which they learn behaviors that aid in their survival and future reproductive success.



Though this is a critical period in development, it has gone relatively unstudied in non-human primates. In this study, I focus on the relationship between juvenile and adult male Coquerel's lemurs at the Duke Lemur Center. I compare two groups using a scan sampling technique, one in which the adult male is the juvenile's father, and one in which they are not related, to examine if kinship has an effect on the level and type of interaction between juvenile and adult males. I predict that the presence of a related adult male is essential for juvenile males to learn key sex-specific behaviors for sexual and social interactions and thus juvenile males will associate more with adult males than adult females and more with related adult males than unrelated adult males. Overall juvenile males did not associate (i.e., groom, nearest neighbor) significantly more with adult males than females although within Group 1 the prediction was supported. Related males overall did not associate more than unrelated males and these results could be due to the varying ages of the juvenile males and group size. Kinship did not seem to have a large influence when comparing juvenile male-adult male dyads, however it does appear that having an adult male in the group is important for the social development of juvenile males.

#### **Meredith Mechanik**

##### ***At a Loss for Words: Exploring 18-Month-Olds' Willingness to Apply the Mutual Exclusivity Bias to Gestural Labels***

Research Advisor: Makeba Wilbourn  
Psychology

According to the mutual exclusivity (ME) assumption, when infants are presented with novel words, they map them onto novel rather than familiar objects because they assume that objects have only one label. However, there is little research exploring whether infants abide by ME across modalities with gestural labels. In this project, we used an interaction paradigm to study how 18-month-olds respond when presented with words or gestures as labels for familiar and novel objects. Infants were presented with familiar words, novel words, and gestures and had to choose between novel or familiar objects. Infants' selections and first looks were recorded. As predicted, infants mapped familiar words onto familiar objects and novel words onto novel objects, abiding by ME. However, infants did not reliably map gestures onto either familiar or novel objects. These findings will be discussed in terms of symbolic development and the role of experience on early label learning.

#### **Grant Meeker**

##### ***Three-Dimensional Quantification of Anterior Cruciate Ligament Geometry: A Validation Study***

Research Advisor: Dr. Nicole Griffin  
Evolutionary Anthropology

Anterior cruciate ligament (ACL) rupture is a devastating injury and considerable research has focused on factors that may elevate ACL injury risk. From an engineering perspective, cross sectional area (CSA) is an important factor in the failure conditions of a structure, but assessment of the cross sectional properties of the ACL in uninjured humans is challenging. Magnetic resonance imaging (MRI) offers physicians a non-invasive, accurate approach to evaluate and diagnose injuries within a joint capsule such as the rupture of the anterior cruciate ligament (ACL) and may also provide a method for quantifying ACL integrity in three-dimensions, though its accuracy in measuring the ACL remains to be fully explored. Objective: The immediate aim of this study is to test the hypothesis that accurate measurements of ACL geometry can be obtained from a magnetic resonance (MR) scan of an intact knee joint. The overarching goal of this study is to play a role in developing a technique that can be used to reliably evaluate the cross sectional area of the ACL and therefore provide valuable information on risk of injury. The preliminary results of this study suggest that this MR imaging and three-dimensional modeling approach provides accurate measurements of ACL volume and CSA. This technique shows potential for efficiently measuring ACL geometry in human patients and may provide a key method for evaluating injury risk so that precautions may be taken to avoid ACL rupture.

#### **Nicholas Mei**

##### ***Assessment of dose and time dependent damage to mitochondrial DNA by 5-Fluorouracil in *Saccharomyces Cerevisiae****

Research Advisor: Sally J. York  
Pharmacology and Cancer Biology

5-Fluorouracil (5-FU) is a commonly used anti-cancer agent that exerts its effects via incorporation into DNA, RNA, and inhibition of thymidylate synthase leading to imbalanced nucleotide pools and uracil incorporation into DNA. Although the effects of 5-FU treatment on nuclear DNA are well characterized, much less is known about its effects and toxicity on mitochondrial DNA (mtDNA). Utilizing a yeast model, we (1) examined the dose and time dependent damage done by 5-FU to mitochondria by utilizing differential plating onto respiration optional and required media, (2) determined the mutation rate of mtDNA treated with 5-

FU by utilizing an erythromycin plating assay, and (3) proposed an assay utilizing LC/MS to quantitate relative amounts of 5-FU and/or uracil incorporated into mitochondrial DNA. We found significant loss of mitochondrial function occurred for 8 and 16 hour incubations with 100 and 500 uM 5-FU concentrations. Initial results for the mutation assay suggest an increased mutation frequency with higher concentrations of 5-FU. The proposed LC/MS assay was found to yield good chromatographic separation for our three structurally similar pyrimidines of interest and was sensitive down to 10 uM concentrations for individual components. Subsequent work with human cell lines should be undertaken to see if similar toxicities hold true and continued work with the LC/MS assay will hopefully elucidate relative involvement of 5-FU and uracil in mtDNA nucleotide incorporation.

**Sharon Mei**

***Nutritional Deficiencies of the Mangyan Indigenous Children of Puerto Galera, Philippines***

Research Advisor: Christina Gibson-Davis  
Public Policy Studies

The indigenous Mangyan children of Puerto Galera, Philippines have consistently performed worse, relative to the general population, on regional academic performance assessments, confirming existing beliefs about the inherent intellectual inferiority of the indigenous people. The Stairway Foundation, aiming to eliminate systematic discrimination by implementing a community assistance program to correct inequalities, performed a needs assessment of the school. The assessment indicates that the school lacks school supplies and academic resources and that the students arrive at school hungry and consequently unable to focus. Using dietary recall interviews, this study seeks to identify the specific nutritional deficiencies relative to both the nationally recommended nutritional intake and that of the general population students of the nearby elementary school the data indicated that the Mangyan students diets were significantly deficient in intakes of protein, calcium, phosphorous, and Vitamins D, E, K, and B12. The Foundation was advised to finance the school's proposed school lunch program, supplementing their proposed lunch menu with additions that would provide more of the deficiencies in the existing student diet.

**Jade Miller**

***The Influence of Sleep Duration and Quality on Weight Loss Outcomes of Overweight and Obese African-American Women in Behavioral Weight Loss Intervention***

Research Advisor: Gary G. Bennett  
Psychology

The current study examined the influence of self-reported sleep duration and sleep quality on weight loss outcomes in a sample of 30 overweight or obese African American women undergoing 6-month behavioral weight loss intervention. The effects of sleep duration and sleep quality on 6-month change in BMI were tested using one-way ANOVA. Sleep duration and sleep quality were not found to be associated with 6-month change in Body Mass Index.

**Manu Mysore**

***Iron Exchange Between A Siderophore Carrier and A Small Molecule Bidentate Chelator: A Kinetic Analysis***

Research Advisor: Dr. Alvin Crumbliss  
Chemistry

Pathogenic bacteria require iron and sequester it from their environment. Exploring iron uptake processes can help with our understanding and treatment of bacterial infections. Bacterial iron uptake processes involve siderophores. Siderophores are low molecular weight, ferric ion specific chelating agents secreted by bacteria and fungi when iron is scarce. The role of these compounds is to scavenge iron from the environment and to make it available to the microbial cell.<sup>1,2</sup> The delivery of iron to the cell can occur due to an exchange mechanism. The iron exchange process between hexadentate chelators, such as siderophores, is generally very slow due to the kinetics of inner coordination sphere ligand exchange at high spin iron (III).<sup>3</sup> It has been shown that the presence of a secondary, low-coordination number chelator, such as 1,2-dimethyl-3-hydroxy-4-pyridinone (DMHP) results in the acceleration of iron exchange between ferrioxamine B (H4DFB+) and EDTA, two hexadentate chelators. However, it was noted that DMHP may also act as a competing chelator in this reaction and was not a simple catalyst. The purpose of this study was to determine the mechanism and rate law by which DFB exchanges iron with DMHP. The kinetics of this competition reaction were monitored spectrophotometrically and the mechanism was determined by varying the pH and DMHP concentration.

**Miki Nishitani**

***The Regulatory Role of ActivinB in the Early Signal of Endomesoderm Specification in Sea Urchin *Lytechinus variegatus****

Research Advisor: Dr. David McClay  
Biology

Cell-type specification is a result of the integration of inductive signals, which stem from the expression of unique regulatory genes. In sea urchins, specification of endomesoderm tissues occurs in response to early-induced signals (Early Signal) sent from micromere cells. Although the Early Signal is necessary for the induction of endoderm fate in neighboring cells, its molecular identity is not completely understood. In this study, I characterized the role of ActivinB in this Early Signal of the *Lytechinus variegatus* species. First, the ActivinB gene from *L. variegatus* was cloned, and morpholino oligonucleotides were designed against its sequence for knockdown of ActivinB protein. Microinjection of the morpholino resulted in reduced spicules and pigment cells, both of which are structures derived from the endomesoderm. The perturbed embryos were then assayed for expression of downstream endomesoderm genes via in situ hybridization. In situ analysis indicated that endomesodermal markers *Endo16* and *FoxA* are both downstream of ActivinB in the regulatory network. In contrast, mRNA expression levels of *Blimp1*, *Bra*, and *GCM* were not reduced, suggesting that these genes are independent of ActivinB function. These findings support the hypothesis that ActivinB is an essential component of the Early Signal in endomesoderm specification. This study contributes to the progressing endomesoderm gene regulatory network and provides a framework for future studies of the regulatory interactions underlying developmental specification.

**Aishlinn O'Connor**

***Political Participation in Cape Coast, Ghana***

Research Advisor: Alma Blount  
Public Policy

During the summer of 2010, local government agencies in Cape Coast, Ghana were working out the details of awareness campaigns and recruiting community members to run in the October Cape Coast Metropolitan Assembly elections. Four years earlier, only 30% of citizens had voted in the CCMA elections (compared to over 70% for Parliamentary elections). While everyone hoped education campaigns would change this, no one had done any research into the causes of the low voter turnout. My research sought to identify several primary reasons that citizens didn't vote while also looking at any other ways in which they

did participate in local government. My research design included interviews with the heads of several local departments, members of the assembly, and citizens. Additionally, a wide range of citizens of Cape Coast were surveyed at the central market. Ultimately, I found that the primary reasons for low voter turnout were more related to the structure and mandates of the CCMA than a lack of education concerning how or when to vote. Conversely, while voter turnout was low in CCMA elections, citizens were more likely to engage their Assemblyman with their concerns during the Assemblyman's term than any other member of government.

**Si Won Oak**

***The Influence of Sialylated IVIG on Various Complement Pathways***

Research Advisor: Michael Frank  
Allergy/Immunology

We are examining the mechanism of action of Intravenous Immunoglobulin (IVIG). IVIG is prepared from the pooled antibody containing fraction (gamma globulin or IgG) of thousands of blood donors. Complement proteins act to destroy invading microorganisms and induce inflammation and IVIG is known to block complement action. It has been shown that IVIG can be separated into sialic acid rich and sialic acid poor molecules and that the sialic acid rich molecules have all of the anti-inflammatory activity. We determined which of these fractions blocks complement action. We examined the effect on the classical pathway of complement action in an Enzyme-Linked Immunosorbent Assay (ELISA). To immune complexes formed on a microtiter plate was added sequentially C1 and C4 in the presence of varying dosage of sialylated or non-sialylated IVIG. We used a rabbit red cell lysis to examine the effect of IVIG on the alternative pathway of complement action. Lysis of rabbit erythrocytes was unchanged in the presence of IVIG. However, sialylated IVIG blocked the C1-C4 interaction and less C4 was found bound to the ELISA plate. The non-sialylated IVIG was not active. Therefore, sialylated IVIG not only blocks inflammation in autoimmunity, but it also blocks the interaction between C1 and C4 in the classical pathway. This may be an integral part of IVIG's mechanism. We will now determine whether other complement binding steps are blocked.

**Dayo Oshilaja*****Investigating the Academic Performance of Black Undergraduates at Duke***

Research Advisor: Dr. William Darity  
Sanford School of Public Policy, African and African-American Studies

My research question is two-fold; first to try and determine if black students are still achieving on-par to the results of the 2006 Campus Life and Learning Project. The Campus Life and Learning Project provides a detailed analysis of a cohort of Duke Students from a variety of different backgrounds. One thing the report discovered is a disparity in the GPA of black students as opposed to non-black students over the course of their four years at Duke. According to the report, Black undergraduate students typically receive a 2.9 GPA their Fall Semester but upon graduation have increased their GPA to 3.4. Fall Semester of Freshmen Year, Asians students have the highest GPA of all racial groups with a 3.42, but upon graduation whites have the highest GPA which is just under a 3.6. My project is interested in discovering if black students still follow the pattern of beginning Duke with a 2.9 GPA and leaving with a 3.4. My second research question is to try and understand the various factors influencing the Academic Performance of Black Undergraduate Students. I have used surveys and interviews to talk to a representative sample of the black community to try and get a comprehensive sense of their academic performance.

**Eugene Park*****A Unique Type Three Secretion System Chaperone***

Research Advisor: Pei Zhou, Ph.D.  
Biochemistry

The type three secretion system (TTSS) is a protein complex used by several pathogenic bacteria to detect potential host cells and secrete proteins that make the target cells more susceptible to the pathogen. There are three general categories of component proteins: structural, effector, and chaperone. The structural proteins form a needle-like assembly on the surface of the cell, which is used both as a probe and a secretion pathway. Effector proteins are usually small peptides that are secreted from the pathogen and, upon entry into the target cell, hijack cell machinery to mediate uptake of the bacterium by the host. Chaperones bind to effectors, protecting them from aggregation and degradation while transporting them towards the needle for secretion. Here, we study the chaperone CT260 and its proposed binding partners CT618 and CT529. Most chaperones have been predicted to interact with an ATPase at the base of the needle, which provides the

energy for dissociation and release of the effector. CT260, however, appears to engage the needle base, thus directly linking effectors to the secretion channel. Furthermore, this protein does not share structural homology with any other known TTSS chaperones and is central to multiple protein-protein interactions. The uniqueness of CT260 makes it an interesting subject for research. The goal of this particular project is to elucidate the structure and function of the chaperone CT260.

**Avni Patel*****Assessing the Educational and Occupational Aspirations of Adolescents at P.R. Thakkar Vidyavihar***

Research Advisor: Dr. Anirudh Krishna  
Public Policy and Political Science

Educational and occupational aspirations are among the most significant predictors of eventual educational attainment. This community-based research (CBR) project thus assesses the educational and occupational aspirations of students from 8th to 10th grade in P.R. Thakkar Vidyavihar, a semi-private institution in Gujarat, India. The research utilized literature review, qualitative observations, and a simple random survey of students and parents to form a strong conceptual and empirical basis of aspirations and their roles in educational outcomes. The data demonstrated that there is a high correlation between parental aspirations for their children and the aspirations reported by the children themselves. Additionally, in general, the mean aspiration level is lower among adolescent males versus females. Lastly, students' hopes that students have correlate exactly to their expectations within the realm of this study and its sample. The research conducted reveals the importance of parental influence on aspiration levels as well as the predictive importance of aspirations on expectations.

**Katherine Patellos*****Effects of short term interaction on trust formation in domestic dogs (Canis familiaris)***

Research Advisor: Brian Hare  
Evolutionary Anthropology

Domestic dogs are known to have advanced social cognitive abilities, specifically they are adept at following human communicative cues and can use reputation to discriminate between human experimenters (Tomasello et al. 1997; Call et al. 1998; Hare and Tomasello 1999; Itakura et al. 1999; Cooper et al. 2003; Elgier et al. 2009; Kundey et al. 2011). In this study, we examined the mechanisms which shape their formation of trust with novel experimenters and

drive this shift in preference over a short interval. To discriminate between alternative pathways in trust formation, we tested 91 dogs at the Duke Canine Cognition Center in Durham, North Carolina. Our results did not support our hypothesis that dogs would trust an experimenter that interacted with the dog during a fifteen minute exposure period more than a completely novel stranger. No significant difference was found in the dogs' performance between experimenters. Further investigation into individual differences between dogs should be conducted to examine whether individual performance during exposure period has an effect on the level of trust formed.

**Hannah Peckham**

***The University and The Church: Searching for the Heart and Soul of Civic Engagement***

Research Advisor: Alma Blount  
Public Policy

Duke University and its peers are increasingly interested in becoming leaders in civic engagement and social entrepreneurship, but the role of faith and spirituality is downplayed in their vision for the future. For my SOL research portfolio, I was interested in finding a successful model for people of faith to work within this university context. Can religion offer something unique to the modern research university's understanding of its purpose? The PathWays program at Duke Chapel functioned as a useful model for students who are interested in discernment and vocation to effect change both at the university level and in Durham. I primarily relied on an interview with a practitioner and literature review to inform my analysis. The portfolio concluded with several recommendations for students to become more involved at Duke and in Durham, particularly through utilizing resources available to them through their church communities.

**Michael Pell**

***The Farmhouse Blues: Reconciling Neo-Traditional American Farming Practices with Labor Regulations***

Research Advisor: Kristen Goss  
Public Policy

My research topic focused on the intersection between agricultural internship practices and American labor regulations. Many small farms throughout the US operate using "work-stay" agreements: arrangements where farmers partially compensate their apprentices with education, room, and board. The federal labor statutes lacks an exception to rules concerning minimum wage and taxes for this sort of agreement. The result is small farms receiving large fines for

practices considered beneficial and necessary for a sustained small agriculture industry by all of the concerned parties. My research explored the precise regulations that work-stay agreements failed to meet, possible solutions to this issue, and the necessities for implementing those solutions. I worked with farmers, small agriculture advocates, educators, professors, lawyers, and elected officials.

**Linda Peng**

***Engaging student microfinance organizations in domestic microfinance initiatives in the U.S.***

Research Advisors: Alma Blount, Lori Leachman  
Public Policy, Economics

Microfinance is a well-known international tool, but due to the recent credit crunch brought onto small businesses because of the economic recession, its presence as a development tool in the U.S. is becoming increasingly important. Given the more than 50 student university microfinance clubs across the country, I set out to explore how student-led microfinance clubs could help scale microfinance in the U.S. through partnerships with microenterprise development organizations (MDOs) in the U.S. such as ACCION USA. Through interviews, on-site university visits at Yale and Rutgers, and survey data from 86 representatives of 28 universities, I found that scaling microfinance through partnerships with student organizations is most feasible by engaging students through activities such as fundraisers, hosting of campus conferences/events, and one-on-one small business coaching. An exceedingly large number of students who were surveyed brought up the need for cross-campus collaboration and the sharing of best practices, which inspired the development of two online social networks: [www.campus-impact.org](http://www.campus-impact.org) and [www.microfinancestudents.com](http://www.microfinancestudents.com).

**Lauren Powers**

***Neural Correlates of Neuroticism in a Healthy Population***

Research Advisor: Ahmad Hariri  
Psychology and Neuroscience

Previous lines of research have separately examined the structural and functional relationships between neuroticism and the brain, particularly focusing on the negative correlations between neuroticism and amygdala gray matter volume or positive correlations between neuroticism and functional amygdala activation. However, little research has looked beyond the amygdala or attempted to discern the relationship among neuroticism, gray matter volume, and BOLD signal throughout the brain in a healthy population. In

this study higher levels of total neuroticism were present with increased dorsomedial prefrontal cortex (dmPFC) gray matter volume in addition to increased amygdala BOLD signal. Specifically, dmPFC gray matter volume positively correlated with the angry hostility (N2) subscale and negatively correlated with the impulsivity (N5) subscale. Amygdala functional activation positively correlated with the depression (N3) subscale. These results suggest the possibility of a relationship between amygdala reactivity and dmPFC gray matter volume in regard to total neuroticism. It remains plausible that amygdala functional reactivity serves a moderating role between trait neuroticism and gray matter volume in the dmPFC. Further research in this and other healthy populations is necessary to solidify this proposal regarding the structural and functional circuitry behind neuroticism.

### **Sandeep Prasanna**

#### ***Let's talk: why do we cooperate?***

Research Advisor: Brian Hare

Evolutionary Anthropology

Human social behavior is marked by interactions between (often unrelated) individuals working together at high frequency, intensity, and complexity, resulting in levels of cooperation not typically observed in other species. This pattern of social interaction presents a puzzle for researchers: how did these unique behaviors evolve, and what psychological processes support inter-individual cooperation? One idea is that punishment is an important proximate mechanism stabilizing cooperation when used as a retributive response to defective behavior. Other models of cooperation highlight the importance of human-specific communication, which allows humans to collaborate, negotiate, and engage in complex interactions. The current study examined the relative efficiency, effectiveness, and desirability of punishment and communication in motivating and stabilizing human cooperative interactions. Utilizing the economic situation known as the 'trust game', we contrasted a situation in which the two subjects in a dyad cannot communicate and are given the opportunity to 'altruistically punish' by spending money to remove money from the other, to a situation in which the dyad can engage in a free-form interaction, communicating during the entire task. We also analyzed supplementary data regarding sex, language use, and digit length ratios. We found that free-form communication was more effective, efficient, and desirable as a proximate mechanism of stable cooperation than altruistic punishment. These cooperative behaviors were significantly correlated with self-reported levels of trust and rapport with the other subject, suggesting that this

particular cooperative behavior is mediated by positive emotional responses. We also observed some effects of sex and language use on cooperative behavior, but found no significant interactions with digit length ratio. We hope that the results of this study will help us move toward a more robust understanding of the mechanisms underlying human cooperation and the possible evolutionary and developmental significance of different cooperative models.

### **Rachna Reddy**

#### ***Do lemurs comprehend what others can perceive?***

Research Advisor: Brian Hare

Evolutionary Anthropology

Thinking about the thoughts of others is an important human social skill. Other anthropoid primates have shown elementary forms of this ability, such as understanding what others see and know. A recent study showed ringtailed lemurs (*Lemur catta*), but not less socially complex species could pick up on the visual social cues of a human competitor. To further investigate the relationship between sociality and social cognitive ability, we tested *L. catta* and mongoose lemurs (*Eulemur mongoz*) in a visual perception task with three conditions, each requiring lemurs to utilize different social cues. In each condition, two experimenters placed food in front of them, but only one could see the food. In condition 1, one experimenter faced forward while the other faced away; in condition 2, one experimenter wore a band over her eyes while the other wore a band over her mouth; in condition 3, both experimenters turned perpendicular to the lemur, one with food in front of her face and the other with food behind her head. If a lemur approached the contested food, the experimenter removed it. *E. mongoz* did not avoid the contested food above chance in any condition. *L. catta* performed above chance in conditions 1 and 3, and outperformed *E. mongoz* in condition 1. The performance of *L. catta* supports previous findings and suggests that social complexity influences species' success in social cognitive tasks.

### **Alena Reich**

#### ***Comparative Evolutionary Morphology of the Primate Rhinarium and Clinical Correlates***

Research Advisor: Dr. Christine Wall

Evolutionary Anthropology

I integrated clinical and anatomical analyses to study epithelial anatomy of the anterior oral cavity in relation to caries development and primate evolution. I determined associations between the morphology of the superior labial frenum (SLF) and rhinarium and (1) the risk for caries in young children, and (2) traced the

homology of the SLF across primates and other non-primate mammals. The primate rhinarium is a key feature used to distinguish major taxonomic groups. The SLF in humans is a component of the rhinarium that is highly modified. Dissections of different species focused on the oral and nasal cavities, with a major emphasis on the rhinarium, alveolar process, and palate. Results indicate that the SLF of humans, though in its typical anatomy it is very reduced in size, can be homologized with the thick mucous epithelium that ties the split rhinarium to the alveolar process in strepsirrhines and non-primate mammals. I also data mined to study the clinical significance of the SLF in humans. This study examined if a constricted and/or thick SLF plays a role in the development of early childhood caries on the primary maxillary incisors. The study also addressed specifically the type of caries found on the teeth surfaces: I found that a constricted correlates with the development of smooth surface caries, while dental crowding correlates with the development of interproximal caries.

**Julie Rivo**

***Health seeking behavior of pregnant women in Leogane, Haiti***

Research Advisor: Kathy Walmer  
Global Health Institute

Maternal mortality continues to be a significant threat in developing countries. One of these countries is Haiti, which has the highest rate of maternal mortality in the Western Hemisphere and the 21st highest rate in the world. It remains challenging to both understand the causes and come up with effective interventions in Haiti due to the scarcity of relevant data and literature. In our study, we wanted to examine the health-seeking behavior of pregnant women and community perceptions of maternal health and mortality in Leogane, Haiti. We sought to assess whether these beliefs put women at a higher risk for death during pregnancy. From June 2010 to August 2010, we interviewed 50 family members and close friends of women who had died during pregnancy or up to 1 month after delivery. We used the International Standard Verbal Autopsy Questionnaire published by the World Health Organization. The interviewees attributed death to a number of medical (eclampsia, anemia, c-section, etc), social (doctor negligence, Voodoo curse, Jesus, etc) and situational factors (accessibility issues at a distance, cost, etc). Interestingly, many interviewees claimed the woman had received prenatal care and many eclampsia as the cause of death despite never receiving a diagnosis from a health care professional. Questions remain about what

prenatal care in the community entails and where information is being obtained.

**Kerri Rodriguez**

***Can Lemurs Remember? A Comparison of Spatial Memory Skills Across Four Strepsirrhine Primates***

Research Advisor: Brian Hare  
Evolutionary Anthropology

Among primates, there are two general hypotheses aiming to explain differences seen in cognitive development across taxa: the ecology hypothesis and the social hypothesis. These hypotheses emphasize ecology and social complexity, respectively, as evolutionary pressures contributing to the development of certain cognitive skills such as memory. Because very little is known about prosimian cognition, we aimed to investigate performance on two spatial memory tasks: one that featured a 1-week delay, and another that mimicked a more naturalistic, 3-dimensional foraging setting. We tested four species of lemur: two that differed in social structure (mongoose lemurs (*Eulemur mongoz*), and ring-tailed lemurs (*Lemur catta*)) and two that differed in feeding ecology (ruffed lemurs (*Varecia variegata*), Coquerel's sifakas (*Propithecus verreaux coquereli*)). Results indicated that the frugivorous ruffed lemurs, who outperform the folivorous Coquerel's sifakas on both memory tasks, are advanced in their ability to both generalize spatial information and retain it over a delay, possibly providing evidence for the ecology hypothesis. Ring-tailed lemurs outperform mongoose lemurs over a long-delay memory task but not on a more naturalistic, multi-location memory task, providing mixed support for the social hypothesis. These results have the ability to provide evolutionary anthropologists with a deeper understanding of the development of cognitive skills across primates and in turn, the evolution of intelligence.

**Ashley Ruba**

***Riding the Technological Wave: The Advent of the iPad***

Research Advisor: Vicki Russell  
Thompson Writing Program

This poster presentation highlights how iPads might benefit Writing Centers. What applications would be useful in tutoring sessions? Will the iPad prove to be an effective tool in Writing Centers? What makes the iPad different from other devices tutors and writers use, such as laptops and desktop computers?

**Charles Saadeh**

***Towards a Tandem FRET Model for use in Processive Enzyme Kinetic Assays***

Research Advisor: Dr. Eric Toone  
Chemistry

Forster Resonance Energy Transfer (FRET) is a powerful tool that can be utilized in enzyme kinetics via acceptor depletion studies. Tandem FRET extends the traditional model of FRET to more than two fluorophores. The purpose of this work is to illustrate how tandem FRET can be a useful methodology with which to monitor processive enzymes in real time. 6-FAM, TAMRA, and Cy5 were chosen and studied on DNA sequences with incorporated blunt-cut restriction sites for RsaI and HaeIII. A two step process was developed that yielded results aligning with theoretical expectations of processive kinetics. Future work should include development of methodologies for a one-step processive model, as well as applications to real processive enzymes such as cellulases.

**Alexandra Shams**

***Hormonal and Observational Effects of Medroxyprogesterone Acetate on Two Species of Eulemur***

Research Advisor: Christine Drea  
Evolutionary Anthropology

Despite the widespread use of hormonal contraceptives, both in humans and captive animals, relatively little is known about any behavioral consequences. Understanding the ramifications of frequent hormonal contraceptive use in animal management is vital, particularly for endangered species. In this study, I examined how hormonal contraception of female strepsirrhine primates, using medroxyprogesterone acetate (or Depo Provera), affects both sexes during the breeding season. I studied eight mixed-sex pairs representing two species (Eulemur rubriventer and Eulemur mongoz) housed at the Duke Lemur Center. I compared the behavior and sex hormone concentrations of reproductively intact and contracepted females, and of their male companions. Relative to intact females, contracepted females showed different behavioral patterns and decreased estrogen levels. Relative to males paired with intact females, males paired with contracepted females showed less up regulation of seasonal testosterone and displayed behavior atypical of the breeding season. Thus, female contraception affects not only the female, but also her male social partner. Continuing research in this area is important for understanding the full consequences of hormonal contraception and for the improved captive management of endangered species.

**Arun Sharma**

***The Role of Endothelial Receptor Endoglin in Mediating (TGF-beta) Smad Signaling***

Research Advisor: Dr. Gerard Blobel  
Pharmacology and Cancer Biology

The molecular mechanisms behind angiogenesis, or the development of blood vessels providing nourishment for cancer tumors, must be better understood in order to develop effective therapies for this disease. In particular, the intricate balances within certain signal transduction pathways involved with aspects of endothelial cell development in angiogenesis, such as the Transforming Growth Factor Beta (TGF-beta) pathway, should be elucidated. In this study, we focus on the interactions between TGF-beta superfamily co-receptor endoglin and Smad signaling in the context of endothelial cells, which are cells lining the interior walls of blood vessels involved in angiogenesis. The Smads are downstream molecules in the TGF-beta pathway that, as a result of signaling cascades, can translocate to the nucleus upon TGF-beta induced phosphorylation, or activation, at the cell membrane and act as transcription factors controlling cell proliferation and motility. However, the mechanism by which the endoglin receptor modulates Smad signaling is not well understood in the context of endothelial cells. The proliferation of these cells is essential for tumor angiogenesis.

**Alvin Shi**

***Identification of mutants of anchor cell invasion in the worm C. elegans from a ZMP-1 enhancer screen.***

Research Advisor: Dr. David Sherwood  
Biology

Cell invasion through basement membranes is a widely conserved process that has been implicated in cancer metastasis and host immune response. Anchor cell (AC) invasion into the vulval epithelium in the nematode *C. elegans* recapitulates this process. It has been demonstrated that the transcription factor FOS-1A regulates AC invasion. FOS-1A has several downstream targets, including ZMP-1, a zinc metalloproteinase that is believed to be responsible for breaking down basement membranes. However, *zmp-1* null worms do not give an invasion block, which suggests that there are other proteins involved in this process. The Sherwood lab conducted an enhancer screen in *zmp-1* null worms to find other factors involved in AC invasion. Here, we characterize two hits from this screen: 3-7 and 3-34. 3-7 shows a significant AC invasion defect, while 3-34 shows a defect in basement membrane morphology. We have determined it is *unc-40*, a netrin receptor required for AC invasion



and polarization. We are still performing experiments in determining the molecular lesion of 3-34.

**Clara Starkweather**

***Cortical deafening: Using Birdsong to Assess Auditory Effects of***

Research Advisor: Richard Mooney  
Neurobiology, School of Medicine

Cortical deafness is an oft-cited neurological condition commonly characterized by the subject's inability to recognize words or register pitch. Patients suffering from cortical deafness retain signs of intact peripheral hearing such as the ability to hear and identify environmental sounds. A major obstacle in precisely characterizing the neurological deficit that incurs cortical deafness is that case studies ground the vast majority of research related to the condition. As one of the few nonhuman animals that produce species-specific vocalizations highly contingent upon auditory feedback, the songbird is a useful system in which to study the effects of central auditory deficits. The quality of auditory feedback is a highly quantifiable indicator of song production ability. A region of particular interest is the avian auditory forebrain is Field L, which is highly interconnected with other regions of the auditory forebrain and deeper regions of the auditory telencephalon, and also projects to the afferent shelf of the nucleus HVC, a critical region in song production. By incurring highly localized lesions in the auditory forebrain, this study aims to characterize the deficits in vocal production and ultimately in auditory feedback that occur as a result of cortical deficits.

**Bo Sun**

***Mechanisms of Outer Membrane Vesiculation in Escherichia coli***

Research Advisor: Meta Kuehn  
Biochemistry

Gram-negative bacterial species possess a two-layer membrane, comprising an outer membrane and an inner membrane; a peptidoglycan-rich periplasmic layer lies in between. Outer membrane vesiculation, characterized as the budding off of the outer membrane, is common in many gram-negative species such as *Pseudomonas aeruginosa* and *Escherichia coli*. Important in phenomena such as toxin transport, the formation of outer membrane vesicles (OMVs) also represents a viable target for antibiotic therapy. Therapies may target individual genes that have been shown to influence OMV formation, but the most effective treatments will take into account the wide-ranging effects of the treatment. Knowledge of gene networks or clusters is therefore essential. A

comprehensive screen of 4,000 single-gene knockout mutants of *E. coli* (Keio Collection) for their vesiculation level has been completed, identifying many genes that may influence vesiculation. Through the use of systems biology programs to direct epistasis analysis, current work on this project will use data generated by the Keio Collection screen to draw predictions of relationships among genes that influence vesiculation.

**Julia Sun**

***c-Myc Oncogene, Neural Stem Cells, and Medulloblastoma***

Research Advisor: Dr. Robert Wechsler-Reya  
Pharmacology and Cancer Biology

The cerebellum is critical for motor coordination and cognitive function and is the target of transformation in medulloblastoma, the most common malignant brain tumor in children with a peak incidence at seven years of age. Treatments include surgical resection, craniospinal radiation and chemotherapy, yet only 60% of affected children are cured, and most suffer from long-term side effects later on in life. The emerging cancer stem cell model suggests that tumors are organized in a hierarchy with a subpopulation of cancer stem cells responsible for tumor maintenance and progression. In the case of medulloblastoma, purified population of neural stem cells from the postnatal cerebellum can undergo self-renewal in culture and are capable of differentiating into cerebellar neurons and glia. The molecular signaling pathways orchestrating the biology of cancer stem cells, however, remain to be elucidated. Deregulated expression of the c-Myc oncoprotein is found in diverse human tumors, is often associated with advanced malignancy and poor prognosis, and has been recognized as a regulator of stem cell biology. In this study, we drive c-Myc expression in CD133+ neural stem cells and trace their short-term fate after transplantation into immunodeficient mice. Identification of cerebellar stem cells and the signaling pathways that regulate them has important implications for the understanding of cerebellar development, the origins of medulloblastoma, and new targets for treatment.

**Brendan Szulik**

***Campus Security: TV Pilot***

Research Advisor: Elisabeth Benfey  
Theater Studies

This project centers on planning and writing one episode of a TV season, as well as the production of that episode. The project focuses primarily on screenwriting's character development, TV formatting,

long stories, etc.” along with additional elements of production such as storyboards, shooting, lined scripts, cinematography, directing, editing. The concept revolves around a detective-comedy serial set on a college campus. The story follows the protagonist’s a prodigy fallen from glory and expelled from college at the age of 15 for his illegal activities” who returns to college several years later for a second chance, getting a work-study position in campus security. Shenanigans and mystery ensue. The protagonist must grapple with the ghosts of his past and the specters of his future, and all the while he must solve crimes with the world’s strangest partner. The work included undertaking pre-production activities as well as intense production and post-production work. The first weeks of this project were dedicated to coming up with character development and a tight outline not only for the long story, but also the episode: what are the A/B/C acts, what is the mystery, how should the characters develop, etc. The last three months were consumed by full-time production, including shooting with professional equipment and editing the pilot into a coherent piece ready for a big-screen presentation.

**Trevor Thomas**

***Investigating the Mechanisms Underlying the Antidepressant-like Effects of Desipramine***

Research Advisor: Benjamin D. Sachs, PhD  
Caron Laboratory, Department of Cell Biology

Research conducted over the past decade has demonstrated that chronic treatment with antidepressants produces increased neurogenesis in the dentate gyrus of the hippocampus. Furthermore, neurogenesis has been reported to be required for some of the behavioral effects of fluoxetine, the prototypical SSRI, and imipramine, a tricyclic antidepressant. However, whether the behavioral effects of other antidepressants, including the tricyclic antidepressant, desipramine, depend upon increasing neurogenesis has not been determined. In this study, we examined the behavioral and neurogenic effects of desipramine in both wild-type and Tph2KI mice. Tph2KI mice harbor a mutation in the brain serotonin synthesis gene and exhibit reduced levels of brain serotonin and increased depression- and anxiety-like behavior. We show that chronic treatment with desipramine reduces feeding latency in the novelty-suppressed feeding (NSF) test, a behavioral paradigm reported to be neurogenesis-dependent, in both genotypes. However, desipramine led to an unexpected decrease in BrdU incorporation, a common indicator of hippocampal neurogenesis, in wild-type mice but not in Tph2KI mice. Our data demonstrate that the antidepressant-like effects of desipramine in the NSF paradigm do not require

increased neurogenesis and are actually associated with decreased neurogenesis. These results indicate that desipramine may induce its behavioral effects via different downstream mechanisms than other monoaminergic antidepressants, including fluoxetine and imipramine, and call into question the importance of increased neurogenesis in mediating antidepressant-like responses in the NSF test.

**Malini Veerappan**

***The prevalence of infectious and chronic disease in Ngãbe seeking health care in Costa Rica***

Research Advisor: Tammy Watkins  
Anthropology

The health transition marks the shift from a higher prevalence of infectious disease to a higher prevalence of chronic disease. Not all countries, or sub-populations within countries, are experiencing this transition at the same rate. One of these populations is migrants. This study investigated the prevalence of chronic versus infectious disease in the Ngãbe migrant population of Costa Rica. Additionally, it compared the ratio of infectious to chronic disease in the Ngãbe migrant population to that of the Ngãbe non-migrant population in order to determine if any disparities in disease burden exist. Two hundred and eighty three medical charts were examined from both migrant and non-migrant populations and any chronic and/or infectious diseases that an individual had in the past year were noted. A significantly ( $p < .001$ ) higher prevalence of infectious disease compared to chronic disease was found among the migrant population. Furthermore, there was a significantly ( $p < .001$ ) higher ratio of infectious to chronic disease in the migrant population as compared to this ratio in the non-migrant population. These results suggest that migrant Ngãbe in Costa Rica have not completed the health transition and that this population is less advanced in the health transition process than the non-migrant Ngãbe of Costa Rica.

**Faith Villanueva**

***Formin-driven actin regulation during cell invasion in C. elegans***

Research Advisor: David Sherwood  
Biology

Cell invasion represents the ability for cells to invade through basement membrane (BM) – a thin, yet dense, obstructive extracellular matrix that surrounds many tissues. The Sherwood laboratory has established a powerful in vivo model of cell invasion, utilizing the *C. elegans* anchor cell (AC), a specialized gonadal cell that invades through the underlying BMs into the vulval epithelium. The significant morphological changes in

the AC suggest the importance of cytoskeletal rearrangement for invasive processes. Actin and its regulators have previously been implicated in polarizing the invasive membrane domain in the integrin and netrin pathway, but the exact nature of this regulation remains ambiguous. Currently, the upstream promoter region of *inft-1* (a formin gene) is being dissected to identify the transcriptional gene battery underlying cell invasion. In addition, an AC-expression screen is currently being performed on 2 formin-related genes, *inft-2* and *cyk-1*. Following an AC expression screen of six known formin-related genes, the functional role of AC-specific formin-related genes will be determined by localization time-lapse studies as well as loss of function approach by a combination of mutant strains and RNAi. Investigating the formin-driven regulation of actin in this model not only speaks of AC invasion in *C. elegans*, but also has broad implications to other systems, ranging from normal development and immune system function to human disease.

**Naima von Ritter Figueres**

***Rings of Fire: Assessing the Use of Improved Cook-stove in Rural Guatemala***

Research Advisor: Anne Martin-Staple  
Public Policy

More than half of the world's population still depends on open-fires for cooking, causing an alarming array of health and environmental concerns, such as severe respiratory infections and deforestation. Over the past few decades, many NGOs have attempted to substitute open fires with improved cook stoves (ICSs), which reduce both smoke and wood consumption. One such example is HELPS International, a NGO that has been distributing ONIL improved cook stoves in Guatemala for more than 11 years. This study responds to a specific request from director of HELPS: to understand why some households are reluctant to adopt the ONIL stove, despite its obvious health and environmental benefits. The research assessed the adoption rate of the HELPS ONIL stoves, and provided feedback from the field to strengthen HELPS's program. Using a structured oral survey, focus group discussions, in-depth interviews, and participant observation, I found that 86% of my respondents use the ONIL on a daily basis, but one third use a parallel cooking method and one fifth alter the stove to introduce larger firewood, thus diminishing the impact of the stove. Reasons for why women do not fully adopt the stoves include implementation-related, technical, and socio-cultural factors. Recommendations include a) ensuring that women receive thorough training and a follow-up visit, b) ensuring that women participate in

the installation process, c) identify an effective "champion" in each community, d) identify options to enhance spatial heating as a co-benefit of the ONIL stove, and e) continue periodic evaluation of the program.

**Kristie Vu**

***The Role of T-beta-RIII Ectodomain Shedding in TGF-beta Signaling Regulation in Human Breast Cancer Cells***

Research Advisor: Dr. Gerard Blobel  
Departments of Medicine, Pharmacology and Cancer Biology, Duke University Medical Center

The Transforming Growth Factor Beta (TGF-beta) signaling pathway has both tumor-suppressing and tumor-promoting roles in different contexts. The most frequently expressed TGF-beta receptor is the type III receptor (T-beta-RIII), which can undergo a process called ectodomain shedding in which the receptor is cleaved from the cell membrane and resides in the extracellular space, thus producing soluble T-beta-RIII. This soluble form of T-beta-RIII inhibits cancer progression in cancerous epithelial cells by hindering TGF-beta signaling, which leads to decreased cell migration, invasiveness, angiogenesis, and metastasis. However, the exact mechanisms involved in ectodomain shedding are not well understood. My research thus plans to investigate whether the ratio of soluble to membrane-bound T-beta-RIII regulates TGF-beta signaling in breast cancer epithelial cells in vitro. This project aims to determine the effect of T-beta-RIII shedding on downstream signaling of the TGF-beta pathway in cancerous and non-cancerous human breast cell lines and to determine the effect of different ratios of soluble to membrane-bound T-beta-RIII on downstream signaling of the TGF-beta pathway in these cell lines. Our lab has created a T-beta-RIII cleavage mutant (which undergoes reduced ectodomain shedding), and super-shedding mutant (which undergoes increased ectodomain shedding), both of which will be used in this study. The results from this study will be significant in the development of a breast cancer treatment that targets carefully controlled TGF-beta inhibition via generation of soluble T-beta-RIII.

**Donna Webb**

***The Use of GnRH Analogues as a Tool for Captive Management***

Research Advisor: Dr. Christine Drea  
Evolutionary Anthropology

In social species, aggression often occurs when animals compete over resources, including mates. Sifaka (*Propithecus coquereli*), black lemurs (*Eulemur macaco*

macaco), and ring-tailed lemurs (*Lemur catta*) are primates endemic to Madagascar that live in small, mixed-sex social groups. Although their societies are female dominant, male-male aggression escalates during the breeding season and is exacerbated in captivity by restricted housing conditions. Here, we tested the effectiveness of two gonadotropin-releasing hormone (GnRH) agonists, deslorelin and leuprolide acetate (lupron), in decreasing male testosterone (T) concentrations and, hence, controlling aggression in all three species. In the lemurs (6 Emm, 10 Lc), we compared serum T and testes mass in control and treated males over a two-four year period. In the sifakas (2 Pc), we examined fecal T and behavior across pretreatment and treatment periods spanning a year. We quantified T using radioimmunoassay and observed behavior during portions of the male's GnRH treatment. Treated males had decreased T concentrations relative to control males; however, the suppressive effects of lupron were shorter lasting than those of deslorelin. Likewise, deslorelin reduced testicular mass in both lemur species. Although the behavioral effects of GnRH analogs are still under investigation, treated Emm and Pc males could be co-housed without adverse consequences. We suggest that GnRH analogs may be effective in regulating inter-male aggression, owing to suppression of the hypothalamic-pituitary-gonadal axis.

**Allison White**

***Fear Generalization in PTSD***

Research Advisor: Kevin LaBar  
psychology

The goal of this study was to conduct an empirical study to examine fear generalization in PTSD patients as contrasted with healthy human volunteers. This experiment was based on the work done by Dunsmoor, Mitroff, and LaBar (2009) on fear generalization in healthy subjects, which concludes that a conditioned fear response to a specifically conditioned stimulus generalizes to other, unconditioned stimuli. We ran PTSD patients in a similar paradigm to explore differences between PTSD patients and healthy controls in the extent of fear generalization experienced during conditioning. The independent variables in this study were images of human faces morphed between fully neutral and fully fearful expressions. The middle value (50% fear/ 50% neutral expression) was paired with an aversive electrical stimulation, which was intended to condition the image of this specific face. The dependent measure in this experiment is the magnitude of the skin conductance response (SCR), a psychophysiological measure of fear arousal, as well as perceptual ratings for emotional expressiveness and shock expectancy.

Fear generalization was quantified by the eventual magnitude of SCR and behavioral responses to stimuli different from the conditioned stimulus. We found very little evidence for generalization in either group but showed expected response differences for different fear percentages.

**Felix Wibergh**

***We No Speak Americano: Understanding International Students' Writing***

Research Advisor: Vicki Russell  
Thompson Writing Program, Writing Studio

Created, Written, and Produced by Felix Wibergh  
Directed, Edited, and Produced by Nicholas Hawthorne  
We No Speak Americano documents international first-year students' experiences learning to write academically in English and in their native languages, as well as reveals the difficulties they face transitioning to university-level writing in America. Duke, as an institution of rigorous academic demands, admits few international undergraduates who exhibit the kinds of difficulties "such as low grammar proficiency" that are traditionally associated with English as a Second Language (ESL) students. What difficulties then do ESL students at Duke actually encounter? What techniques for writing in English, structuring papers, and developing arguments do they bring with them from their respective cultures? Do any of these techniques conflict with the American understanding of what writing should look like? Do any of them put the students at a distinct disadvantage to their American peers? We No Speak Americano was inspired by Writing Across Borders, a 2005 documentary written and directed by Wayne Robertson of the Writing Center at Oregon State University.

**Jason Wong**

***Optimizing Rainwater Harvesting Installation in Kashongi, Uganda: Sustainable Rural Water Supply, Collective Action and Institutions***

Research Advisor: Alessandro Tarozzi  
Economics

Community-based water supply systems like Institutional Rainwater Harvesting (IRWH) are promising solutions to water supply in rural areas like Uganda. However, IRWH tank systems have been unsustainable in the long-term due to collective action failure, causing agencies to switch to less cost-effective systems. Current literature shows that local institutions are important in community resource management, but little specific research has been done in the area of potable water supply systems. This study aims to use empirical research to shed light on IRWH system

sustainability, and provide takeaways for NGOs and researchers working in other rural areas. Focus groups, interviews and surveys were used to collect both qualitative and quantitative data in Kashongi ub-county, Uganda. The results show that villages in Kashongi Sub-county have the potential to be self-reliant in sustaining their IRWH tank system. Institutions are associated with tank sustainability through two ways: financial sustainability and tank functionality. Multiple regression analysis was used to identify several key predictors of both financial sustainability and tank functionality. The study made recommendations based on these findings, and a key conclusion was that agencies implementing community-based water supply systems should either seek to foster suitable institutional arrangements within villages, or identify villages with characteristics of strong institutions in order to maximize their investment.

**Katherine Xu**

***Kidney Cross-Transplantation: The Role of ACE2 in Blood Pressure Regulation***

Research Advisor: Susan Gurley

Division of Nephrology, Department of Medicine

Blood pressure homeostasis and fluid balance in humans are regulated by the renin-angiotensin system. Angiotensin-converting enzyme 2 (ACE2) functions in this system to metabolize Angiotensin II (Ang II), one of the major contributors in hypertension. Because ACE2 is expressed predominantly in the kidney, which is extensively involved in blood pressure modulation, a kidney cross-transplantation strategy in mice was used to isolate the effects of ACE2 in the kidney from its expression in other tissues. Wild-type or total ACE2 knockout (KO) mice were transplanted with a wild-type or ACE2 KO kidney, creating four experimental groups: wild-type, renal ACE2 KO, systemic ACE2 KO, and knockout group. Mice in all groups were infused with Ang II, which caused a significant rise in blood pressure. Although systemic ACE2 KO mice were expected to have lower blood pressure than renal ACE2 KO mice during the two weeks of Ang II infusion, systemic ACE2 KO mice were observed to have higher blood pressure levels than mice in all other groups. While this experiment confirmed that Ang II infusion is a good model for inducing hypertension, loss of ACE2 expression in the kidney alone was not found to contribute to high blood pressure. Future studies can repeat this cross-transplantation strategy isolating other tissues with ACE2 expression.

**Amy Xu**

***Toll-like Receptors Induce Pro-survival Responses in Mouse Bone Marrow Derived Macrophages***

Research Advisor: Dr. Jerry P Eu

Duke Medicine Pulmonary Division

The Toll-like receptors (TLRs) are a family of cell surface and intracellular proteins that recognize specific bacterial, fungal, and viral antigens such as lipids, lipoproteins, and nucleic acids. After engaging with a microbial antigen, TLRs initiate an immune response through the production of inflammatory mediators (such as cytokines TNF-alpha and interferon-alpha) that recruit and activate white blood cells to combat the invading microorganism. Recent developments in our lab have shown that activation of cell surface TLRs induces a pro-survival, proliferative response in mouse bone marrow derived macrophages, an effect that is absent after activation of intracellular TLRs. We postulate that these results are due to differences in stimulation of NF-kB, a calcium-dependent transcription factor critical to the activation of the immune response. However, further studies investigating the calcium dependency of cell surface TLR-mediated proliferation indicate that the process is independent of calcium influx and NF-kB activation, a result that counters previous literature indicating otherwise. Continued research on the TLR-mediated immune response will likely improve our understanding of the pathways underlying asthma, COPD, and chronic bronchitis.

**Jing Zhang**

***Calcineurin Signaling in C. albicans & C. lusitaniae***

Research Advisor: Joseph Heitman

Molecular Genetics and Microbiology

The Candida species is one of the most common human fungal pathogens and the fourth leading cause of hospital bloodstream infections that account for 10% of deaths in the U.S. The C. albicans species causes the majority of all Candida infections although infections caused by non-albicans Candida species are increasing. My species of interest, C. lusitaniae, is associated with a high mortality rate due to its resistance of amphotericin B and other antifungal agents like 5-fluorocytosine and fluconazole. The calcium activated calcineurin signaling cascade is essential to how fungal pathogens sense and respond to environmental triggers. Calcineurin has been demonstrated to be required for azole tolerance, serum survival, and ion homeostasis in Candida albicans. Since calcineurin is known to be necessary for virulence in a majority of common human and plant fungal pathogens, it is hypothesized that calcineurin also plays a role in the virulence of C.

lusitaniae. My project attempted to create a *crz1* and *cnb1* mutant, and study their phenotypes through sensitivity assays. I was able to create a *cra1* mutant and assess its phenotype under temperature and ion stress.

**Tim Zhang**

***Silver-Coating Copper Nanowires for Transparent, Flexible Electrodes***

Research Advisor: Benjamin J. Wiley

Chemistry

Transparent, flexible electrodes made with a network of copper nanowires are less expensive than electrodes made with indium tin oxide films, and have comparable levels of sheet resistance and light transmittance. However, copper nanowires by themselves have problems with aggregation and oxidation upon exposure to air and high temperatures. We believe that

coating the copper nanowires with silver will increase wire dispersion, decreasing sheet resistance, and will form a protective sheath that will allow the electrode to maintain high conductivity under air and heat for longer periods of time. Silver was deposited onto the copper nanowires in two steps: first by reduction using a hydroquinone solution, and then by galvanic replacement. SEM and EDS mapping of treated copper nanowires show the presence of a layer of silver. A thin film of wires was then produced on a glass slide using a Meyer rod. Currently, electrodes produced from this process are not conductive, due to low number density of wires, and light transmittance is reduced due to the presence of silver particles. Once the coating procedure is finalized, we will determine the optimal ratio of silver nitrate to copper for electrodes with the lowest sheet resistance and highest light transmittance that can maintain conductivity after flexing and over time with exposure to air and heat.

## Visible Thinking Addendum

### **Katie Barzee**

Research Advisor: Avner Vengosh  
*Heavy Metal Sediment Contamination in Hyco Lake and Mayo Lake*  
(Physical Science) Session II

### **Robert Cieri**

Research Advisor: Steven Churchill  
*Craniofacial feminization in Pleistocene Homo sapiens*  
(Biological Science) Session I

### **Alejandro Cortese**

Research Advisor: Mark Kruse  
*In Search of Doubly and Fractionally Charged Particles at the LHC*  
(Physical Science) Session III

### **Leah Croll**

Research Advisor: Nina Sherwood  
*Katanin-p60-Like1 Regulates the Nocifensive Response via Class IV Sensory Neurons in Drosophila melanogaster*  
(Biological Science) Session III

### **Erica Duh**

Research Advisor: Nina Sherwood  
*Building genetic tools for the examination of the interaction between spastin and Pak3*  
(Biological Science) Session III

### **Alicia Eubanks**

Research Advisor: Leslie Babinski  
*Addressing Child Sexual Abuse: Programming in Public Elementary Schools*  
*Can Silence be Golden?*  
(Social Science) Session I

### **Lawson Kurtz**

Research Advisor: Rochelle Schwartz-Bloom  
*Online Science: A platform for virtual experimentation and analysis*  
(Social Science) Session I

### **Allison LeCavalier**

Research Advisor: Vicki Russell  
*When Will I Use This? First-Year Writing and Engineering Students*  
(Social Science)

### **Alexandra Levitt**

Research Advisor: Rochelle Schwartz-Bloom  
*Adapted Primary Literature: A Novel Approach to Genetics Education*  
(Social Science) Session III

### **Nnenna Opara**

Research Advisor: Ruth Day  
*Effects of New Information on Old: Side Effects in TV Drug Ads*

(Social Science) Session II

### **Amanda Gill**

Research Advisor: Elizabeth Marsh  
*Exploring Similarities and Differences in Collective Memory: Northerners and Southerners Remember the U.S. Civil War and World War II*  
(Psychology) Session II

### **Ryan Gimple**

Research Advisor: Nina Sherwood  
*Analysis of RNAi Mediated Knockdown of Katanin-p60 in Drosophila melanogaster*  
(Biological Science) Session III

### **Rubayet Hossain**

Research Advisor: Susan Alberts  
*Impacts of natural hybridization on the fitness of large-bodied African primates*  
(Biological Science) Session I

### **Lauren Hughes**

Research Advisor: Elizabeth Brannon  
*Functional Connectivity in Autism*  
(Psychology) Session III

### **Sidney Johnson**

Research Advisor: Vicki Russell  
  
(Psychology) Session II

### **Andy Pettit**

Research Advisor: Kathy Sikes  
*Perceived Impacts of Extracurricular Sports Participation on Academic Motivation, Behaviors and Achievement*  
(Social Sciences) Session I

### **Amelia Rountree**

Research Advisor: Zachary Rosenthal  
*Shame as a Predictor of Suicidal Ideation in Borderline Personality Disorder*  
(Psychology) Session II

### **Braxton Shelley**

Research Advisor: Anthony Kelley  
*"Total Praise": A Model of Canonization in African American Gospel Music*  
(Humanities) Session III

### **Kendyl Tash**

Research Advisor: Ruth Day  
*Drug Benefits and Side Effects: "Corrections" in TV Ads*  
(Psychology) Session I