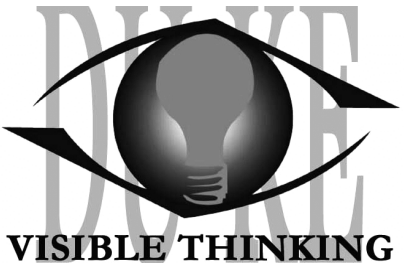

French Family Science Center
Tuesday, April 22, 2014
11:30 a.m.-2:00 p.m.

Undergraduate Research Support Office
Trinity College of Arts and Sciences
Duke University

Ron Grunwald, Director
Deborah Wahl, Associate Director
Laura Stein, Staff Specialist
undergraduateresearch.duke.edu

Acknowledgments

We are grateful to our friends and associates who provided generous assistance including:

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 from the following College and University programs in 2013-2014:

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Undergraduate Research Support at Duke University

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A Presentation of Undergraduate Research

11:30am – 12:30 pm
Poster Session

Name	Advisor	Research Field	Title
Tristan Ballard	Dalia Patino-Echeverri	Bass Connections	Modeling Tools for Energy Systems Analysis
Elisa Berson	Subhashini Chandrasekharan	Bass Connections	Non-Invasive Prenatal Testing in the Developing World: Ethical, Legal, Social and Practical Challenges
Britany Cohen	Mine Cetinkaya-Rundel	Bass Connections	Coursera and the Future of Massive Open Online Courses
Clara Colombatto	Deborah Jenson	Bass Connections	How does trauma change us? Interdisciplinary approaches to the multifaceted impact of PTSD on cognitive function.
Akshita Iyer	Edna Andrews	Bass Connections	Spoken and Sung Phoneme Perception & Associated Brain Regions
Rachel James	Rochelle Schwartz-Bloom	Bass Connections	Environmental Effects on Cognitive Development
Lauren Kelly	Ken Rogerson	Bass Connections	North Carolina Common Sense
Eileen Lu	Roberto Cabeza	Bass Connections	Age Differences in Economic Decision Making
Ana Restrepo	Jennifer Groh	Bass Connections	Ant or elephant? The brain's response to hierarchical classification
Rachel Roberts	Elizabeth Brannon	Bass Connections	Doing math with dot arrays: behavioral implications for NC Pre-K 4- and 5-year-olds
Kelly Shen	Brian Southwell	Bass Connections	Effective Energy Communication Strategies for Low-Income Residents
Christine Adams	Christine Drea	Behavioral Sciences	The function of mixing antebrachial and brachial secretions in male ring-tailed lemur (Lemur catta) scent-marking behavior

Rachel Fischell	Scott Huettel	Behavioral Sciences	Ethics of Memory Dampening Using Propranolol as a Treatment for PTSD in the Field of Emergency Medicine
Hannah Hopkins	Andrew Butler	Behavioral Sciences	The Effect of Repeated Retrieval on Memory for Positive and Negative Film Clips
Daniel Kort	Laura Richman	Behavioral Sciences	Discrimination Experience as a Psychosocial Cause of Health Disparities
Elizabeth McGlamry	Elizabeth Marsh	Behavioral Sciences	Investigating Differences in Northerners' and Southerners' Memories of the US Civil War
Daniel Wei	Kevin LaBar	Behavioral Sciences	Empathy under Stress: Emotionally Impaired, Cognitively Spared
Paige Arnold	Kristin Scott	Biological Sciences	Overcoming Centromere Instability in S. pombe via a rad51-dependent Pathway
Matthew Baron	Charles Gersbach	Biological Sciences	Designing Synthetic Gene Networks Using Artificial Transcription Factors in Yeast
Ryan Bartholomew	Henry Yin	Biological Sciences	Optogenetic stimulation of striatopallidal and striatonigral neurons during operant action timing
Nan Cheng	John Perfect	Biological Sciences	Mapping the Connection Between Urea and Capsule Production in Cryptococcus gattii
Tiffany Chien	Mary Foster	Biological Sciences	Molecular analysis of human Goodpasture autoantibodies
Edward Chiou	Rahima Zennadi	Biological Sciences	The Effect of Erythropoietin on Sickle Red Cell Adhesion to the Endothelium and Vasoocclusion in Sickle Cell Disease
Parth Chodavadia	Ratan Bhardwaj	Biological Sciences	Characterizing Wnt5B Ligand-Receptor Interactions In ATRT
Jila Dabestani	Tatiana Rebrik	Biological Sciences	Retinal Morphology in EML1 knockout mice: effect on photoreceptor development
Yvette Dzumaga	Rebekah Fleming	Biological Sciences	Immediate and lingering effects of isoflurane on ethanol sensitivity of GABA-A Receptors in dentate gyrus granule cells
Stefanie Engert	Nina Sherwood	Biological Sciences	Specific influence of pak3 on the spastin pathway of synaptic bouton formation is corroborated by its lack of effect on tkv

			stimulated bouton growth
Pramodh Ganapathy	Karyne Rabey	Biological Sciences	Effects of whole body vibration and muscular activity on bone in mice
Jennifer Hewitt	Michael Lynch	Biological Sciences	Preliminary Evaluation of E. coli as a Host for Second-Generation Electrofuels Processes
Brendan Huang	Timothy McMahon	Biological Sciences	Separation of Hemoglobin Variants in Sickle Cell Blood after Transfusion or Hydroxyurea treatment
Manoj Kanagaraj	Sandeep Dave	Biological Sciences	Genetic mechanisms underlying Common Variable Immune Deficiency and its association with lymphoma
Garrett Kelly	Michael Lynch	Biological Sciences	Directed Evolution of Triacetic Acid Lactone
Suyash Kumar	Charles Gersbach	Biological Sciences	Engineering Cas9 for targeted Epigenetic Modification
Richa Lavingia	Blythe Williams	Biological Sciences	Use of Virtual Endocasts to Reconstruct Primate Brain Proportions
Kevin Le	Chantal Reid	Biological Sciences	Chitinase Isolation for In Vivo Fungal Labeling
Rebecca Leylek	Terry Lechler	Biological Sciences	Ndel1 Function in Epithelia
Daniel Li	David Dunson	Biological Sciences	Probability of Ovulation and Conception After One Random Act of Intercourse
Anays Murillo	Monica Kraft	Biological Sciences	Increased Response to Corticosteroids in the Presence of Pioglitazone in Obese Asthmatic Subjects
Rowan Murray	Leslie Digby	Biological Sciences	The Effects of Age on Behavioral Thermoregulation in Lemur catta and Propithecus coquereli
Freddie Peng	Deborah Muoio	Biological Sciences	Metabolic Analysis of Mechanical Load as a Muscle Cell Culture Model of Exercise
Meredith Rahman	Daniel Schmitt	Biological Sciences	Effects of habitual loading on bone material properties: a comparison of primate and non-primate mammals
Arielle Shkedi	Christopher Nicchitta	Biological Sciences	Trafficking of Newly Exported Ribosomes
Lillian Sun	Jeff Rathmell	Biological Sciences	Metabolism in Chronic Lymphocytic Leukemia (CLL) Cells

Anne Talkington	Dan McShea	Biological Sciences	Modeling Interactions among Migrating Species
Angela Woods	Michael Lynch	Biological Sciences	Directed Evolution of a Malonate Semialdehyde Dehydrogenase
Danwei Wu	Debra Silver	Biological Sciences	Exon junction complex component RBM8a is needed for neurogenesis
Zohair Zaidi	Ute Hochgeschwender	Biological Sciences	Genetically Targeted Non-Invasive Self-Regulation of Neurons
Yuqi Zhang	Daniel Kiehart	Biological Sciences	Deciphering the Role of Drosophila Beta-Spectrin and Ankyrin in the morphogenesis of Drosophila melanogaster
Mark Herzog	Eric Green	Community Engaged Research	Baby Monitor: Developing a Business Model to Scale a Mobile Platform Delivering Care to Pregnant Mothers and Children in Western Kenya
Kirsten Osborne	David Malone	Community Engaged Research	Boys in Tutus, Girls in Bowties: Gender Representations in Picture Books
Karishma Popli	Alma Blount	Community Engaged Research	Lighting the Future with Technology: The efficacy of solar lamp use in rural villages in India
Allison Smalley	Alma Blount	Community Engaged Research	Teaching the Personal Essay: How to Implement an Effective Summer Writing Program for High School Students
Christophe Viret	Nicole Lawrence	Community Engaged Research	Hill Center Alumni Postsecondary Education and Occupations
Jacob Tobia	Karin Shapiro	Humanities	Documenting LGBT History in South Africa
Hannah Ward	Mark Goodacre	Humanities	Spirituality and Health in an Increasingly Secular Age
Virginia Isava	Alan Boudreau	Physical Sciences	Petrographic analysis of outcrops in the northern region of Great Smoky Mountains National Park, Tennessee
Melody Lim	Robert Behringer	Physical Sciences	Observation of Shockwaves in a Suspension of Soft Particles
Audrey Melville	Robert Behringer	Physical Sciences	The Role of Anisotropy in Hopper Flows
Jenny Su	Bob Behringer	Physical Sciences	Quantum Tunneling and Chaos in Classical Scale Walkers
Yiqiu Zhao	Robert Behringer	Physical Sciences	Jamming Transition in Pentagon Particle System

Nicole Lee	Rick Hoyle	Psychology Graduation with Distinction	Redefining High Trait Self-Control: An Ability to Self-Regulate or a Capacity to Strategically Avoid?
Danielle Thompson	Makeba Wilbourn	Psychology Graduation with Distinction	Mind the Gap: The Effects of African American English and Academic Achievement Motivation on the Black-White Achievement Gap
John Bowman	Charlotte Clark	Social Sciences	Building an Inc. 500 City: Why fast-growing companies start where they do
Qi Dong	Fan Li	Social Sciences	Individual Treatment Assignment as a Decision Problem Using Potential Outcome Framework
Kathryn Henschel	David Rubin	Social Sciences	The effect of repeated retrieval on the contents and phenomenological characteristics of autobiographical memorie for emotional events
Grady Lenkin	Alma Blount	Social Sciences	Addressing the Prevalence of Urban Poverty and Immobility in Bangalore, India

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

Name	Advisor	Research Field	Title
Jason Chen	Gale Boyd	Bass Connections	Energy Efficiency in Industry: Motor Vehicle Manufacturing-Toyota Team
Ishan Thakore	Sara LeGrand	Bass Connections	Juntos: A Digital Health Intervention
Ege Yalcinbas	Michele Diaz	Bass Connections	Multisensory Integration Differences Between Older and Younger Adults
Min Su Kang	Nancy Zucker	Behavioral Sciences	Acquisition and Extinction of Pathological Fear Learning in Anorexia Nervosa
Kyle Rand	Roberto Cabeza	Behavioral Sciences	Modulations of cognitive load during value-based decision making
Elizabeth Wiley	Leslie Digby	Behavioral Sciences	Evaluation of Individual Aye-Aye Enrichment Usage
John Canty	Richard Brennan	Biological Sciences	RNA Recognition and Binding in the Bacterial Post-Transcriptional Regulator Hfq
Emily Du	Michael Platt	Biological Sciences	Neural basis of social learning in rhesus macaques
Linda Kim	Nina Sherwood	Biological Sciences	Understanding the role of BMP signaling in pak-3 mediated suppression of synaptic button defects in spastin null Drosophila
Eric Lakey	Emily Derbyshire	Biological Sciences	Targeting Chorismate Synthase to Treat Malaria
Josh McMenemy	Charles Gersbach	Biological Sciences	Purification and Activity of Recombinant Cas9
Kurren Mehta	Matthew Foster	Biological Sciences	Regulation of NOS2 by B30.2/SPRY domain proteins
Sagar Patel	Cagla Eroglu	Biological Sciences	Glia-Secreted Proteins Hevin and SPARC Control Synaptic Maturation in Mouse Visual Cortex
Anusha Singh	Chay Kuo	Biological Sciences	Investigating interactions between HDAC6 and AnkG190

Johnny Wei	Gerard Blobe	Biological Sciences	Investigating the Crosstalk between HER2 and the type-III TGF-β Receptor in Breast Cancer
Jessica Yan	George Truskey	Biological Sciences	Characterization of F-actin Stress Fibers in in Aging Endothelial Cells
Olivia Zhu	Richard Mooney	Biological Sciences	The role of dopamine in zebra finch learning
Margaret Oliver	Alma Blount	Community Engaged Research	How C.A.A.R.E Builds a Community in Durham
Maggie Shannon	Alma Blount	Community Engaged Research	How can personal relationships prolong an addict's participation in treatment at TROSA and his or her sobriety?
Christopher-Marcus Gibson	Michael Ferejohn	Humanities	A Science of Good & Evil? - On the Possibility of Ethical Knowledge
Nicole Rudden	Hans Van Miegroet	Humanities	From Le Brun to Hitler: How the Art of Human Physiognomy has Codified Stereotype in our Visual Culture
Katherine Ferguson	Alan Boudreau	Physical Sciences	Sulfide Minerals in the Middle Banded Series of the Stillwater Complex, Montana, USA
Jacob Martin	Michael Fitzgerald	Physical Sciences	Novel Enrichment Strategy for Methionine Containing Peptides
Benjamin Bleiberg	Terrie Moffitt	Psychology Graduation with Distinction	The Long Shadow of Maternal Depression: Post-Natal Depression, Child Maltreatment, and Child Psychopathology A Cohort Longitudinal Design
Jeremy Chaikind	Timothy Strauman	Psychology Graduation with Distinction	Writing old wrongs: Psychological effects of a goal failure-focused expressive writing intervention
Madeline Dean	Robert Thompson	Psychology Graduation with Distinction	Thwarted Belongingness, Suicidal Ideation, and BMI among Mothers in the Fragile Family Study
Ricardo Guerra	Christina Williams	Psychology Graduation with Distinction	Modeling Schizophrenia-induced Motivation Deficits in Mice: Efficacy of Current and Novel Antipsychotics

Grace Hopkins	Harris Cooper	Psychology Graduation with Distinction	Academic Motivation Across the Undergraduate Years: How Does It Change? What Predicts Change?
Zenzi Huysmans	Rebecca Shelby	Psychology Graduation with Distinction	The Breast Biopsy Experience: Relationship between Anxiety, Anticipatory Pain and Psychological Variables
Devin Jones	Ahmad Hariri	Psychology Graduation with Distinction	Examining Paralimbic Connectivity and Psychopathic Traits
Francesca Kassing	Terrie Moffitt	Psychology Graduation with Distinction	Predicting Violence: Mental Health as a Moderator between Child Maltreatment and Violent Behavior
Alexandra Lewis	Stephanie Wormington	Psychology Graduation with Distinction	Examining the Influence of Friends on Latino and Non-Latino Students' Academic Outcomes
Lillie Reed	Kathleen Sikkema	Psychology Graduation with Distinction	Predictors of engagement in transactional sex behaviors: A study of Patrons of Alcohol-Serving Venues in A Cape Town Township
Rachel Roberts	Elizabeth Brannon	Psychology Graduation with Distinction	Math is demanding: Increased parieto-frontal connectivity during approximate arithmetic
Lindsay Samuel	Timothy Strauman	Psychology Graduation with Distinction	Separation Anxiety and Depression in College Freshmen
Miray Seward	Makeba Wilbourn	Psychology Graduation with Distinction	It's A Matter of Perspective: Examining Cultural Differences is Communication Styles
Alli Smalley	David Rabiner	Psychology Graduation with Distinction	Single-sex vs. Coed Schools: Does single-sex high school attendance correlate with students' academic and social attitudes, beliefs, and behaviors in college?
Pooja Utamsingh	Laura Richman	Psychology Graduation with Distinction	R.E.S.P.E.C.T: Find Out What It Means: Heteronormativity & the Doctor-Patient Interaction
Katie Walter	Christina Grimes	Psychology Graduation with Distinction	A Developmental Approach to Conventional and Unconventional Leadership in Adolescence
Reem Alfahad	Laurie McIntosh	Social Sciences	What strategies should El Roble implement in order to best

			facilitate the integration of its immigrant children within the center?
Ajay Parikh	Anirudh Krishna	Social Sciences	Health-Seeking Behaviors, Health Information, and Health Awareness in Bangalore City Slums
Yvette Vasquez	Charles Thompson	Social Sciences	The Undocumented Experience: The Intersectional Geographies of Space, Identity and Activist Philosophy in Southern California

VISIBLE THINKING

A Presentation of Undergraduate Research

12:30-1:30pm

Poster Session

Name	Advisor	Research Field	Title
John Hare-Grogg	Deborah Gallagher	Bass Connections	Strengthening Community Environmental Health through Duke-HBCU Partnerships
Shajuti Hossain	Rick Larrick	Bass Connections	Goals and Collective Efficacy: Routes to Energy Saving
Chelsea Pieroni	Kristin Lanzoni	Bass Connections	Visualizing Venice
Bailey Ryan	Staci Bilbo	Bass Connections	Why Mom Matters: Environmental Justice and the Early-Life Origins of Health Disparities
Julie Stefanich	Suzanne Shanahan	Bass Connections	Kenan Institute for Ethics Refugee Resettlement Project: How does displacement and resettlement process affect refugee mental health and well-being?
Christopher Streiffer	Martin Brooke	Bass Connections	Live Processing and Live Art: Performance and Technology
Jania Arcia-Ramos	Leslie Digby	Behavioral Sciences	Differential habitat use as a behavioral thermoregulatory strategy in lemurs
Ernst Casimir	Elizabeth Marsh	Behavioral Sciences	Probing the Effect of Testing on Transfer of Learning
Min Kyung Hong	Ahmad Hariri	Behavioral Sciences	Analysis and Processing of Physiological Data from Shock Avoidance Study
Leah Kaiser	Brian Hare	Behavioral Sciences	The evolution of transitive inference: Chimpanzees' performance with social and nonsocial stimuli
Sarah Teitell	Sarah Teitell	Behavioral Sciences	Structural Brain Abnormalities Underlying Memory Deficits in HIV-Positive Individuals
Talia Baghdoyan	Liz Brannon	Biological Sciences	Visuospatial Aspects of Implicit Learning in Lemurs
Catherine Blebea	David	Biological	Discerning the Role of SPARC

	Sherwood	Sciences	in Basement Membrane Invasion in Caenorhabditis Elegans
Shulei (Shelley) Chen	Lucy Williams	Biological Sciences	Investigating the role of RNA Polymerase II pausing in mouse macrophages
Amalia Cong	Gregory Wray	Biological Sciences	Molecular and morphological analysis of tooth development in chimpanzees
Daniella Cordero	Christina Meade	Biological Sciences	White matter abnormalities in HIV infection and cocaine dependence: a diffusion tensor imaging study
Caitlin Cristante	Nina Sherwood	Biological Sciences	Determining the Interaction between the Drpr and Pak-3 Genes
Justin Fu	George Truskey	Biological Sciences	Substrate Stiffness Promotes Endothelial Cell Senescence and Proliferation
Ashley Gartin	Huntington Willard	Biological Sciences	Epigenetic Therapy with 5-azacytidine and HDAC Inhibitors for t(4;14)(p16;q32) Multiple Myeloma
Lillian Kang	Neil Freedman	Biological Sciences	Anti-atherogenic Mechanisms of Kalirin in Endothelial Cells
Hyun Soo Kim	Michael Lynch	Biological Sciences	Citrate Synthase Metabolic Switch
Jasmine Nee	Gerard Blobe	Biological Sciences	Stroma biology identifies heparins as differentiating agents in neuroblastoma
Jasmine Nee	Jasmine Nee	Biological Sciences	Stroma biology identifies heparins as differentiating agents in neuroblastoma
Lydia Ran	George Truskey	Biological Sciences	Conditions for human endothelial cell and skeletal muscle lamellar co-culture in vitro
Akshay Save	Gayathri Devi	Biological Sciences	Development of a Three-Dimensional Model to Assess Tumor Growth Progression and Evaluation of Biomarkers in Inflammatory Breast Cancer
Benjamin Schwartz	Christine Wall	Biological Sciences	Molecular analysis of tooth development in chimpanzees
Caroline Taylor	Andrea Taylor	Biological Sciences	Validation of a model for estimating sarcomere length operating range of the superficial masseter muscle in primates

Bhavya Varma	David Sherwood	Biological Sciences	Affects of Starvation on Anchor Cell Development in C. elegans
Alissa Wall	Erica Davis	Biological Sciences	Dysfunction of 60S ribosomal protein (RPL10) is associated with X-linked microcephaly
Catherine Wang	Hai Yan	Biological Sciences	Understanding the biological foundation of IDH1-mediated gliomagenesis
Emma Zhao	Mary Foster	Biological Sciences	Assessing Cross-reactivity of Anti-alpha3(IV)NC1 (Goodpasture) Autoantibodies
Mao Hu	Dalene Stangl	Community Engaged Research	What Factors Predict Housing and Income Outcomes for Homeless Persons with Disabilities?
Naureen Huda	David Boyd	Community Engaged Research	Knowledge of Autism and Family Support among Parents of Children with Autism at a Training Center in Kolkata, India
Michelle Jeon	Katie Hyde	Community Engaged Research	Providing Mental Health Treatment Through Arts Education: Literacy Through Photography at Child Welfare Centers
Vandana Kumar	David Boyd	Community Engaged Research	Knowledge of Autism and Family Support among Parents of Children with Autism at a Training Center in Kolkata, India
Meghan Scanlon	Dalene Stangl	Community Engaged Research	Strengthening Families: Evaluating Nurses for Newborns' Child Abuse and Neglect Prevention Program
Chandler Thomas	Katharine Bartlett	Community Engaged Research	The Women's Right to Know Act: A Barrier to Abortion?
Chandler Thomas	Shane Goodridge	Community Engaged Research	Model Practices for Low-Income, High Minority School Districts
Maria Diaz	Sarah Deutsch	Humanities	The Role of Pachquismo in (Re)shaping Chicanidad and Latinidad in Houston, Texas
Destiny Hemphill	Wahneema Lubiano	Humanities	"Even the Sea is Grieving": Investigating a Politics of Melancholia in Chicana Feminist Literature
Maia Hutt	Carol	Humanities	Gubarev's The Kingdom of

	Apollonio		Crooked Mirrors as a Reflection of Soviet Society: Shifts in Nationalist Rhetoric and Perception of Gender Roles 1951-1956
Stephen Kirchner	Thomas Robisheaux	Humanities	Alchemy and the Scientific Revolution in England, between John Dee and Isaac Newton
Christopher Flower	Haiyan Gao	Physical Sciences	Two-Body Photodisintegration of 3He with Double Polarizations
Caroline Steiblin	Al Goshaw	Physical Sciences	Comparing Monte-Carlo (MC) simulations of Z boson mass reconstruction from muons, photons, and electrons to LHC data
Vaibhav Tadepalli	Benjamin Wiley	Physical Sciences	Development of a method for large scale synthesis of high aspect-ratio copper nanowires as a replacement for conventional transparent conductors
Jennifer Walker	Gary Dwyer	Physical Sciences	Deep ocean conditions in the western tropical Atlantic and their relationship to climate cycling over the last 110,000 years
Preston Cotnoir	Christina Meade	Psychology Graduation with Distinction	The Relationships between Aging and HIV Infection on Neurocognitive Functioning
Marisol Azpeitia	David Rubin	Social Sciences	Chronicity of shame and guilt
Nicole Daniels	Harris Solomon	Social Sciences	Why Is She Smiling?: Circular Migration and Women's Empowerment in Rural Rajasthan, India
Natalie Ferguson	Alma Blount	Social Sciences	Encouraging Top College Graduates to Pursue Teaching as a Long-Term Career
Kshipra Hemal	Alma Blount	Social Sciences	The Challenges of Treating Heart Disease in Women
Madeline McKelway	Erica Field	Social Sciences	Micro-Banking and Health: Evidence from Self-Help Group Involvement and Child Nutrition
Emily O'Loane	Jan Riggsbee	Social Sciences	Healthy Lifestyles: Integrating the "Healthy Lifestyles" curriculum into the Children's Defense Fund's Freedom Schools program

Jillian Williams	Jedediah Purdy	Social Sciences	The Devil and the Deep Blue Sea: A Comparative Constitutional Approach to Understanding (In)Equality

Christine Adams
The function of mixing antebrachial and brachial secretions in male ring-tailed lemur (Lemur catta) scent-marking behavior
Research Advisor: Christine Drea
Evolutionary Anthropology

Olfactory communication is increasingly characterized by the use of composite signals integrating many components and sensory modalities. The complexity of composite signals makes it difficult to determine function. Ring-tailed lemurs (Lemur catta) exhibit a highly sophisticated olfactory repertoire, as evidenced by the presence of specialized glands in males. Male ring-tailed lemurs display a unique scent-mixing behavior, shoulder rubbing, in which antebrachial (A) and brachial (B) gland secretions are mixed together (A+B) prior to wrist marking. The function of this chemical mixing is unknown, but I hypothesized that when mixed, heavy compounds expressed in brachial secretions, specifically squalene (S), act as a fixative that prolong the signal of the more volatile compounds present in antebrachial secretions (the 'fixative hypothesis'). To assess the fixative function of the brachial secretion, I used behavioral bioassays in two experiments. I presented 12 adult male ring-tailed lemurs with natural odors (experiment 1: A, B, A+B) and synthetic odors (experiment 2: A, S, A+S), in fresh and 12-hour decayed states. This was the first study to present individual signal components alongside the composite signal. I found that male ring-tailed lemurs investigated natural mixtures more than synthetic mixtures. Moreover, I found subjects were more interested in pure B than S. Males were equally interested in fresh and decayed odorants in both experiments, contrary to expectations. The results suggest that the brachial secretion, beyond any putative fixative properties, may contain its own informative message, and that mixing with A may create an entirely different message that needs further evaluation.

Behavioral Sciences, 11:30-12:30

Reem Alfahad, Jennifer Moreno
What strategies should El Roble implement in order to best facilitate the integration of its immigrant children within the center?
Research Advisor: Laurie McIntosh
Cultural Anthropology

El Roble is an afterschool program whose population consists of nonimmigrant and immigrant children. Immigrants' children that participate at El Roble confront educational and social impediments along with discrimination, limiting their future success. Four main issues at El Roble are lack of support, lack of consistency in participant attendance, lack of collaboration with school/parents , and bullying. Introducing sexual education, interactive and artistic classes, anti-bullying teachings, and parent workshops are strategies El Roble can implement allowing immigrants' children to become integrated into the center. Over the summer, we worked with El Roble to develop a curriculum to help facilitate the integration of the immigrant children into the center.

Social Sciences, 12:00-1:00

Alissa Wall
Dysfunction of 60S ribosomal protein (RPL10) is associated with X-linked microcephaly
Research Advisor: Erica Davis
Cell Biology

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

Biological Sciences, 12:30-1:30

Jania Arcia-Ramos
Differential habitat use as a behavioral thermoregulatory strategy in lemurs
Research Advisor: Leslie Digby
Evolutionary Anthropology

To reduce the energetic cost of controlling internal body temperatures physiologically, animals engage in "behavioral thermoregulatory activities" such as changing postures or social huddling. In this study we aimed to analyze what behavioral thermoregulatory strategies lemurs engage in, and specifically, how the lemurs use their habitat for this purpose. We determined patterns of temperature and humidity variation throughout the forest at the Duke Lemur Center and then analyzed how individuals of Propithecus coquereli and Lemur catta use these variations as a strategy for behavioral thermoregulation. We found that generally temperatures tended to increase with forest depth, with a few deviations from this pattern during the fall months. When analyzing how the lemurs use the forest in response to temperature variation, we found that contrary to what we expected, individuals preferred to spend the majority of their time at the edge or out of the forest for all temperatures, and spent very little time at the interior of the forest (30m or 60m depths). This was also the case when we controlled for sun exposure levels. However, individuals did employ other behavioral thermoregulatory strategies, including increasing extended postures during hotter temperatures and increasing tucked postures during cooler ones, yet there was no clear relationship between the employment of these strategies and the use of forest depth. Possible explanations for the data were explored, including the effect of human interaction.

Behavioral Sciences, 12:30-1:30

Paige Arnold
Overcoming Centromere Instability in S. pombe via a rad51-dependent Pathway
Research Advisor: Kristin Scott
IGSP

A functioning centromere is essential for proper loading of the spindle fibers at the kinetochore. A defective centromere can result in chromosome breakage, loss, and other abnormalities. Because chromosomal abnormalities play a role in cancer as well as a variety of birth defects, an understanding of centromere structure and function is essential. The fission yeast centromere is similar to that of higher eukaryotes in that it is repetitive and possesses discrete heterochromatin domains. While exploring the role that different chromatin features play in maintaining centromere structure, my lab generated an experimental strain that contains a reporter gene insertion at the same locus on both the left and right side of the centromere—we refer to this as the "doubly-marked" centromere. Some doubly-marked cells are sickly, i.e. they display abnormal morphology, extended doubling time, and segregation defects. We observe an interesting phenomenon when we grow the doubly-marked strain in the absence of selection for one cell cycle—some cells completely excise either the left or right reporter gene insertion. With only one insertion, the cells return to being wild type in both phenotype as well as in doubling time. The observation of reporter gene loss, combined with the repetitive nature of the centromere, suggests some role for homologous recombination. To explore this possibility, we generated cells with a doubly-marked centromere that were mutant in rad51, the master regulator of homologous recombination. Our experimental results indicate that loss of the reporter gene is occurring via an unknown mechanism that is dependent upon rad51.

Biological Sciences, 11:30-12:30

Marisol Azpeitia
Chronicity of shame and guilt
Research Advisor: David Rubin
Psychology and Neuroscience

Recent research on self-conscious emotions has dichotomized the constructs of guilt and shame according to the "adaptiveness" of each emotion. Guilt is thought to be a more adaptive emotion because it drives reparative action and does not harm self-esteem in the way that shame does. But when shame and guilt are experienced regularly, as in depressive states, these self-conscious emotions may create social anxiety and impair functionality. It is important to understand how the chronicity of shame and guilt is uniquely involved in depressive and anxious contributors to functional impairment. This study seeks to establish a scale that measures shame and guilt chronicity to understand how the construct is related to rumination, social anxiety, and functional impairment, apart from the measurement of guilt or shame alone. Understanding chronicity of shame and guilt may provide important clinical information for self-impairing characteristics in clinical populations.

Social Sciences, 12:30-1:30

Talia Baghdoyan
Visuospatial Aspects of Implicit Learning in Lemurs
Research Advisor: Liz Brannon
Evolutionary Anthropology

Implicit learning is a key component in human abilities ranging from language to motor skills. This phenomenon of gaining knowledge without being instructed to learn has been studied within the limited comparative framework of rhesus macaques and cotton-top tamarins. This study sought to expand the comparative framework to a prosimian primate, the ring-tailed lemur (Lemur catta), to elucidate the evolutionary beginnings of implicit learning. Experiment 1 added a comparison on an earlier branch of the primate evolutionary tree using a serial reaction time (SRT) task that measured changes in reaction time to a novel four-item sequence with prior extensive training on a predictable sequence. Experiment 2 compared the effects of visual and motor aspects of stimuli on implicit learning by presenting subjects with motor- or visual- novel sequences. Both experiments presented four visual items simultaneously and a flashing border, which advanced to the next stimulus when lemurs made a correct selection, designated the correct response. Lemurs showed increases in reaction time from predictable sequences to sequences novel in their motor- and visual- order and to sequences novel only in their motor order, but not to sequences novel only in their visual order. The increases in the both- and motor- novel conditions were similar, suggesting motor sequence learning may be responsible for the majority of the effect in this study. This provides evidence of the capacity for implicit learning in a basal primate lineage, extending the existing comparative framework to a prosimian. Motor sequence learning may be the primary cause of implicit learning in all similarly structured studies in other primates, whereas visual sequence learning may be unique to the haplorhine branch of primate evolution.

Biological Sciences, 12:30-1:30

Tristan Ballard, Terry Conlon
Modeling Tools for Energy Systems Analysis
Research Advisor: Dalia Patino-Echeverri
Nicholas School of the Environment

This project aims to design and develop education and research tools, in open source software, for facilitating systematic and efficient investigation on how to integrate wind and solar power into the electric grid. The software system will enable detailed description and modeling of electric power system operations and market interactions. It includes three model components: a security-constrained unit commitment model, which determines which power generation units to commit to operation ahead of time; a security-constrained economic dispatch model, which selects the units, among the committed ones, to operate in order to minimize the operation cost; and a time series simulation model, one major application of which would be to provide accurate simulations of wind power generation from a collection of turbines.

Bass Connections, 11:30-12:30

Matthew Baron
Designing Synthetic Gene Networks Using Artificial Transcription Factors in Yeast
Research Advisor: Charles Gersbach
Biomedical Engineering

Synthetic gene circuits have the potential to revolutionize gene therapies and bio-industrial methods by allowing predictable, customized control of gene expression. Bistable switches and oscillators, key building blocks of more complex gene networks, have been constructed using naturally occurring and well-characterized regulatory elements. In order to expand the versatility and variety of these circuits, we designed and constructed gene networks using artificial transcription factors (ATFs). The ATFs are of two classes: inhibitory TAL proteins and a catalytically inactive dCas9 protein with small guide RNA elements, each orthogonal to the yeast genome. Using mathematical modeling, we determined the parameters expected to create bistability and oscillation, using tandem binding site kinetics to achieve cooperativity. Based on these results, we assembled a library of plasmids containing ATFs, binding sites, regulatory elements, and fluorescent reporters. We then integrated these genes into the genome of Saccharomyces cerevisiae and are currently characterizing them using flow cytometry.

Biological Sciences, 11:30-12:30

Ryan Bartholomew
Optogenetic stimulation of striatopallidal and striatonigral neurons during operant action timing
Research Advisor: Henry Yin
Psychology and Neuroscience

Two pathways in the basal ganglia exert contrasting control over movement. Activity of the direct pathway promotes movement, whereas activity of the indirect pathway inhibits movement. Degeneration or inappropriate modulation of medium spiny neurons (MSNs) located in the striatum, which receives input to the direct and indirect pathway, is associated with motor deficits in several neurodegenerative disorders. Lesions to the striatum also impair learning and performance of operant behaviors. Using optogenetic methodology, we stimulated direct and indirect pathway MSNs in vivo using D1-ChR2 and A2A-ChR2 mice, respectively, while the mice performed a discrete trial temporal differentiation task. MSN stimulation disrupted action timing during performance of the learned operant behavior. Stimulating MSNs induced changes in movement consistent with the hypothesis that MSN activity acts as a reference signal for movement velocity. A potentially aversive property of direct pathway stimulation was also identified.

Biological Sciences, 11:30-12:30

Elisa Berson, Anthony Hung, Dechen Lama, Grace Li, Shilpa Shridar

Non-Invasive Prenatal Testing in the Developing World: Ethical, Legal, Social and Practical Challenges

Research Advisor: Subhashini Chandrasekharan
IGSP

The aim of this project is to explore how the commercial introduction of non-invasive prenatal testing (NIPT) in low and middle income countries affects clinical care, equity of access, and the safety, efficacy and quality of prenatal information. Clinical integration is complicated by the fact that prenatal screening is not always the standard of care, especially in impoverished areas where communities are under-resourced and lack access to many genetic services. In these economically disadvantaged contexts, NGOs may provide the majority of clinical services and serve a critical role in the dissemination of technologies like NIPT. In other areas, countries such as Iran and Saudi Arabia already have well-established premarital genetic screening programs. The implementation of non-invasive prenatal testing in these countries will not only allow for earlier detection of fetal genetic disorders in the existing timeline of fetal genetic diagnosis and decision-making but also have implications for current genetic counseling and genetic education structures. However, some countries have comprehensive laws against abortion or, in the case of India and China, the provision of prenatal fetal sex information, raising concerns about the use of prenatal information. Additional difficulties pertain to the commercial availability of NIPT in low and middle-income countries where weaknesses in the existing medical infrastructure undermine dissemination. Although these tests have the potential to increase access to safe and accurate prenatal information, they also raise questions regarding the education of physicians, families, and policymakers concerning these new technologies and the benefits of NIPT to the current standard of care.

Bass Connections, 11:30-12:30

Catherine Blebea
Discerning the Role of SPARC in Basement Membrane Invasion in Caenorhabditis Elegans
Research Advisor: David Sherwood
Biology

The extracellular matrix glycoprotein SPARC (secreted protein acidic and rich in cysteine) is a highly conserved extracellular matrix protein found throughout multi-cellular animals. Both underexpression and overexpression of SPARC is associated with cancer metastasis in a variety of cancers. SPARC interacts with basement membrane (BM), a specialized sheet-like form of extracellular matrix and one of the main barriers for cell invasion. These barrier properties of BM are primarily derived from type IV collagen, which forms a highly cross-linked polymeric network within the BM. Previous research has shown that overexpression of SPARC in Caenorhabditis elegans significantly decreases the amount of type IV collagen in the BM, providing a possible explanation for how SPARC promotes cell invasion and metastasis. The mechanism by which SPARC regulates type IV collagen in BM, however, is unknown. This project aims to determine how SPARC regulates type IV collagen in the BM and to elucidate the effects of underexpression of SPARC. This research will help discover the basic mechanism behind how SPARC affects the BM and further our knowledge of BM invasion and cancer metastasis.

Biological Sciences, 12:30-1:30

Benjamin Bleiberg
The Long Shadow of Maternal Depression: Post-Natal Depression, Child Maltreatment, and Child Psychopathology A Cohort Longitudinal Design
Research Advisor: Terrie Moffitt
Psychology and Neuroscience

Prior studies have disagreed about whether children of depressed mothers have elevated problem behaviors. Some studies suggest mothers' depression interferes with parenting and leads to child psychopathology. Other studies suggest that only antenatal depression has an influence on the child, which would rule out parenting. I used data from the E-Risk Study, a representative British cohort of 1116 children and their mothers, assessed at 5, 7, 10, and 12 years of age. I tested for a link between maternal depression during the child's life and the child's depression, anxiety, and conduct problems. I further hypothesized that when maternal depression was present with child maltreatment, children would have the worst outcomes. Maternal depression occurring after the child's birth was associated with child's conduct disorder and depression symptoms, but not anxiety. I found a significant dose-response relationship; the more distinct depressive episodes a mother experienced, the more symptoms the child developed. I also found that maternal depression was a risk factor for child mental health most strongly when there was child maltreatment in the family, but even in the absence of child maltreatment, children whose mothers were depressed had more conduct and depression symptoms. Findings suggest mothers' depression after a child's birth indicates risk for child psychopathology, specifically depression and conduct disorder.

Psychology Graduation with Distinction, 12:00-1:00

John Bowman
Building an Inc. 500 City: Why fast-growing companies start where they do
Research Advisor: Charlotte Clark
Nicholas School of the Environment

The purpose of this study was to understand the factors and features that influence an entrepreneur's decision to start his or her company in a given city. In particular, the study focused on the subclass of entrepreneurs who start fast-growing companies. We surveyed companies listed on the Inc. 500 (a list of America's fastest growing companies) for insight into 1) whether entrepreneurs more likely to select a city in which they lived or have lived as the location for their company and 2) the features that entrepreneurs value when selecting a site to found their company. The study was designed to help policymakers understand whether to focus on the promotion and cultivation of local entrepreneurship (if entrepreneurs are more likely to select a city due to their personal connection to the region) or focus on branding and marketing their city to appeal to entrepreneurs with no connection to the city.

Social Sciences, 11:30-12:30

John Canty
RNA Recognition and Binding in the Bacterial Post-Transcriptional Regulator Hfq
Research Advisor: Richard Brennan
Biochemistry

Hfq is a bacterial post-transcriptional regulator that plays diverse roles in gene expression by facilitating the annealing of sRNAs to their target mRNAs in order to affect RNA translation and stability. Based on previous research, Hfq has been implicated as an important factor that contributes to bacterial multidrug resistance and virulence. Hfq preferentially binds to A and U-rich sequences of sRNA, and has two distinct faces - the proximal face and the distal face- with each face exhibiting unique RNA binding motifs. Although the functionality of Hfq RNA-binding is relativity well understood in Gram-negative bacteria, less is known about the RNA-binding properties in Gram-positive species. In this study, our aim is to describe the structure and RNA-binding properties of Hfq from the Gram-positive pathogen Listeria Monocytogenes using a combination of structural and biochemical methods. To determine the Lm-Hfq RNA sequence specificity and binding affinity, we have used a combination of tryptophan fluorescence quenching (TFQ) and fluorescence anisotropy studies. Furthermore, we have attempted to characterize the RNA-free and RNA-bound structures of Lm-Hfq using x-ray crystallography. In this study, we describe the structure of Lm-Hfq in an RNA-free form and bound to a U6 (poly-uridine) substrate. Interestingly, we have also observed that Lm-Hfq sRNA exhibits novel sRNA sequence specificity that differs from RNA-binding in Gram-negative species. The aims of our investigation have been two-fold: to understand how Lm-Hfq binds sRNA/mRNA and to determine what RNA sequences Lm-Hfq favorably binds. These detailed structural and functional descriptions may ultimately facilitate the identification of novel drugs aimed at reducing or eliminating bacterial virulence.

Biological Sciences, 12:00-1:00

Ernst Casimir
Probing the Effect of Testing on Transfer of Learning
Research Advisor: Elizabeth Marsh
Psychology and Neuroscience

Testing has been shown to increase one's ability to transfer learned information to new contexts. However, little research has been done to parse out the specific components of transfer improved by testing. We were interested in investigating the retention and application components of transfer documented by Barnett and Ceci (2002). Does testing improve one's ability to apply knowledge to new contexts above and beyond retention? In the current experiment, undergraduate students learned new material either by repeatedly reviewing or repeatedly recalling the material. After a week delay, we assessed participants' ability to transfer their knowledge to new contexts. In order to distinguish between participants' ability to apply knowledge and their ability recall knowledge, a two-phase procedure was adopted from Butler, Godbole, & Marsh (2013). The current experiment shows that testing improves one's ability to recall information, and this improved recall leads to improved transfer of learning. But we did not find that testing improves one's ability to apply information. Thus we concluded that testing does not improve understanding above and beyond retention.

Behavioral Sciences, 12:30-1:30

Jeremy Chaikind
Writing old wrongs: Psychological effects of a goal failure-focused expressive writing intervention
Research Advisor: Timothy Strauman
Psychology and Neuroscience

Depression and anxiety disorders are substantial health problems that often go untreated despite the existence of many effective therapies, possibly because these interventions are expensive and time-intensive. I propose a low-burden psychotherapeutic writing protocol combining two partially effective models for reducing depressive and anxious distress. Self-regulatory psychoeducation reduces distress associated with dysregulated goal pursuit systems but may not convey long-term benefits. Traditional expressive writing reduces distress through cognitive reappraisal of stressors but has mixed support in clinical populations. A writing protocol focused on goal failure could integrate these two models integrated, allowing the strengths of each to compensate for the weaknesses of the other. In this study, I evaluate the psychological effects of this combined protocol and its two individual subcomponents in a nonclinical population to assess the feasibility of future clinical research, and I investigate the ways in which trait differences in personality and self-regulatory behavior influence these effects. Contrary to predictions, this protocol had no effect on symptomatology. However, it attenuated the increases in quiescent mood, cheerful mood, and general positive affect that were experienced by participants writing about neutral topics, driven by differences in response to the traditional expressive writing component. The directed-writing component had no general effects, but was more beneficial for participants with greater self-discrepancy and regulatory system dysregulation. These findings suggest that the proposed intervention targets dysphoric and agitated mood, more beneficially affecting participants with greater self-regulatory dysfunction. The implications of these findings for the future development of this paradigm are discussed.

Psychology Graduation with Distinction, 12:00-1:00

Jason Chen, Robert Collins
Energy Efficiency in Industry: Motor Vehicle Manufacturing-Toyota Team
Research Advisor: Gale Boyd
Economics

The auto manufacturing industry spends around $3.6 billion on energy each year. Manufacturers can use energy efficiency investments to reduce their exposure to variable fuel costs and also to gain a competitive advantage as the industry becomes more of a consumer-driven sector. Our client is Toyota Motor Engineering & Manufacturing North America, Inc. (TEMA), and we have been working closely Tim Hertel, Toyota Energy Engineer and Energy Manager, to learn about Toyota's 13 North American plants and their goals going forward with efficiency. Toyota has been partnering with the U.S. Environmental Protection Agency in their Energy Star program for industrial efficiency, and has won its ninth consecutive Energy Star Partner of the Year Award. Our client has realized over $370 million in cost savings at their 13 plants in North America, and reduced energy use by 15 percent per vehicle manufactured. Toyota is looking to further reduce energy use at individual plants and discover why some plants and shops are more efficient than others. The Duke Bass Connections team aims to use Toyota's historical plant data to further validate Toyota's energy prediction model and provide new insight and analysis into plant efficiencies and their trends over time. Our team is comprised of two undergraduate and three graduate students, and our expertise covers a broad range of fields from engineering to computer programming and econometrics.

Bass Connections, 12:00-1:00

Shulei (Shelley) Chen
Investigating the role of RNA Polymerase II pausing in mouse macrophages
Research Advisor: Lucy Williams
National Institute of Environmental Health Sciences Molecular Carcinogenesis Branch

Transcription by RNA Polymerase II can be regulated at multiple points in the transcription cycle. Traditional models depict recruitment of RNA Pol II as the rate limiting step for transcriptional activation. Conversely, Adelman lab and others have demonstrated an alternative model of activation for many stimulus responsive genes - RNA Pol II is preloaded, begins transcription, but pauses during early elongation. NELF complex is required for RNA Pol II pausing, and transcriptional activation occurs by releasing RNA Pol II into the gene body. Several genes important for the inflammatory response in macrophages were previously shown to exhibit pausing. We seek to understand how dysregulating RNA Pol II pausing affects macrophage functions. Global gene expression profiling was performed on naïve macrophages. Several dysregulated genes in NELF KnockOut macrophages were identified as direct targets by chromatin immunoprecipitations - cFOS, Gadd45a, and Nfkbie – with paused RNA Pol II at the promoter. First, I validated a direct target of NELF-mediated pausing, cFOS, with ChIP. cFOS was upregulated in NELF-KOs. Second, Nfkbie, a negative regulator of the NFkB transcription factor, was downregulated in NELF KOs, resulting in increased constitutively active NFkB. To understand how this affects stimulus responsive gene expression, I checked the expression of NFkB target genes in Control macrophages that are either unchallenged or challenged by pathogens and compared it to NELF KO cells in equivalent situations. Western Blot showed that in NELF KO macrophages, NFkB target genes were already upregulated prior to challenge and target gene expression increased in response to LPS challenge. The disruption of NELF-mediated pausing led to elevated expression of inflammatory genes before and during immune challenge.

Biological Sciences, 12:30-1:30

Nan Cheng
Mapping the Connection Between Urea and Capsule Production in Cryptococcus gattii
Research Advisor: John Perfect
Molecular Genetics & Microbiology

Cryptococcus neoformans is a pathogenic yeast that infects the central nervous system and causes meningoencephalitis in immunocompromised patients. Occasional strains, such as C. gattii, can even cause infections in healthy individuals. Cryptococcus species persist in the cerebrospinal fluid (CSF) of the mammalian host during infection by utilizing nutrients present in the CSF. Urea is a nitrogen-based molecule found in the CSF of mammalian hosts that is readily assimilated by cryptococcus. Urea can also signal increased capsule production in cryptococcus. Our goal was to investigate the molecular and genetic basis of urea as a signaling molecule for increased capsule production. Using Agrobacterium-mediated insertional mutagenesis (ATMT), we sought to identify mutants that failed to induce capsule when grown in the presence urea or conversely, that produced high yields of capsule. We screened a library of approximately 22,000 C. gattii mutants for dull or mucoid colony morphologies on media containing urea, which indicate reduced or increased levels of capsule. Traditionally, mapping of insertion sites is performed by inverse PCR and sequencing. However this method has limited success. To overcome the challenge of mapping insertion sites by inverse PCR, we successfully adapted the Splinkerette PCR methodology for mapping insertion sites in cryptococcus. To date, we identified 302 dull and 62 mucoid mutants. Of 17 selected mutants, we were able to map the insertion sites for 11 mutants. We identified two mutants that had independent insertion sites in the same gene (CNBG_1990 and CNBG_1989). CNBG_1990 encodes a serine/threonine kinase while CNBG_1989 encodes a hypothetical protein. Future work includes continued mapping of insertion sites for the remaining mutants as well as characterization of select genes and mutants for impact on pathogenesis. We predict that this new methodology will become a valuable tool for efficiently mapping fungal insertion sites that can be scaled for large screens and furthermore we will be able to understand mechanisms of how urea induces capsule production.

Biological Sciences, 11:30-12:30

Tiffany Chien
Molecular analysis of human Goodpasture autoantibodies
Research Advisor: Mary Foster
Medicine - Nephrology

Goodpasture (GP) syndrome is a rare yet deadly autoimmune disease that is defined by pulmonary hemorrhage and acute kidney injury. I investigated two approaches to capture and characterize GP autoantibodies (autoAb). One consisted of capturing GP autoAb that originate from a GP patient. Patient B cells were immortalized by Epstein Barr virus infection. In a subset of captured B cells, I found that 90% produced IgG while 100% produced IgM. I tested 88 lines for GP autoAb activity and found 8 weakly positive. However, further investigation found none were consistently positive on GP antigen. This suggests that IgG Ab can be recovered from patient blood cells, but the GP antigen specific B cells are rare or not easily recoverable from blood. Second, hematopoietic stem cells from human cord blood were injected into a strain of immunodeficient mice, giving rise to a murine-hosted human immune system. These mice were immunized with GP antigen. B cells were then immortalized by EBV infection, and one cell line, 2D6, bound GP antigen. I sequenced the immunoglobulin genes from 2D6 and determined that this autoAb is an unmutated human IgM, which suggests that a B cell could become autoreactive without mutations introduced during rearrangement. Using a humanized mouse model is useful for capturing IgM but has limitations in capturing the IgG associated with GP syndrome. Next steps involve investigating other methods to capture more anti-GP autoAb. Having multiple sequences are critical to gain a greater understanding of the mechanisms that result in this autoimmune response.

Biological Sciences, 11:30-12:30

Edward Chiou
The Effect of Erythropoietin on Sickle Red Cell Adhesion to the Endothelium and Vasoocclusion in Sickle Cell Disease
Research Advisor: Rahima Zennadi
Medicine: Division of Hematology

In sickle cell disease (SCD), occlusion of blood vessels or vasoocclusion, the hallmark of SCD, is the primary cause of both acute painful vasoocclusive "crises" and multi-organ damage. Sickle red blood cells play an active role in vasoocclusion, largely through their adherence to the endothelium and leukocytes. Erythropoietin, a cytokine that stimulates erythroid cell proliferation and maturation, is gaining therapeutic use in SCD. In addition, many patients with sickle cell disease have high levels of erythropoietin in the plasma. However, the effect of erythropoietin on the activation of sickle red cell adhesion is unknown. The mitogen activated protein kinase (MAPK), ERK1/2 signaling in sickle red cells is abnormally activated and mediates adhesion to the endothelium. Because erythropoietin activates ERK1/2 signaling in erythroid cells, I hypothesize that erythropoietin can up-regulate sickle red cell adhesion to the vascular endothelium, promoting vasoocclusion in vivo. Herein, I show that erythropoietin stimulates sickle red cell adhesion to endothelial cells via ERK1/2 signaling using in vitro assays. Erythropoietin stimulation of sickle red cells increased phosphorylation of ERK1/2 and its upstream effectors Ras, Raf1 and MEK1/2. The kinases Ras and Raf1 were also involved in adhesion of erythropoietin-activated sickle red cells to endothelial cells in vitro. Importantly, erythropoietin also increased adhesion of sickle red cells to the vascular endothelium promoting vasoocclusion in vivo; an effect involving ERK1/2 signaling. These data suggest that erythropoietin may initiate or exacerbate vasoocclusion and thus raise serious questions about the therapeutic use of erythropoietin in SCD.

Biological Sciences, 11:30-12:30

Parth Chodavadia
Characterizing Wnt5B Ligand-Receptor Interactions In ATRT
Research Advisor: Ratan Bhardwaj
TGen: Cancer & Cell Biology Division

Atypical teratoid rhabdoid tumors (ATRT) are pediatric brain tumors with a poor two-year survival rate of 10-15%. Because conventional treatment paradigms of surgical resection followed by radiation and chemotherapy pose significant threats to a dynamically developing brain, identification of novel non-invasive therapeutic targets remains important for improving survival in ATRT patients. Preliminary data showed that Wnt5B mRNA is one of the mRNAs that is significantly upregulated in ATRT patient-derived cell lines and tumor samples – suggesting that Wnt signaling dysregulation might be involved in ATRT tumorigenesis and progression. To elucidate the role of Wnt5B in ATRT and identify Wnt receptors that might serve as potential targets for non-invasive therapeutic intervention, three ATRT cell lines including CHLA-ATRT-04, CHLA-ATRT-05, and CHLA-ATRT-06 were examined. Cell lysates from these lines were extracted and analyzed via western blotting and immunoprecipitation. Western blotting indicated that Wnt5B was detectable in all three untreated cell lines. This confirmed that Wnt5B mRNA overexpression in ATRT translates to the protein level and suggested that Wnt5B plays a role in regulating ATRT tumorigenesis and progression. Immunoprecipitation of untreated cell lysates with Wnt5B indicated that Wnt5B possibly binds Frizzled-1, Frizzled-3, and ROR-1 receptors in these three cell lines. Immunoprecipitation analysis also indicated that there is weaker binding between Wnt5B and Frizzled-2 and Ryk receptors. Further studies need to be conducted to functionally characterize Wnt5B ligand-receptor interactions and evaluate the role of Wnt5B in ATRT tumorigenesis.

Biological Sciences, 11:30-12:30

Britany Cohen, Clara H. Lee, Anthony Weishampel, Will Trautman, Maria Elena Carvajal, Heather Shapiro
Coursera and the Future of Massive Open Online Courses
Research Advisor: Mine Cetinkaya-Rundel
Statistical Science

With the rise of massive, open, online, publicly available education, educators have begun to question the legitimacy and practicality of this new form of learning (research opportunities, cost effectiveness vs. quality of education, completion rates, etc.). Our Bass Connections team in the Education and Human Development theme has developed and launched two Coursera courses in introductory chemistry and statistics, developing modules, investigating alternative means of conveying information, and probing the future of open online education through mixed-methods research.

Bass Connections, 11:30-12:30

Clara Colombatto, Jennie Xu, Lei Zhang, John Hosey
How does trauma change us? Interdisciplinary approaches to the multifaceted impact of PTSD on cognitive function.
Research Advisor: Deborah Jenson
Duke Institute for Brain Sciences

Traumatic experiences have extensive and complex effects on cognitive and behavioral functioning. Effective diagnoses and treatments of trauma require investigation and integration of knowledge about its biological/neural basis, behavioral presentation, and cultural conceptualization. Our team unites faculty and students from neuroscience, psychiatry, global health and the humanities to study diagnostic, clinical and neurobiological paradigms of neuropsychological trauma. Poster 1: Jennie Xu (11-11.30) The ethnopsychology of post-earthquake Haiti is of keen interest to healthcare providers because the symptoms of trauma-related mental illness in Haiti are often incongruent with the Western framework of a mind-body dichotomy. A Creole translation and back-translation of the Short PTSD Rating Interview Expanded (SPRINT E) conducted by researchers in Haiti revealed cross-culture translational issues and suggest a need for more culturally sensitive psychometric tools. Poster 2: Clara Colombatto (11.30-12) Literary theory offers a valuable perspective to fill the gap between isolated understanding of the workings of the brain and empirical assessment of symptomatic behavior. With text mining techniques we aim to identify literary tropes and narrative structures that emerge and evolve in psychoanalytic treatment of childhood trauma. Poster 3: Lei Zhang (12-12.30) Typical symptoms of PTSD include hyper vigilance and re-experiencing, where emotions related to terrifying circumstances of traumatic experiences are generalized to innocuous stimuli. To elucidate fear generalization in PTSD patients, this neuroimaging study investigates neural processing and physiological arousal in a fear-conditioning model where fearful facial expressions are paired with a mild electrical stimulation. Poster 4: John Hosey (12.30-1) Recent neuroscientific imaging research has focused on patterns of brain activity in aversive learning paradigms, where subjects receive an electrical shock upon display of certain objects (dog) and learn to generalize fear to the corresponding object category (animals). This poster investigates the neural circuits of fear generalization in combat veterans with PTSD and combat-exposed veterans without PTSD.

Bass Connections, 11:30-12:30

Amalia Cong
Molecular and morphological analysis of tooth development in chimpanzees
Research Advisor: Gregory Wray
Biology

Teeth are masticatory tools whose morphologies are correlated with function and are key to understanding the evolutionary changes related to diet, feeding biomechanics, glucose transport, and cranial development within the primate lineage. A challenge associated with studying the evolution of human diet is the lack of any comparative data on gene expression or detailed morphology within developing chimpanzee teeth. In this study, the mRNA expression levels of four genes involved in enamel development - MMP20, AMELX, ENAM, TUFT1 - were measured using reverse transcription quantitative PCR within three distinct tissue sections of molars in two chimpanzees at different stages of early development. Complementary morphological data of chimpanzee teeth were obtained from micro-CT which were utilized for accurate extraction of the tooth samples. Our results indicate that enamel genes are expressed in a spatial and temporal pattern consistent with the known functions of these genes. The data gathered from this study represent a survey of gene expression across different tissues at different points of the developmental time series. The methods devised have laid the groundwork for current and future comparisons of tooth development among other enamel genes - ODAM, AMBN, AMTN, KLK4 - and other primate species in order to more holistically understand the evolutionary changes within teeth and their relationship with diet.

Biological Sciences, 12:30-1:30

Daniella Cordero
White matter abnormalities in HIV infection and cocaine dependence: a diffusion tensor imaging study
Research Advisor: Christina Meade
Psychiatry & Behavioral Sciences

Drug abuse is known to be a major risk factor for HIV infection. This is due both to direct exposure through injection drug use and to drug-induced increases in risky sexual behavior. Independently, HIV infection and cocaine abuse have been found to have detrimental effects on neural structure and functioning. However, little research has been conducted on the interactive effects of HIV infection and cocaine dependence in humans. The present study used diffusion tensor imaging (DTI) data in order to examine the interactive effects of HIV and cocaine on white matter in the human brain. Voxelwise analyses using tract-based spatial statistics revealed significant FA reduction in HIV+ cocaine dependent subjects relative to both HIV+ non-using and HIV- cocaine dependent groups. Interestingly, cocaine only resulted in significant FA reductions when acting in the HIV+ brain. These findings suggest a possible interaction between HIV and cocaine, in which HIV increases the brain's vulnerability to cocaine-related white matter degradation. Future research is needed to confirm and develop these preliminary findings.

Biological Sciences, 12:30-1:30

Preston Cotnoir
The Relationships between Aging and HIV Infection on Neurocognitive Functioning
Research Advisor: Christina Meade
Psychiatry & Behavioral Sciences

Background: Having an HIV-positive serostatus increases the risk of neurocognitive impairment. According to the Center for Disease Control (CDC), HIV-infection is becoming more prevalent in older individuals than 40 years ago. However, few researchers have examined the impact of aging on neurocognitive functioning in the context of HIV. Aims: This study examined the independent and combined effects of aging and HIV on neurocognitive functioning in a sample of non-drug users. Methods: The sample included 22 HIV-positive "older" (>50 years) individuals and 12 HIV-positive "younger" (<40) individuals as well as 5 HIV-negative older individuals and 8 younger individuals who all met eligibility criteria for the study. A comprehensive neurocognitive battery was administered to assess memory, executive function, motor function, attention/working memory, learning, processing speed, verbal fluency, and global function. Results: HIV-positive participants performed worse than HIV-negative participants on memory ($F(1, 46) = 4.524$, $p = 0.039$), executive function ($F(1, 46) = 5.887$, $p = 0.020$), attention/working memory ($F(1, 46 = 5.209$, $p = 0.027$), learning ($F(1, 46) = 5.990$, $p = 0.019$), and global function ($F(1, 46) = 6.312$, $p = 0.016$) . There were no significant results for age. Furthermore, there was a significant interaction effect between HIV serostatus and age group for motor function, $F(1, 46) = 10.428$, $p= 0.002$. Conclusion: These results suggest that HIV and aging may exacerbate neurocognitive decline among non-drug users already experiencing neurocognitive impairment.

Psychology Graduation with Distinction, 12:30-1:30

Caitlin Cristante
Determining the Interaction between the Drpr and Pak-3 Genes
Research Advisor: Nina Sherwood
Biology

Both pak-3 and drpr have been shown to regulate spastin, a microtubule severing protein in neurons. Because spastin defects cause hereditary spastic paraplegia, the understanding of this pathway is crucial to developing treatments for this condition. Previous experiments within Dr. Sherwood's laboratory have demonstrated that: (i) spastin knockouts have neurons with an abnormally high number of terminal boutons, (ii) mutations in both the pak-3 and spastin genes rescue the wildtype bouton morphology, (iii) pak-3 regulates the actin cytoskeleton, so over-expression of this protein creates additional filopodia in glial cells, (iv) the drpr protein is involved in clearing cellular debris, and (v) drpr knockouts have fewer terminal boutons than wildtype organisms. However, the signaling pathway among these proteins remains unclear. This semester, experiments were conducted to determine whether pak-3 is activated downstream of drpr, thereby regulating its activity. This was tested using genetic crosses of drosophila without drpr expression and with pak-3 over-expression. The experiment included two types of drpr knockouts: drpr RNAi and drpr delta 5. Since pak-3 and drpr both suppress spastin, it is possible that they also follow the same pathway for fwe, which also affects boutons. Larvae with this mutation have clustered, "flowery" boutons, and pak-3 deletions have been shown not to restore the wildtype phenotype. A separate experiment using drpr and fwe double-mutant drosophila was conducted to determine whether the wildtype phenotype would be rescued. If drpr and pak-3 are in the same pathway, then drpr would not be expected to have an effect on fwe

Biological Sciences, 12:30-1:30

Jila Dabestani
Retinal Morphology in EML1 knockout mice: effect on photoreceptor development
Research Advisor: Tatiana Rebrik
Duke Eye Center

EML1 is the homologue of CNG-modulin, the modulator protein of cyclic nucleotide-gated channel Ca2+ sensitivity in the retinal cone photoreceptors in striped bass (Rebrik et al., 2012). Until now, the effects of the Eml1 protein on retinal morphology have not been studied in detail in the mammalian model. We created an Eml1 transgenic knockout mouse and through breeding pairs, generated a line of eml1 knockout mice. In order to characterize the function of this protein in mammals, we use plastic sections to show that Eml1 dysfunction results in decreased migration of rod-like cells from the INL to the ONL, confirm that these ectopic cells in the INL are indeed rods via immunohistochemistry, and use a TUNEL assay to determine that their cell fate mechanism follows apoptosis similar to rod photoreceptors that do not migrate during normal retinal development. In addition we created a Eml1/Talpha double knockout mouse to inhibit activity of the rod photoreceptor transducin talpha subunit to confirm that the morphological effects of Eml1 knockout are not due to malfunctions in rods. We also show Eml1 colocalization of the Eml1 protein to the cone outer segments in the wild-type mouse confirming its same localization in mammals as in the striped bass. Our results showed that Eml1 knockout mice are born with an ONL that is 6 rod-photoreceptors thick and maintains this thickness throughout their life. The density of the photoreceptors in the ONL also remains the same with age in eml1 knockout mice. The inner nuclear layer (INL) of eml1 knockout mice is thicker than that of wildtype mice early in development, but at a later age, the INL of the knockout mice disappears and looks like the wildtype mouse INL at that age. This thickness of the INL in eml1 knockout mice is due to the presence of what seems to be rod-like cells remaning in the INL (Lavail et al., 1979). These rod-like cells cause the INL to be much thicker in eml1 knockouts compared to wild-type mice, but disappear by about 5 months of age. In addition the outer segments of the knockout mouse are shorter than that of the wild-type. We propose that Eml1 is a signal for rod photoreceptor migration early in retinal development. Further characterization is necessary to determine its potential clinical applications.

Biological Sciences, 11:30-12:30

Nicole Daniels
Why Is She Smiling?: Circular Migration and Women's Empowerment in Rural Rajasthan, India
Research Advisor: Harris Solomon
Cultural Anthropology

Migration is indispensable for many families in the poorest sections of rural India. Migration is largely pursued by men, while women maintain the home in the village. For my senior honors thesis, I completed ethnographic research in rural villages in Udaipur District, Rajasthan. My thesis explores life in rural villages and particularly the experiences of women whose husbands migrate for work. My initial research questions included: What changes does migration bring? What stays the same? What does it mean for women to be left behind by migration? Do the social freedoms of women differ while their husbands are away? Contrary to what I initially expected, the absence of men does not produce many freedoms for women. The patriarchy in India is not attached to the male migrant and able to travel with him. I argue that by conceptualizing migration through movement alone, we are doing a huge disservice to the people and places that are immobile, yet are deeply influenced by the movement of other people and ideas.

Social Sciences, 12:30-1:30

Madeline Dean
Thwarted Belongingness, Suicidal Ideation, and BMI among Mothers in the Fragile Family Study
Research Advisor: Robert Thompson
Psychology and Neuroscience

The purpose of this study was to examine the relationship between BMI and suicidality among mothers surveyed in the Fragile Families and Child Wellbeing Study. Two study hypotheses were generated to address this aim (1) BMI is associated with suicidal ideation among mothers from fragile families, and (2) thwarted belongingness mediates the relationship between BMI and suicidal ideation in this sample. Results indicated a significant association between body weight and suicidal ideation among mothers who also met criteria for depression and/or anhedonia. Results from a mediation analysis using logistic regression indicated that thwarted belongingness, a category of social support, does not mediate the relationship between BMI and suicidal ideation among this sample. These results suggest that women from fragile families may constitute a specific subgroup of the population at high-risk for the joint problems of obesity and suicidality. Future studies should continue to assess the mechanisms through which body weight and suicide are linked, particularly using longitudinal data.

Psychology Graduation with Distinction, 12:00-1:00

Maria Diaz
The Role of Pachquismo in (Re)shaping Chicanidad and Latinidad in Houston, Texas
Research Advisor: Sarah Deutsch
History

This project examines the role of cultural production as a form of ethnic resistance through pachuquismo, a 1940s Mexican American youth subculture, and its reuptake by the Chicano Movement in the 1960s and 1970s. Particularly, it attempts to make sense of how pachuquismo was used to shape an identity politics during el movimiento by comparing it to the subculture's WWII and post-war context. By focusing on Houston, this project expands on the existing literature of Chicano cultural production, most of which focuses on southern California.

Humanities, 12:30-1:30

Qi Dong
Individual Treatment Assignment as a Decision Problem Using Potential Outcome Framework
Research Advisor: Fan Li
Statistical Science

Previous studies put great weight on drawing causal inferences and assigning treatment based on the average treatment effect. This paper explores an alternative strategy. We focus on individual level treatment assignment and frame it as a decision problem using Bayesian modeling. We propose a scheme that helps decision makers (e.g. doctors, policy makers) to decide whether to assign a treatment (e.g. medical procedure, job training program) to any particular individual. Under the assumption that there is no unmeasured confounding factor in the data, we adopt the Rubin Causal Model framework and build a Bayesian model based on past data to predict any incoming individual's potential outcomes (e.g. probability of survival from a disease, probability of increase in annual income) with and without treatment applied. Based on that comparison, we assign treatment to the individual with the objective of maximizing the individual's probability of obtaining a desirable result. The paper examines the advantage and implication of this framework by applying it to the RHC dataset, which was collected at five medical centers in the U.S. and contains the information about 5735 hospitalized adult patients' treatment assignment, life status on the 30th day after admission and measurements of 52 potential confounding factors. We show that our framework can be used as a meaningful and reliable tool that enables decision makers to assign treatment effectively and efficiently.

Social Sciences, 11:30-12:30

Emily Du
Neural basis of social learning in rhesus macaques
Research Advisor: Michael Platt
Psychology and Neuroscience

Social learning is the process by which animals learn by observing conspecifics. Even though social learning has been studied in many animal species, the neural mechanisms mediating it remain poorly understood. We developed an experimental paradigm that uses implicit valuation measures to determine how monkeys evaluate novel foods following direct experience with the food or by observing another monkey taste the food. We have shown that monkeys spend more time looking at good-tasting foods, whether they have learned the value through reinforcement or social learning, readily switching their looking behavior when the color-flavor associations are switched. Inactivating the anterior cingulate cortex gyrus (ACCg) with muscimol, a GABA-A receptor agonist, temporarily prevented the ability of monkeys to reverse their looking behavior when learning from another monkey (social learning), while leaving direct experience learning unaffected. By contrast, the same injections did not affect learning through direct experience. Inactivating the anterior insula with muscimol produced the opposite effect, preventing the ability of monkeys to reverse their looking behavior during direct experience learning, while leaving social learning unaffected. These results demonstrate that temporary inactivation of the ACCg and anterior insula impairs different aspects of learning, informing our understanding of the roles of these brain regions in social cognition, empathy, and theory of mind.

Biological Sciences, 12:00-1:00

Yvette Dzumaga
Immediate and lingering effects of isoflurane on ethanol sensitivity of GABA-A Receptors in dentate gyrus granule cells
Research Advisor: Rebekah Fleming
Psychology and Neuroscience

Adolescent ethanol consumption is a critical public health issue; early exposure to alcohol may permanently alter brain function, disrupting processes such as memory formation. Studies have shown that early exposure to ethanol makes rat neurons more sensitive to ethanol in adulthood. Extrasynaptic GABA-A receptors expressed on granule neurons within the hippocampus have increased sensitivity to ethanol, increasing tonic inhibition that suppresses granule cell firing. These effects may lead to permanently altered circuits downstream of the hippocampus. However, research has yielded different results for ethanol potentiation of the baseline current found in granule neurons, which may be due to the anesthetic used during brain extraction. Research has suggested that isoflurane has immediate and lingering effects in the brain, potentially acting on the same substrates as ethanol. Using electrophysiology, this project first seeks to explore how isoflurane changes GABA-A Receptor- mediated current compared to a ketamine cocktail anesthetic, consisting of ketamine, acepromazine, and xylazine. This study expects to find a shift in baseline tonic current immediately post isoflurane exposure, especially coupled with ethanol perfusion. The second aim of this project is to measure the lingering effects of isoflurane on adolescent and adult rats through a comparison of baseline tonic current a week post isoflurane exposure and immediately following an ethanol bolus. This data will hopefully support previous behavioral findings that adolescent rats previously exposed to isoflurane have increased ethanol sensitivity. These combined results will resolve a controversy in the field and determine the effect of isoflurane's interaction with ethanol on granule neurons.

Biological Sciences, 11:30-12:30

Stefanie Engert

Specific influence of pak3 on the spastin pathway of synaptic bouton formation is corroborated by its lack of effect on tkv stimulated bouton growth

Research Advisor: Nina Sherwood
Biology

Spastin, a microtubule severing protein of the AAA family, has been shown to influence the morphology of the neuromuscular junction in Drosophila melanogaster, especially the number of boutons formed. Null alleles of spastin lead to a highly increased number of synaptic boutons and extra branching in neurons —a phenotype that can be suppressed with a null allele of p21-activated kinase 3 (pak3), which is highly expressed in glial cells. Expression of a constitutively active form of the mitogen receptor Thickveins (Tkv) in neurons leads to a phenotype similar to that of spastin null mutants with an increase in synaptic bouton number. It has, however, not been previously shown whether pak3 reduction in glia can rescue this phenotype as well or whether the pak3 pathway of influencing synapse morphology interacts specifically with that of spastin. For this purpose, we tested the removal of pak3 from flies overexpressing Tkv in neurons. Using meiotic recombination, we generated fruit flies containing both the pak3d02472-5 hypomorphic allele and constitutively active Tkv. After crossing the recombinant flies to the neuronal driver line elavGal4 in a pak3 mutant background, larvae in the 3rd instar stage were dissected, their neurons visualized by staining with fluorescently tagged antibody and the morphology of their neuromuscular junction characterized in comparison to control flies. We found that the number of synaptic boutons was not suppressed when pak3 was reduced, which leads us to conclude that pak3 specifically influences the spastin pathway of synaptic bouton formation.

Biological Sciences, 11:30-12:30

Katherine Ferguson
Sulfide Minerals in the Middle Banded Series of the Stillwater Complex, Montana, USA
Research Advisor: Alan Boudreau
Earth and Ocean Sciences

Models of the origin of the platinum-group element deposits in layered intrusions such as those of the 2.7 billion year old Stillwater Complex range from strictly magmatic to hydro-magmatic. Meurer et al found evidence for Cl-rich fluids moving through the Middle Banded Series (MBS) of the Stillwater complex. They suggested that the ore metals in the MBS were remobilized and fractionated by a vapor refining process. The whole rock analysis by Meurer et al shows modification of Cu content in olivine-bearing zones III and IV (OB-III and –IV) that broadly matches models of chromatographic separation by a Cl-rich fluid moving upward through the column. This project has looked for petrographic evidence of high temperature remobilization of sulfide minerals in the MBS to confirm Meurer et al's findings. The MBS includes troctolites and olivine-bearing gabbros and gabbronorites which contain single phase sulfides in addition to multiphase sulfides composed of combinations of chalcopyrite, pentlandite, pyrite, and pyrrhotite. These assemblages differ from those expected in magmatic crystal fractionation and settling models where Ni is quickly depleted and Cu becomes dominant. Instead, the profiles of the Ni- and Cu-containing sulfides pentlandite and chalcopyrite indicate modification of sulfides during cooling, possibly by late magmatic vapor that caused remobilization of ore elements. The variations seen in these sulfide percentages are too rapid to be the result of fractional crystallization, but are consistent with vapor remobilization of Cu in the cooling crystal pile.

Physical Sciences, 12:00-1:00

Natalie Ferguson
Encouraging Top College Graduates to Pursue Teaching as a Long-Term Career
Research Advisor: Alma Blount
Public Policy

In the process of narrowly defining success, elite colleges, and society as a whole, have created a misconception that teaching is second-rate career. As a result, the education system has failed to consistently recruit top achieving college graduates to be teachers. The teaching profession has innate shortcomings that dissuade many college graduates. The profession lacks a dynamic career trajectory; the only opportunity for a teacher to climb the ranks is to stop being a teacher and work in administration. Relatedly, teachers are often rewarded with higher salaries or immunity to being laid off based on time of service, not by teacher performance. Furthermore, when teachers feel as though they have become experts in their field, they often have little recognition for their accomplishments compared to masters in other fields. The combination of limited visibility of top performers and minimal sharing of teaching success perpetuates teacher discontent. Where teaching falls short of providing graduates with a career brimming with distinction and status, it has the potential of bringing immense amounts of fulfillment and happiness to the lives of graduates. Allowing college graduates to understand the many reasons why teachers are satisfied with their jobs could potentially recruit more high-achieving graduates. In this project, I suggest that the media should take an active role in portraying the teaching profession as a 'successful' career. I also suggest that programs like Teach for America expand their influence and provide long term fellowship programs for alumni. Finally, I stress the importance of elite colleges establishing pre-teaching programs and providing opportunities for undergraduates to meet teachers who are masters in their field.

Social Sciences, 12:30-1:30

Rachel Fischell
Ethics of Memory Dampening Using Propranolol as a Treatment for PTSD in the Field of Emergency Medicine
Research Advisor: Scott Huettel
Psychology and Neuroscience

Imagine a world where one could selectively remember events. Unwanted memories would never be encoded and we would be left with the ability to recall only pleasant remains. In this world, a witness to a violent mutilation following a severe car accident could forget every detail of what they'd observed and avoid the emotional aftermath. In emergency situations in the United States, emergency medical personnel are relied on to respond quickly and save the lives of citizens in critical, but often disturbing, conditions. The nature of this work causes the incidence of post-traumatic stress disorder (PTSD), characterized by reiterations of the trauma through intrusive and distressing recollections of the event, flashbacks and/ or nightmares, to be incredibly high in this profession. About 20 percent of emergency medicine employees will develop the disorder and as a result, the average career-span of those who choose to pursue occupations in this field is only about 4-7 years. One potential solution for such high rates of PTSD (and therefore early career burnout) involves administration of propranolol prior to or immediately following traumatic situations to prevent emotional memory reconsolidation. The goal would be for propranolol to ensure that no traumatic experience becomes embedded in the amygdala as non-conscious emotional memory. Preventing such embedding could avoid a chronic hyperactive fear response commonly triggered by certain stimuli long after the event, which is the basis for PTSD. For example, when an EMT is called to assist with a ten-car pile-up on a major highway, he or she would be administered propranolol either before or immediately after treating the victims to help to prevent emotional memory consolidation. Without the emotional component of the memory, the EMT would be far less likely to develop symptoms of PTSD. However, because propranolol works to prevent aspects of memory consolidation via reduction of emotion, moral judgments that might arise during such traumatic situations could be affected, thus compromising the quality of patient care. Consequently, alteration of memory reconsolidation, resulting in reduction of emotion and ability to make moral judgments, is unethical and should be prohibited. The disadvantages and potential risks of propranolol administration significantly outweigh the potential benefits, especially for the 80 percent of emergency medical personnel who will not develop PTSD.

Christopher Flower
Two-Body Photodisintegration of 3He with Double Polarizations
Research Advisor: Haiyan Gao
Physics

The study of the two-body photodisintegration of 3He using a longitudinally polarized target and a circularly polarized gamma-beam provides data and information that can be used to better understand novel three-body calculations and determine the Gerasimov-Drell-Hearn (GDH) integral from the two-body breakup threshold to the pion production threshold. 100% circularly polarized gamma-rays from the HIGS facility at the Duke Free Electron Laser Laboratory will be used to perform the first measurement of the spin-dependent differential cross sections from the two-body breakup of polarized 3He at incident photon energy of 30 MeV. Gaseous 3He targets made up of a single piece Pyrex glassware cell (with both a spherical pumping chamber and cylindrical target chamber) will be used. In order to polarize the 3He contents of the cell, spin exchange optical pumping will be used. This entails using a mixture of alkali metals (Rb and K) and a buffer gas (N2) in the cell (along with 3He) and optically pumping the mixture with laser light. Polarized light at approximately 794.8 nm will polarize the alkali metal atoms which will in turn transfer their polarization to 3He nuclei through spin exchange collisions. The buffer gas is included in order to control the population of polarized Rb atoms. A weak magnetic field produced by a pair of Helmholtz coils will also be present to ensure that 3He atoms will be polarized at a certain orientation. This project is being carried out primarily by Georgios Laskaris and Professor Haiyan Gao's Medium Energy Physics Group.

Justin Fu
Substrate Stiffness Promotes Endothelial Cell Senescence and Proliferation
Research Advisor: George Truskey
Biomedical Engineering

Atherosclerosis develops in regions of a blood vessel where there is high endothelial cell (EC) turnover and high oxidative stress, leading to accelerated aging. Atherosclerotic regions are also characterized by increased vessel wall stiffness, but the link between pathology and increased vessel stiffness remains unclear. To determine whether changes in the mechanical environment promotes cell senescence, human cord blood-derived ECs (hCB-ECs) were seeded on to fibronectin-immobilized variably compliant polyacrylamide gels. We found that hCB-EC senescence increased with increasing substrate stiffness ($p<0.05$). hCB-EC proliferation also increased with increasing substrate stiffness ($p<0.05$). Young cells exhibited greater proliferation than aged cells for all stiffnesses ($p<0.0001$). Young cells also exhibited less senescence than aged cells for all stiffnesses. To determine whether matrix protein affects cell senescence, we seeded cells on gels derivatized with collagen. Preliminary results indicate that changes in proliferation and senescence with increased stiffness remain consistent. The results of this study show that increasing stiffness promotes endothelial cell aging and proliferation, which is independent of matrix protein.

Biological Sciences, 12:30-1:30

Pramodh Ganapathy
Effects of whole body vibration and muscular activity on bone in mice
Research Advisor: Karyne Rabey
Evolutionary Anthropology

Application of whole body vibration (WBV) as part of a treatment program for osteoarthritis and osteoporosis has shown promise, but the mechanisms by which WBV repairs cartilage and bone loss are poorly understood. WBV of awake, mobile mice has shown to increase the volume of cancellous bone (porous bone also referred to as trabecular or spongy bone) in certain areas of the body, such as at the proximal tibial metaphysis (i.e. knee joint). However, it is not yet known if voluntary muscle contractions are a significant contributing factor to bone change under WBV nor if WBV stimulates growth in dense cortical bone. The role of muscle activity in bone formation can be studied by comparing the effects of WBV in bone in awake and anesthetized mice. This study examined twenty 3-month-old mice divided into four groups: (1) untreated, (2) anesthetized with no WBV, (3) awake with WBV and 4) anesthetized with WBV. WBV was applied to unrestrained animals on a vibration table at 50 Hz and 0.3 m/s/s. The treated animals were anesthetized and/or received WBV for 15 minutes every other day for 28 days. After the experiment, humeral cross-section and microCT scans of the proximal tibial metaphysis were collected and compared across groups, and patterns of difference were considered in the context of the vibration regimes. These results provide a pathway for further studies and implications for treatment of osteoporosis in humans.

Biological Sciences, 11:30-12:30

Ashley Gartin
Epigenetic Therapy with 5-azacytidine and HDAC Inhibitors for t(4;14)(p16;q32) Multiple Myeloma
Research Advisor: Huntington Willard
IGSP

Multiple myeloma is an incurable plasma cell malignancy that accounts for 13% of all hematological cancer diagnoses each year. T(4;14)(p16;q32) is a common chromosomal abnormality in MM and correlates with a poor prognosis. Furthermore, t(4;14) MM has been shown to associate with higher DNA methylation levels than other subtypes. In light of this, epigenetic therapy was attempted on a t(4;14) KMS11 cell line using non-cytotoxic, transient doses of the DNA methyltransferase inhibitor 5-azacytidine to prime for treatment with entinostat or vorinostat, both histone deacetylase inhibitors. We found that neither 5-azacytidine/entinostat nor 5-azacytidine/vorinostat significantly lowered cell viability. Additionally, methylation-specific PCR (MSP) and RT-PCR were used to assess the effects of 5-azacytidine on DNA methylation and gene expression. MSP showed that p16, a known tumor suppressor gene, is partially methylated in untreated KMS11 cells, but becomes demethylated after 500 nM 5-azacytidine treatment. However, RT-PCR did not show any post-treatment differences in p16 expression. MSP also demonstrated that MGMT, a gene involved in DNA repair, is unmethylated in both untreated and treated cells, but RT-PCR showed post-treatment MGMT downregulation. These data indicate that further optimization of epigenetic therapy is needed to assess its potential contribution to MM treatments.

Biological Sciences, 12:30-1:30

Christopher-Marcus Gibson
A Science of Good & Evil? - On the Possibility of Ethical Knowledge
Research Advisor: Michael Ferejohn
Philosophy

This honors thesis examines how far we can make ethics scientific, and what this ethical knowledge would be like, by way of engagement with the works of Aristotle. This research delves into current scholarly literature on Aristotle's ethics and theory of science, where I seek to understand how Aristotle believes ethics to resemble and differ from the exact sciences such as mathematics or logic without entirely lacking scientific rigor. I claim we can explain and evaluate ethical claims on the basis of a foundational definition of flourishing human life. Ethical science would investigate the necessary components and conditions of a flourishing life and demonstrate these findings on the basis of the definition. What complicates the issue is how we arrive at the definition: upbringing and acculturation shape our understanding of what activities are worthwhile, and I warn that we should not pretend we can reverse the process or step outside our own character when searching for the definition. I argue, furthermore, that we can only understand a definition of flourishing through both reason and desire: someone could only know what flourishing is by both understanding and experiencing why it's worthwhile. If the conceptual framework of an Aristotelian-type "character" ethics can be fruitfully married to our best contemporary methods and findings in the behavioral sciences, it may turn out that a scientifically rigorous ethics of character is possible. I thus hope to show that the insights and conceptual apparatus furnished by Aristotle and his contemporary interpreters serve as a robust, lively point of departure for a mode of contemporary ethical inquiry and discourse which is both interdisciplinary and practically-oriented.

Humanities, 12:00-1:00

Ricardo Guerra
Modeling Schizophrenia-induced Motivation Deficits in Mice: Efficacy of Current and Novel Antipsychotics
Research Advisor: Christina Williams
Psychology and Neuroscience

Schizophrenia is a complex psychiatric disorder with symptoms classically divided into positive, negative, and cognitive domains, although only positive symptoms are treated effectively by approved antipsychotics. To better understand amotivation, a negative symptom strongly linked to poorer patient outcomes, two animal models of schizophrenia were tested under a progressive ratio operant task to potentially capture schizophrenia-related motivation deficits: the dopamine transporter knockout (DAT KO) and phencyclidine (PCP, a NMDA glutamate receptor antagonist)-treated models. Mice were then acutely injected with the atypical antipsychotic clozapine (dopamine D2 and serotonin (5-HT) antagonist, 5-HT1A partial agonist) or novel antipsychotics UNC9975A (beta-arrestin 2 (βARR2) biased D2 agonist with 5-HT receptor activity) or CHO-3 (5-HT2C agonist) to rescue any motivational deficits observed. Results demonstrated reduced motivation (measured by breakpoint in the operant task) in DAT KO mice compared to C57BL/6J controls. However, PCP-treated mice displayed no significant differences in motivation compared to saline-treated controls. In PCP-treated mice, UNC9975A and CHO-3 decreased motivation, with the decrease induced by UNC9975A appearing to occur in a dose-dependent manner. Similarly, in DAT KO and non-PCP treated C57 mice, UNC9975A, CHO-3, and clozapine decreased motivation. These results suggest that dopamine signaling (through βARR2) and serotonin signaling play important roles in amotivation in schizophrenia, but the role of glutamate may be less critical. Scrutinizing the dose schedule of PCP is required to validate its use in models of schizophrenia-related amotivation, and testing a broader array of antipsychotics with unique receptor affinities and functional profiles will help elucidate an efficacious therapeutic mechanism for amotivation and its underlying cause in this paradigm and the disorder itself.

Psychology Graduation with Distinction, 12:00-1:00

John Hare-Grogg Jake Lennert Vaib Penukonda
Strengthening Community Environmental Health through Duke-HBCU Partnerships
Research Advisor: Deborah Gallagher
Nicholas School of the Environment

Environmental amenities enhance and support the health of community members. Yet, urban communities with high concentrations of minority, low income and new immigrant residents are disproportionately burdened by environmental disamenities such as food deserts, landfills, air pollution and undeveloped brownfield parcels, which have a negative impact on public health. Our project will confront environmental injustice and community health issues in a disadvantaged urban neighborhood in Dallas, Texas, in partnership with students at Paul Quinn College. Students at both schools will apply community-based participatory research methods in which traditional research subjects become research partners. We will collaborate with community partners to use techniques such as such as interviews, surveys and PhotoVoice to examine links between ecological restoration, redevelopment and community health and to define options for addressing health disparities and sustainably revitalizing the neighborhood.

Bass Connections, 12:30-1:30

Kshipra Hemal
The Challenges of Treating Heart Disease in Women
Research Advisor: Alma Blount
Public Policy

Despite the widespread misconception that cardiovascular disease is a man's disease, it is the leading cause of death for American women. In fact, since 1978, more women have died of cardiovascular disease than men. Additionally, women are treated less aggressively for cardiovascular disease than men. These disparities exist because of low rates of public awareness about cardiovascular disease in women, lack of sex-specific research on the topic and because diagnostic tools are not efficient at detecting the female patter of cardiovascular disease.

Social Sciences, 12:30-1:30

Destiny Hemphill
"Even the Sea is Grieving": Investigating a Politics of Melancholia in Chicana Feminist Literature
Research Advisor: Wahneema Lubiano
African and African American Studies

Drawing upon critical race theory, Eng and Han's theory of racial melancholia, Chicana feminist theory, and literary theory, this interpretative analysis of Chicana feminist literature will explore the political capacities of melancholia. Because melancholia is an affective response to losses of ideals, culture, language and disenfranchisements, I argue in my larger project that it is then useful for identifying and contesting the systems of oppression (such as homophobia, racism, sexism, and classism) that result in physical, emotional, or psychic disempowerment of those who are subjected to such oppressions. Furthermore, in light of its treatment of Chicanas whose bodies are both racialized and gendered, this project can be used to remark upon the material conditions for multiply marginalized women of color in society. Such an investigation provides relevant commentary in consideration of policies that are nominally multicultural but ultimately serve to re-consolidate institutionalized racism and misogyny.

Humanities, 12:30-1:30

Kathryn Henschel
The effect of repeated retrieval on the contents and phenomenological characteristics of autobiographical memorie for emotional events
Research Advisor: David Rubin
Psychology and Neuroscience

The act of retrieving a memory is not a neutral event – it can strengthen or alter memories. When people repeatedly retrieve a memory of an event that they experienced, it can change what they remember about this event (i.e. the content) and how they remember it (i.e. the phenomenological characteristics). We investigated how repeated retrieval of memories for emotional, personally significant events affects the content and phenomenological characteristics of these autobiographical memories. Participants nominated memories for four recently experienced events (two positive and two negative events), then wrote descriptions and completed questionnaires regarding the phenomenology of these memories. After three weeks of repeatedly retrieving one positive and one negative memory, they wrote another description and re-answered the questionnaires for all four memories. The descriptions and questionnaire ratings indicated that the memories nominated by participants were highly emotional, vividly remembered, and personally significant. Little change was seen in the questionnaire ratings for memories that were repeatedly retrieved relative to memories that were not retrieved. One possible explanation for this finding is that the memories nominated by the participants had already been repeated retrieved many times prior to the experiment and thus had already reach a stable form. Another possible explanation is that participants thought about these personally significant memories a lot regardless of whether they were asked to retrieve them for the experiment.

Social Sciences, 11:30-12:30

Mark Herzog
Baby Monitor: Developing a Business Model to Scale a Mobile Platform Delivering Care to Pregnant Mothers and Children in Western Kenya
Research Advisor: Eric Green
Global Health

Millions of women and children continue to die every year from preventable causes that occur as a result of complications during pregnancy and the first months following delivery. Proven interventions can prevent two-thirds of newborn deaths and eighty percent of maternal deaths, but barriers to care prevent women from accessing critical screenings and healthcare. Baby Monitor is a mobile screening and referral system that brings the clinical screenings directly to mothers. Previous work has established the validity and reliability of the mobile screenings but continued research must be directed towards a scale-up strategy. Effective scale up of a global health technology can best be achieved through the development of a sustainable business model. Interviews with community health workers and clinicians were used to define stakeholders and establish the value of Baby Monitor from the end user's perspective. A business model built around end user demand allows for effective communication of the value proposition to those in need and facilitates scale-up. To lay the groundwork for developing a business plan, a SWOT analysis was completed to outline the strengths, weaknesses, opportunities and threats Baby Monitor faces from the community perspective. Community engagement ensures that Baby Monitor develops within the Kenyan context and helps define a business model that can enable a scaled impact.

Community Engaged Research, 11:30-12:30

Jennifer Hewitt
Preliminary Evaluation of E. coli as a Host for Second-Generation Electrofuels Processes
Research Advisor: Michael Lynch
Biomedical Engineering

This study focuses on evaluation of the feasibility of a second-generation electrofuels process. This process relies on the delivery of a soluble and reduced electron carrier to a fermentation vessel. Microbial (E. coli) cells oxidize the soluble electron carrier and reduce carbon dioxide to produce fuel molecules. Simultaneously, the reduced soluble electron carrier is oxidized to a relatively insoluble product, making recovery and recycling feasible. We are evaluating the use of a genetically modified E. coli to oxidize the readily soluble 1,6-hexanediol to the relatively insoluble adipic acid. To date, three primary components of the process were studied: 1) the toxicity of adipic acid to the microbe, 2) the ability of the microbe to metabolize the electron carriers and 3) the enzymatic activity of the dehydrogenases to be used for oxidation. Initial toxicity studies identified the ammonium salt of adipic acid as the least toxic soluble form. Toxicity, as expected, varied as a function of pH. Preliminary metabolic studies suggest that our E. coli strains are incapable of utilizing adipic acid as a sole source of carbon. In addition, two key dehydrogenases needed for the oxidation of 1,6-hexanediol to adipic acid were cloned, and initially characterized. The implications of these on the potential of this approach and E. coli as a host are discussed.

Biological Sciences, 11:30-12:30

Min Kyung Hong
Analysis and Processing of Physiological Data from Shock Avoidance Study
Research Advisor: Ahmad Hariri
Psychology and Neuroscience

Indices of physiological response are commonly collected during psychological experiments in order to assess internal processes. Yet to date, few studies have investigated how these internal processes are related to behavioral performance during different psychological states. Electromyography (EMG) assesses the electrical activity of skeletal muscles and previous work has demonstrated that the onset of EMG response is correlated with reaction time (RT) latencies during voluntary finger extensions. We set out to determine how EMG responses of the extensor indicis proprius muscle of the forearm, specifically peak amplitude and latency to peak, are related to RT and if these measures can be affected by experimental manipulation. We additionally collected data assessing skin conductance responses (SCRs). SCRs are indicative of sympathetic autonomic arousal however it is currently unclear if these responses impact behavioral performance. In this study, we continuously monitored EMG and skin conductance activity while participants performed an auditory signaled shock avoidance task. Shock trials resulted in faster RTs, larger EMG peak amplitudes, and larger SCRs. Surprisingly latency to peak, which was not affected by shock contingency, was positively correlated with RT, but peak amplitude was not. SCRs were negatively correlated with RT, but only early during the experiment. Our results suggest that EMG peak amplitude and latency reflect different aspects of performance. Further, our results suggest that autonomic arousal is inversely related to performance early during an experiment. We conclude that the manner in which physiological responses are assessed have implications for their relation to performance.

Behavioral Sciences, 12:30-1:30

Grace Hopkins
Academic Motivation Across the Undergraduate Years: How Does It Change? What Predicts Change?
Research Advisor: Harris Cooper
Psychology and Neuroscience

This study investigated the change in college students' academic motivation over the undergraduate years and the relation between their motivation and subsequent academic performance. To examine these questions, I used two self-report questionnaires that measured student motivation and academic performance, and were previously administered to student enrolled at a private university in the southeastern United States. These two surveys were administered to matriculating freshman (Time 1), from 2005-2009, and graduating seniors (Time 2), from 2009-2013. The current study's total sample size amounts to N=545, with a sub-sample (N=61) used for some of the analyses. Hierarchical regression analyses revealed that matriculating students' interest and academic self-concept individually and significantly predict their average grade in college. However, academic self-concept and general academic motivation did not seem to predict intrinsic motivation at graduation, while only general and writing self-concept positively predicted a mastery goal orientation. Implications of these findings and future directions are discussed.

Psychology Graduation with Distinction, 12:00-1:00

Hannah Hopkins
The Effect of Repeated Retrieval on Memory for Positive and Negative Film Clips
Research Advisor: Andrew Butler
Psychology and Neuroscience

Repeated retrieval (also referred to as "rehearsal") is thought to be a mechanism responsible for changes in autobiographical memories over time. Repeatedly retrieving memories can maintain their availability and solidify details into a stable narrative. Repeated retrieval can also cause memories to change through the integration of new information, such as when the emotional intensity of memories decreases as the result of reappraisal. The effects of memory retrieval have been extensively explored in previous autobiographical memory studies using retrospective designs (i.e. asking people to estimate how much they retrieved a certain memory in the past). In contrast, the current study adopts a prospective design by creating "events" in the lab (having participants view film clips) and then manipulating whether or not these events are repeatedly retrieved. During the initial session, participants were shown four film clips – two positive events and two negative events. Afterwards, they wrote a description and filled out a questionnaire that measured various phenomenological characteristics of their memory (e.g., emotional intensity, confidence, etc.) for each event. Over the next three weeks, participants repeatedly retrieved their memory for one of the positive events and one of the negative events at three-day intervals. In the final session, they wrote another description and filled out the phenomenology questionnaire again for each of the four events. The data were analyzed for changes from the initial session to the final session in both the content and phenomenological characteristics of their memories for the events. Preliminary results will be presented.

Behavioral Sciences, 11:30-12:30

Shajuti Hossain, Marie Komori
Goals and Collective Efficacy: Routes to Energy Saving
Research Advisor: Rick Larrick
Fuqua School of Business

It has been increasingly recognized that insights from psychology and behavioral economics are crucial to initiate and maintain the behavioral changes necessary to curtail energy use. Our team considered three routes to energy saving that focused on how information is presented and relied upon a psychological understanding of how people construct and pursue energy-related goals. Our team's first project, led by Gabriel Goffman, shows that people display stronger intention to engage in energy-saving action when the benefits of such action is aggregated over many people. Our team's second project, led by Marie Komori, shows that people are persuaded to behave more energy efficiently when presented with multiple arguments, particularly when those arguments are in the same general domain, such as health or environment. Our team's third project, led by Shajuti Hossain, shows that people generally underestimate the energy required to power appliances and they especially underestimate the energy required to produce foods; however, this misperception can be reduced by labelling products with familiar energy information, such as light-bulb energy equivalencies. Overall, the insights produced by our Bass Connections team can be usefully implemented by policy-makers and social marketers to encourage people to engage in more energy efficient actions: present multiple related arguments, aggregate potential savings over communities, and speak about energy consumed in terms of familiar units.

Bass Connections, 12:30-1:30

Mao Hu

What Factors Predict Housing and Income Outcomes for Homeless Persons with Disabilities?

Research Advisor: Dalene Stangl
Statistical Science

Homeless persons in San Diego have higher rates of disability compared to the general U.S. population – in 2012, 65% of adult individuals in transitional housing programs in the San Diego region had a disabling condition, compared to 19.2% among all U.S. individuals. Homeless persons with disabling conditions often experience barriers to accessing health care, such as the need to fulfill immediate needs like food and shelter. St. Vincent de Paul Village, a homeless assistance program in San Diego, aims to address these needs by helping clients gain income and housing. The objective of this study was to i) identify factors that predict whether or not clients with disabilities go to permanent housing, temporary housing, or to the street and ii) identify factors that predict whether or not clients applying for disability benefits receive benefits before leaving the Village. Using multinomial regression, longer stays at the Village and increased age predicted increased odds of permanent housing versus the street, while being incarcerated within the last two years predicted decreased odds of permanent housing versus the street. Using logistic regression, longer stays at the Village and a self-reported diagnosis of Schizophrenia were associated with increased odds of getting disability benefits. These results suggest subgroups of the population of homeless persons that might benefit from specialized resources, such as clients who have been recently incarcerated.

Community Engaged Research, 12:30-1:30

Brendan Huang
Separation of Hemoglobin Variants in Sickle Cell Blood after Transfusion or Hydroxyurea treatment
Research Advisor: Timothy McMahon
Biology

Sickle cell disease (SCD) is a hereditary blood disorder affecting hundreds of thousands of people annually. It is characterized by a mutation in the β-globin subunit of hemoglobin (Hb), causing erythrocytes to take on abnormal shapes and stick to various other cell types. Currently, there are two major treatments that mitigate the effects of SCD: red blood cell (RBC) transfusion and hydroxyurea. These interventions increase the concentration of adult (A) and fetal (F) Hb variants, respectively, and decrease the overall concentration of mutated sickle Hb (HbS) within the RBCs. Since SCD is also associated with a deficiency in vasodilator nitric oxide (NO) derivatives bounded reversibly to Hb, NO donor drugs have also been touted as potentially beneficial treatment. We developed a method to separate SCD patient Hb into the hemoglobin variants A, F, and S using ion exchange chromatography (IEX). IEX is able to provide a crucial step in separation and analysis of specific biomarkers attached to Hb. By isolating the individual Hb variants, one can analyze the effects of transfusion or hydroxyurea treatment on each individual variant. Knowing the variants that most benefits from NO donor drugs, and possibly hydroxyurea, may guide treatment decisions in order to improve clinical outcomes and ameliorate the symptoms of SCD involving deficient NO. Furthermore, this process leads to informative research on how NO can safely and effectively is harnessed to treat other blood disorders.

Biological Sciences, 11:30-12:30

Naureen Huda
Knowledge of Autism and Family Support among Parents of Children with Autism at a Training Center in Kolkata, India
Research Advisor: David Boyd
Global Health

Individuals with autism spectrum disorder (ASD) often face stigma from their communities and are socially withdrawn. Autism Society West Bengal (ASWB), a nonprofit organization in Kolkata, India, works with children with ASD and their families to improve their quality of life through a number of programs. One of these programs is ASPIRES, a twelve-week training course in which parents of children with ASD participate in theory classes to better understand the disorder and hands-on behavior management training with their child. ASWB identified a need to better understand the knowledge and attitudes regarding ASD among the immediate and extended families of children with the disorder and the levels of support the family provides to the child. In my community-based research project with ASWB, I sought to assess the impact of ASWB's ASPIRES program on parents' understanding of ASD and management of their child's condition. I also sought to examine the perceived level of societal and familial support among the parents in ASPIRES. I conducted qualitative interviews with all twelve of the parents enrolled in the ASPIRES program for the first time. Overall, I found that the parents in the ASPIRES program had little to no knowledge of ASD before participating in ASPIRES and that their knowledge of ASD increased throughout the program. Additionally, a common sentiment among parents was that their family and friends do not understand the child's condition and in some cases cast judgment, disappointment, or disbelief toward it. Parents generally felt, however, that the program reduced their anxiety about their child's condition and that the interaction with other parents of children with ASD was beneficial. Based on my research results, I developed seven recommendations for ASWB to improve its support resources for individuals with ASD and their families.

Community Engaged Research, 12:30-1:30

Maia Hutt

Gubarev's The Kingdom of Crooked Mirrors as a Reflection of Soviet Society: Shifts in Nationalist Rhetoric and Perception of Gender Roles 1951-1956

Research Advisor: Carol Apollonio
Slavic and Eurasian Studies

Soviet cultural institutions used children's literature as a tool to convey societal expectations to younger generations. This function of children's literature was particularly important during the 1950s as the USSR recovered from WWII and experimented with cultural liberalism. This paper examines the depiction of gender roles in Vitaly Gubarev's popular children's story, The Kingdom of Crooked Mirrors. I conclude that despite the widespread notion that feminism faltered during the post-war years, children's literature of the day still promoted non-traditional and flexible gender roles through depictions of strong female characters and female to male cross-dressing.

Humanities, 12:30-1:30

Zenzi Huysmans
The Breast Biopsy Experience: Relationship between Anxiety, Anticipatory Pain and Psychological Variables
Research Advisor: Rebecca Shelby
Psychology and Neuroscience

Imaging guided breast biopsies are an important diagnostic tool in the early detection of breast cancer. Breast biopsies are an uncomfortable and distressing experience for many women and as such have been linked to high levels of anxiety and pain. The primary aim of the study was to examine the contribution of self-compassion and emotion regulation (cognitive reappraisal and expressive suppression) to anticipatory pain and anxiety among women undergoing imaging-guided breast biopsy. The secondary aim was to explore whether the effect of self-compassion on anticipatory pain and state anxiety was mediated by emotion regulation. The sample included 125 women who presented for breast biopsies at a university medical center breast imaging clinic. The average patient age was 53.04 (SD=12.07) years. Approximately 67% (n=84) of the participants were white, 21.6% (n=27) were African American and 2.4% (n=3) were Asian. Participants completed self-report measures assessing self-compassion, emotion regulation, anxiety, and anticipatory pain in the biopsy clinic immediately prior to their procedure. Women also completed a demographic questionnaire. Correlational analyses showed that lower STAI anxiety was associated with greater self-compassion ($r=-0.34$, $p<0.01$) and higher cognitive re-appraisal scores ($r=-0.22$, $p<0.05$). STAI anxiety was not related to expressive suppression. Anticipatory pain and biopsy-related anxiety showed no associations with either self-compassion, cognitive re-appraisal or expressive suppression. Higher levels of self-compassion were strongly associated with higher levels of cognitive re-appraisal ($r=0.52$, $p<0.01$) and lower levels of expressive suppression ($r=-0.30$, $p<0.01$). Results from linear path modeling indicated that higher self-compassion was significantly associated with lower STAI anxiety ($\beta=-0.30$, $p=0.005$). After accounting for the relationship between self-compassion and STAI anxiety, neither cognitive re-appraisal ($\beta=-0.04$, $p=0.72$) nor expressive suppression ($\beta=-0.06$, $p=0.44$) were associated with STAI anxiety. Results therefore suggest that that people who engage in self-compassion strategies to reduce anxiety do not use cognitive re-appraisal as the mechanism through which to reduce anxiety.

Psychology Graduation with Distinction, 12:00-1:00

Virginia Isava
Petrographic analysis of outcrops in the northern region of Great Smoky Mountains National Park, Tennessee
Research Advisor: Alan Boudreau
Earth and Ocean Sciences

Great Smoky Mountains National Park is located in the southern region of the Appalachian mountain chain. The rocks that form the region today range from 1000 to 541 million years in age and are metasedimentary, at various stages of deformation. This study examines rock samples collected from the park in order to associate their petrography with the area's greater geologic history. Upon analysis, the appearance of garnet but not orthopyroxene in slate samples indicated greenschist or amphibolite facies were the likely metamorphic conditions during the rock's alteration from shale. The study is ongoing, and in the future will involve chemical analysis of samples that are too fine-grained to be studied under petrographic microscope, as well as microprobe analysis of porphyritic garnets to form pressure-temperature-time sequences that map the change in the samples' environment.

Physical Sciences, 11:30-12:30

Akshita Iyer, Anita Restrepo, Ege Yalcinbas
Spoken and Sung Phoneme Perception & Associated Brain Regions
Research Advisor: Edna Andrews
Slavic and Eurasian Studies

This research project examined whether the perception of phonemes changes when the presentation of phonemes changes. This was accomplished by analyzing differences in spoken and sung phoneme production and perception of an unknown language, Russian. The results revealed that errors are made not just in the identification of sung phonemes, but in the identification of spoken phonemes as well. fMRI data was analyzed from a longitudinal fMRI study on 2nd language acquisition during which subjects' listened to an unknown language (Russian) in the form of spoken verses. Analysis revealed that during the Russian-rest condition, there was significant activation in the STG in both left and right hemispheres. There was little to no activation across subjects bilaterally in the middle occipital gyrus. These findings further support the middle occipital gyrus as a region not associated with listening perception, and the superior temporal gyrus as a region important to listening perception and comprehension.

Bass Connections, 11:30-12:30

Rachel James, Chenchen Feng, Christine Nunez
Environmental Effects on Cognitive Development
Research Advisor: Rochelle Schwartz-Bloom
Pharmacology & Cancer Biology

Tobacco smoke is well known for its detrimental health effects, especially in pregnant women. Effects of exposure to first- or second-hand tobacco smoke during pregnancy to a woman's unborn child includes low birth weight, lower IQ, and increased behavioral problems. Novel research into epigenetics (or simply, how gene function is altered) has provided a new perspective on the effects of environmental tobacco smoke (ETS). Specifically, ETS can cause chemical changes on the genes of a fetus that can persist throughout life. Importantly, such chemical changes can also be found on the DNA of the fetus' sex cells, meaning that future generations may also be affected. There is increasing evidence that ETS-induced changes increase a child's chances of developing ADHD, whether exposure occurs in utero or postnatally. Approximately 14% of pregnant women smoke throughout pregnancy, and an even greater percentage will be exposed to some form of ETS. We are approaching this issue from a new perspective to inform pregnant women about the effects ETS may have on their children as well as their future grandchildren. While the exact epigenetic mechanism is not yet fully understood, it is crucial to address this issue now because people with ADHD are more inclined to smoke, thus perpetuating the cycle. We want to stop the cycle now. To address this issue, we have developed an informative and engaging infographic to distribute to health clinics around the community. The information is presented visually and at a basic reading level to make it inviting to mother with varying levels of education. We hope that this information will make a difference in women's decisions during pregnancy.

Bass Connections, 11:30-12:30

Michelle Jeon
Providing Mental Health Treatment Through Arts Education: Literacy Through Photography at Child Welfare Centers
Research Advisor: Katie Hyde
Documentary Studies

This research is on the plausibility of implementing arts education, specifically "Literacy Through Photography (LTP)" methods, as a means to increase self-esteem, enhance self-expression, and foster creativity as means to enhance children's mental health and stability in local children's centers. The research was conducted over 2 months of teaching children photography through the LTP method, and analyzing their mental stability change through a pre session and post session survey as well as analysis of their photographs, especially photographs serving as self-portraits. Overall, the research showed increase in confidence and mental stability as children formed a strong identity as a photographer, a result found through the surveys as well as the photographs. While further research on a long-term basis must be conducted to further solidify and support this result, arts education undeniably has a connection to building a child's identity as an artist, which fosters their ability to communicate their true emotions. / This research will consist of 6 sections: the first section will consist of a brief introduction to the Korean education system, the role of children's centers, and the motivation behind this research; the second section will provide a brief guide to the theory of LTP; the third section will analyze the group of children who participated in the study and their general characteristics; the fourth section will analyze the various photograph projects done by the children; the fifth section will analyze the general changes, then the children's specific changes; the sixth will provide basic guidelines to implementing successful photography education programs in children's centers, schools, and other facilities that hope to utilize this research and use LTP as a means to help children increase their self-esteem, self-expression, and creativity.

Community Engaged Research, 12:30-1:30

Devin Jones
Examining Paralimbic Connectivity and Psychopathic Traits
Research Advisor: Ahmad Hariri
Psychology and Neuroscience

Psychopathy is a complex, neurodevelopmental personality disorder which affects only 1% of the general population. However, psychopaths make up a quarter of the prison population and commit a disproportionate amount of violent crimes in our society. Prior research has found that psychopathy is best conceptualized as a constellation of personality and behavioral traits including shallow affect and lack of empathy, guilt, and remorse, in addition to risky sexual and criminal behavior. These traits are believed to exist on a continuum not only in incarcerated populations, but the general population as well. Understanding the extent to which psychopathic traits and the associated biological abnormalities exist in the general population can teach us more about the etiology of the disorder, and inform efforts to improve rehabilitation, reduce recidivism, and even prevent criminal behaviors. This study aimed to determine whether connectivity between the amygdala and "paralimbic" brain regions (i.e. orbitofrontal cortex, anterior and posterior cingulate, and angular gyrus, among others) are associated with psychopathic traits. To test this association, a large sample of young adults was used to measure the relationship between continuously measured psychopathic traits and three measures of structural and functional connectivity – resting state functional magnetic resonance imaging (rs-fcMRI), diffusion tensor imaging (DTI), and psychophysiological interaction (PPI) – in a dimensional, rather than categorical, context. While self-reported psychopathy scores did not predict structural connectivity between the amygdala and orbitofrontal cortex, psychopathy scores were found to predict functional connectivity between the amygdala and a number of paralimbic brain regions.

Psychology Graduation with Distinction, 12:00-1:00

Leah Kaiser
The evolution of transitive inference: Chimpanzees' performance with social and nonsocial stimuli
Research Advisor: Brian Hare
Evolutionary Anthropology

A number of theories posit various social and nonsocial factors as the central drivers of the evolution of intelligence. Cognitive skills, such as transitive interference, that have important implications in both the social and nonsocial domains can help identify drivers of cognitive evolution. Transitive inference is an inferential reasoning skill, which allows individuals to deduce unknown relationships from known ones. Due to its importance in both social and nonsocial contexts it can provide a powerful test of the driving forces behind primate cognitive evolution. We compared chimpanzees' (Pan troglodytes) performance on social and nonsocial versions of a transitive inference task in order to assess whether they are better adapted to apply transitive reasoning to social or nonsocial stimuli. Our preliminary findings provide partial support for the hypotheses that chimpanzees are better adapted to use transitive inference in the social and nonsocial domains. However, our statistical abilities are limited by a small sample size and several confounding factors regarding the age and sex of our subjects, which limit firm conclusions. Further research (outlined in our methods) will allow us to more accurately asses the factors associated with the evolution of transitive inference skills in chimpanzees.

Behavioral Sciences, 12:30-1:30

Manoj Kanagaraj
Genetic mechanisms underlying Common Variable Immune Deficiency and its association with lymphoma
Research Advisor: Sandeep Dave
IGSP

Problem: Common Variable Immune Deficiency (CVID) is characterized by poor antibody function and frequently results in predisposition to severe infections. The genetic causes of CVID are largely unknown. A major complication of CVID is the 10-100 fold higher risk of lymphoma. The reasons for this higher risk are poorly understood. Methods: We performed whole exome sequencing on DNA obtained from 213 patients with CVID and 229 patients with lymphoma. Target genes were identified based on statistical enrichment of mutation in CVID or lymphoma compared to nearly 10,000 controls without disease. Results: By examining genes that arose in both diseases, we identified NOTCH1 as a candidate that increases risk of lymphoma in CVID patients. Of the 11 patients with rare, nonsynonymous NOTCH1 mutations, 5 developed cancer ($P < 0.05$). Our data and analysis provide a rich starting point for understanding the role of genetic alterations in CVID and their contribution to risk of developing lymphoma.

Biological Sciences, 11:30-12:30

Lillian Kang
Anti-atherogenic Mechanisms of Kalirin in Endothelial Cells
Research Advisor: Neil Freedman
Cell Biology

The primary cause of myocardial infarction and stroke, atherosclerosis is characterized by the chronic buildup of cholesterol-rich, inflammatory plaques along the inner walls of arteries. The goal of this study is to determine whether the dual RhoGEF Kalirin protects against atherosclerosis through its activity in endothelial cells [ECs], by potentiating the activity of endothelial nitric oxide synthase [eNOS]. In order to determine the role of Kalirin in eNOS activation in ECs, we used two Kalirin loss-of-function tactics: Kalirin RNAi and ITX3 inhibition of Kalirin's RhoGEF1 domain. All ECs were stimulated with VEGF-A165 to mimic the effects of sheer stress on VEGFR2 activation. We hypothesized that due to Kalirin's Rac1-specific RhoGEF1 domain, Kalirin activates eNOS using a Rac1/PAK1 cascade. We found that Kalirin loss of function techniques did reduce the amount of eNOS phosphorylation at residue Ser635, the amount of PAK1 autophosphorylation at residue Thr423, and the production of nitric oxide. We conclude that EC Kalirin acts as a RhoGEF to activate Rac1 and subsequently PAK1, which by phosphorylating eNOS on Ser635 augments eNOS driven NO production, giving Kalirin an anti-atherogenic role.

Biological Sciences, 12:30-1:30

Min Su Kang
Acquisition and Extinction of Pathological Fear Learning in Anorexia Nervosa
Research Advisor: Nancy Zucker
Psychology and Neuroscience

A core diagnostic feature of anorexia nervosa (AN) is an intense, disabling fear of gaining weight. Theoretical models of AN propose that aberrations in fear learning, specifically, rapid fear acquisition and heightened resistance to extinction, are key mechanisms of symptom expression and maintenance. Fear conditioning in AN has never been formally tested. This is the first study to empirically test the acquisition and extinction of fear in individuals with current diagnosis of anorexia in relation to healthy control and those with a history of AN. METHODS: Participants completed 32 conditioning trials. Of two rejecting social images, one was paired 62.5% of the time with "annoying" electrical stimulation. Learning trials were followed by 32 extinction trials, in which no electrical stimulation occurred. Galvanic skin response was measured throughout both trials, state measures of affect were administered pre- and post-conditioning, and self-reported trait measures were administered following the trial (e.g. Sensory Profile, Difficulties in Emotion Regulation, Brief Symptom Inventory, Acceptance and Action Questionnaire). RESULTS: This study is ongoing so no results are available. We have currently collected data from patients with current AN as well as those with a history of AN. DISCUSSION: Findings from the current study will aid in understanding the pathophysiology of AN and help in the development of novel intervention strategies. Addressing this gap in knowledge is essential as there are currently no empirically supported treatments for adults with AN.

Behavioral Sciences, 12:00-1:00

Francesca Kassing
Predicting Violence: Mental Health as a Moderator between Child Maltreatment and Violent Behavior
Research Advisor: Terrie Moffitt
Psychology and Neuroscience

In recent years, many studies have been conducted on the effects of child abuse on development and later outcomes. Some of these studies have explored the transmission of abuse to the next generation, known as the cycle of violence. However, while the concept of the 'cycle of violence' is generally supported, there is little research on what factors separate those who perpetuate this cycle from those who do not. This study's purpose is to address this gap and discover what relationship, if any, mental illnesses have with the continuation of the cycle of violence. Data from the Dunedin Longitudinal Study (a 40-year study of a birth cohort of 1037 New Zealanders) was separated by gender, method of maltreatment measurement, type of mental disorder, and number of violent convictions in order to analyze differences across these divisions. For males, prospective methods supported the cycle of violence; however, retrospective methods did not. Instead, retrospective methods revealed that males were more likely to be violent if they were not maltreated. Prospective data showed that individuals with externalizing disorders were more likely to be violent regardless of maltreatment history, while individuals with internalizing disorders were only more likely to be violent if they also experienced childhood maltreatment. For retrospectively measured maltreatment, individuals with externalizing and internalizing disorders were more likely to be violent if they experienced childhood maltreatment. Overall this study helps paint a better picture of the role that mental disorders play in the cycle of violence and we may use this information in the prevention and treatment of violent behavior.

Psychology Graduation with Distinction, 12:00-1:00

Garrett Kelly
Directed Evolution of Triacetic Acid Lactone
Research Advisor: Michael Lynch
Biomedical Engineering

One of the major endeavors in the field of metabolic engineering has been to create new environmentally sustainable resources to replace non-renewable resources, such as petroleum. With the use of genetic modification tools, new pathways can be created to produce renewable chemicals with the process of fermentation in bacteria. One such renewable chemical, triacetic acid lactone (TAL), is an important precursor in the production of pharmaceuticals and phloroglucinol, which can be used in the production of resins. As previously demonstrated TAL can be produced in fermentation pathways by the Triacetic Acid Lactone Synthase (TALS) enzyme, but at a low level of efficiency. An approach based on directed evolution and a screen of TAL production would increase TALS efficiency in E. coli strains. Efficient TALS mutants would allow for high production of the intermediate metabolite TAL under the control of genetic switches. A method has been developed in which a mutant library of TALS genes was generated and transformed into an E. Coli strain containing apldf and a temperature sensitive fabI gene. Individual mutants were grown in 96-well plates and TAL production was triggered with phosphate depletion and a temperature shift. The plates were screened for TAL concentration by reading the absorbances from a ferric chloride test in a high throughput assay. The development of this approach for the improvement of TALS genes will further promote the viability of this pathway in the production of TALS as an industrial chemical.

Biological Sciences, 11:30-12:30

Lauren Kelly Steven Blaser
North Carolina Common Sense
Research Advisor: Ken Rogerson
Public Policy

North Carolina Common Sense is dedicated to making government finances accessible to the public for review, engaging citizens in data-driven discourse and catalyzing a grassroots movement for less wasteful governance. Our goal is to improve the public's access to and understanding of government spending in North Carolina. The government is charged with spending the money of its citizens, and it should be simple for the latter to understand how their money is being spent. Unfortunately, in / North Carolina, it is not. According to the Center for Public Integrity, our state earned a failing grade for its "State Budgetary Processes," a category that includes how well citizens can access the budgetary process. At the moment, it is exceptionally difficult for the average North / Carolinian to comprehend the budgetary decisions of his or her government. Such a disconnect leads to the perpetuation of inefficiencies, and results in a frustrated and ill-informed populace. The main product of NCCS is its visualizations—they are what set us apart and offer the most value to our users. Our visualizations are produced by our team of analysts using Tableau Software, and are designed to take raw budgetary data and turn it into interactive and visually appealing graphics. The visualizations are designed to expose the ideas and trends that are hidden within the data in a straightforward and logical manner. Accompanying our visualizations are analyses, which are intended to give the visualizations context with unbiased and nonpartisan explanations.

Bass Connections, 11:30-12:30

Hyun Soo Kim
Citrate Synthase Metabolic Switch
Research Advisor: Michael Lynch
African and African American Studies

The effectiveness of CRISPR-Cas system as a metabolic switch for TCA flux control in E.coli was studied for the goal of increasing the yield of oxidized malonyl-CoA derivative products. Preliminary study showed low yield of oxidized malonyl-derivative products including malonate. One proposed method of increasing this yield was reducing the flux of acetyl-CoA—a precursor to malonyl-CoA—to the tricarboxyl acid cycle (TCA). The key enzyme involved in this process is citrate synthase, which catalyzes the conversion of acetyl-CoA into citrate—the starting molecule in the TCA cycle. CRISPR-Cas system and inducible promoters were used to achieve a controllable repression of gltA gene that codes for citrate synthase. Sequencing results for the plasmid insert showed three point mutations; however, these mutations occurred at non-essential portions of the gene and the sequence was concluded to contain all desired sequences in the essential regions. Growth analysis from shake flask experiment showed that strains containing dCas9 gene or both dCas9 and sgRNA genes had significant growth defect when dCas9 was induced at inoculation (t=0). Also, the strain containing both dCas9 and sgRNA genes showed significant growth defect even when induced three hours post inoculation (t=3HR). Further study is required to determine whether dCas9 alone causes growth defect when induced three hours post inoculation. The citrate synthase levels of strains in different genetic and induction conditions were measured using a commercially available citrate synthase enzyme assay kit. Enzyme assay protocol was optimized using several combinations of serial dilutions of cell lysate, substrates and buffer. Enzyme assay results showed that apldf and sgRNA strains had relatively high level of citrate synthase activity while AB1623 (gltA mutant) and negative control (no lysate added) showed close to zero enzyme activity as expected. However, high activity in sgRNA+dCas9 strain and reduced activity in dCas9 strain was unexpected and further analysis on the enzyme assay procedure is in progress to check the validity of this data.

Biological Sciences, 12:30-1:30

Linda Kim
Understanding the role of BMP signaling in pak-3 mediated suppression of synaptic button defects in spastin null Drosophila
Research Advisor: Nina Sherwood
Biology

In Drosophila melanogaster, the larval neuromuscular junction (NMJ) is where neurons synapse onto the muscle fiber, and studying this area elucidates how synapses develop and function. Spastin normally forms a hexamer to sever microtubules, which are critical for proper bouton morphology. Consequently, in spastin mutants, there are extra boutons, which appear smaller and clustered on the distal tips of the axons. In addition, glia are closely associated with the NMJ and in cooperation with muscle cells, engulf presynaptic material. It is known that the loss of pak3 suppresses the spastin mutant phenotype both morphologically and functionally at the NMJ; however, the molecular process is unknown. Bouton growth is regulated by signaling via secreted BMP (Bone Morphogenetic Protein) from both glia and muscle. Since pak3 is highly expressed in glia, one hypothesis is that pak3 mutations affect the BMP signaling pathway. Hence, this experiment tested BMP pathway components, such as trio, thickveins, and wishful thinking for an interaction with spastin in bouton formation. Genetic interaction tests for suppression or enhancement of spastin heterozygote defects include genetic crosses, larval filleting, and immunostaining to label neurons. Through these methods, the NMJ morphology was visualized and quantified for its overall size (total synaptic bouton number) and branching (terminal bouton number). Lastly, a student's T-test was used to determine statistical significance relative to the spastin heterozygous and wild-type controls. The experiment showed that some components of the BMP pathway modified the spastin bouton phenotype. Further testing of these alleles with spastin homozygotes will reinforce results.

Biological Sciences, 12:00-1:00

Stephen Kirchner
Alchemy and the Scientific Revolution in England, between John Dee and Isaac Newton
Research Advisor: Thomas Robisheaux
History

I engaged in preliminary research into the relationship between alchemy and the Scientific Revolution in England. Many of the key players in the Revolution, including renowned scientists such as Robert Boyle and Isaac Newton, were in fact involved in Alchemy at multiple stages in their careers. While both were empirical scientists, to some degree they and others found alchemy a worthwhile pursuit in both scientific and religious realms. I had intended on working from John Dee to Isaac Newton, with the intent of charting the progression of English science from the occult work of Dee to the empiricism of Newton. While this progression does exist, I also found myself examining the different views of alchemy over time. Namely, the progression of alchemy from a religious and mystical pursuit to one of real world chemical implications was fascinating. I then spent my time charting alchemy's rise as an art form and political tool through to its downfall. This progression, when looked at alongside the development of science, and indeed, the progression of British history as a whole, showed alchemy to have a unique place as both art, science, and political tool, all over the short period of 200 years.

Humanities, 12:30-1:30

Daniel Kort
Discrimination Experience as a Psychosocial Cause of Health Disparities
Research Advisor: Laura Richman
Psychology and Neuroscience

Drastic health disparities differentiate White and Black Americans. These disparities exist even when controlling for economic and geographical factors. Oyserman et al. (2007) indicate that health behaviors are closely tied to racial/ethnic identity. African-American participants were either primed with race or not. In our study, participants were randomly assigned to respond to a racism scenario in the workplace or a non-race relevant workplace stressor (control). Then, participants completed a Me/Not Me task in which they classified 26 stereotypically "Black" or "White" health behaviors as personally descriptive or not. We hypothesized that the race-relevant prime would increase participants' racial identity salience, in turn causing them to choose more unhealthy and stereotypical health behaviors. The results suggest that discrimination experiences cause people with stigmatized identities to classify their health as consistent with their groups, expanding on the social and behavioral bases of health disparities.

Behavioral Sciences, 11:30-12:30

Suyash Kumar
Engineering Cas9 for targeted Epigenetic Modification
Research Advisor: Charles Gersbach
Biomedical Engineering

Epigenetic modifications of the genome have been shown to play increasingly important roles in various biological phenomena from early embryonic development to the progression of human disease. However, the ability to experimentally probe (and understand) epigenetic signals has been limited by the lack of tools to modify them at particular genomic loci. The recent development and growth of programmable DNA-binding effectors (e.g. Zinc-Finger Nucleases (ZFNs), TAL effectors (TALEs), and CRISPR/Cas systems) presents new opportunities to engineer novel sequence-specific enzymes for targeted experimentation. By fusing these programmable genome-engineering tools to various epigenetic effectors, we create a toolset of targeted epigenetic modifiers. Specifically, we engineer TAL and Cas9 fusions of a DNA methylase and demethylase, and an H3K9 histone methylase and demethylase. These domains have been cloned from cDNA for construction of the fusion proteins. Initial activity is first assayed using qPCR for various targets, to be followed by bisulfite sequencing and ChIP-seq as appropriate. The DNA methylases have shown modest catalytic activity and transcriptional repression, but further experimentation is needed to verify robust function. Development of robust, targeted epigenetic tools will enable new experimental approaches to both understand and probe the epigenetic modifications that cover our genome.

Biological Sciences, 11:30-12:30

Vandana Kumar
Knowledge of Autism and Family Support among Parents of Children with Autism at a Training Center in Kolkata, India
Research Advisor: David Boyd
Global Health

Autism, like many mental disorders, carries with it a stigma across cultures and generations. In India, the stigma associated with autism can be particularly heavy because the individual with the disorder is not the only one who carries the burden of the diagnosis – the family does, too. While the immediate family is most heavily impacted, close relatives such as the child's grandparents, aunts, and uncles may also become distressed, as they too are often deeply involved in the child's care. Our community partner, Autism Society West Bengal (ASWB), expressed interest in better understanding the attitudes towards autism and the level of support for children with the condition across both the immediate and extended families of these children. Based on these interests, we evaluated the impact of ASWB's three-month parent training program on its participants' understanding of autism and preferred methods of behavior management. We also assessed the knowledge and management behaviors regarding autism among 12 parents and eight grandparents of children served by ASWB and their conceptions of family support. To address these research goals, we conducted qualitative, in-person interviews. Based on our findings, we developed seven recommendations to help ASWB further improve its high-quality resources for individuals with autism and their families.

Community Engaged Research, 12:30-1:30

Eric Lakey
Targeting Chorismate Synthase to Treat Malaria
Research Advisor: Emily Derbyshire
Chemistry

Malaria is a deadly disease caused by unicellular parasites that are spread to humans by infected mosquitos. Over half of the world's population is currently exposed to malaria and it is one of the largest vector-borne causes of morbidity and mortality in the world. To decrease this burden, a biological pathway that is key to parasite survival must be identified and subsequently inhibited with small, bioactive molecules. Specifically, I intend to work on targeting the chorismate pathway in malaria parasites. I propose to I) biochemically characterize a key enzyme in the chorismate pathway: chorismate synthase, II) optimize a high-throughput screen to identify inhibitors of chorismate synthase, and III) test chorismate synthase inhibitors for activity against the parasites. The ultimate goal of this work is to identify parasite chorismate synthase inhibitors to aid in the eradication of malaria.

Biological Sciences, 12:00-1:00

Richa Lavingia
Use of Virtual Endocasts to Reconstruct Primate Brain Proportions
Research Advisor: Blythe Williams
Evolutionary Anthropology

Strepsirrhine and haplorrhine primates exhibit quantifiable differences in frontal lobe, cerebellum, cerebrum, and olfactory bulb volumes relative to total brain volume. However, these differences are difficult to assess in fossil crania due to the loss of soft tissue and scarcity of brain lobe boundaries on the endocranium. In this study, we created and dissected virtual endocasts and measured the volumes of the posterior cranial fossa (PCF), the site of the cerebellum, medulla, and pons; the anterior cranial fossa (ACF), the site of the frontal lobes; and the olfactory fossa (OF), the site of the olfactory bulb. Strepsirrhines had significantly higher mean residuals in regressions of log-transformed PCF and OF volumes against log-transformed endocranial volume, and significantly lower mean residuals in a regression of log-transformed rest of endocast volume (a proxy for cerebrum volume) against log-transformed endocranial volume. Strepsirrhines and haplorrhines did not have significantly different mean residuals in a regression of log-transformed ACF volume against log-transformed endocranial volume, possibly due to the landmarks used to define the ACF. A discriminant function analysis performed using PCF, OF, and rest of endocast residuals correctly classified each species as either a haplorrhine or a strepsirrhine. To assess the validity of this method in reconstructing primate brain proportions, we performed linear regressions using data on brain lobe volumes. We observed similar differences in residuals between strepsirrhines and haplorrhines. These results demonstrate the potential use of endocast dissections in reconstructing the relative proportions of particular brain lobes and in timing changes in brain proportions in anthropoid evolution.

Biological Sciences, 11:30-12:30

Kevin Le
Chitinase Isolation for In Vivo Fungal Labeling
Research Advisor: Chantal Reid
Biology

Practical methods of nondestructively observing fungal/plant interactions in vivo do not currently exist. Nondestructive examining of fungal/plant systems allows for more accurate observations and may elucidate aspects of the relationship that were previously unknown or poorly understood. In this study, we posit that chitinase can be used as an efficient fungal-labeling agent due to chitin's presence in fungi and absence in animal tissue. Fungal chitinase production was tested by treating a colloidal chitin-prepared Petri plate with five treatments: Mortierella, Atractiella, Trichoderma, commercial chitinase and double distilled water. This set up was repeated three times for a total of four plates, each with the five treatments. Two days after application of the treatments, a "zone of clearing" with a 1cm diameter appeared around Mortierella in each plate. Seven days after application, Mortierella had a zone of clearing with a diameter of 3.5cm, while Trichoderma had a 2.5cm diameter. A second experiment was conducted in order to determine if chitinase production was constitutive or induced (i.e. if chitinase was produced as a result of the chitin or not). Culture filtrate from Mortierella was obtained and used to inoculate three colloidal chitin-prepared plates. After three days, no chitinase activity was detected, implying induced chitinase production in Mortierella. From these results, it would appear that Mortierella and Trichoderma are prime candidates for chitinase isolation. Isolated chitinase could then be labeled and introduced into natural systems, where fungus/plant interactions can be observed.

Biological Sciences, 11:30-12:30

Nicole Lee
Redefining High Trait Self-Control: An Ability to Self-Regulate or a Capacity to Strategically Avoid?
Research Advisor: Rick Hoyle
Psychology and Neuroscience

Trait self-control is the capacity an individual has in attaining deliberative control over impulses in various self-control situations, with some individuals displaying greater capacities than others. Imhoff and colleagues (2013) found that ironically, individuals with high levels of trait self-control were much less effective in exerting self-control on a subsequent task after their self-control resources had been previously depleted. Our current research aims to address whether this ironic effect of trait self-control on ego depletion can be replicated and furthermore attempts to propose a mechanism for why this ironic effect occurs. In our first experiment, we attempted to find evidence that supports that high trait self-control individuals actually perform worse on self-control tasks than individuals low in trait self-control. Results from the first experiment demonstrated that high trait self-control participants ate more candy following an ego depletion task. In our second experiment, we attempted to provide supporting evidence for a mechanism of why this ironic effect occurs. One plausible hypothesis is that individuals high in trait self-control may strategically avoid temptations, and thus have fewer experiences in self-control conflict situations, making them more vulnerable to situation-specific self-control failures. No significant results were obtained for the avoidance hypothesis in the second experiment, but methodological limitations are considered. Several explanations for these results are discussed, as are implications for future research.

Psychology Graduation with Distinction, 11:30-12:30

Grady Lenkin
Addressing the Prevalence of Urban Poverty and Immobility in Bangalore, India
Research Advisor: Alma Blount
Public Policy

The city of Bangalore has grown by over three million people in the last 15 years. Much of this growth comes from rural migrants who move to the city in search of a better life. Oftentimes, people will move to the city and into slum conditions of abject poverty. However, over time they will escape poverty and make a better life for themselves. The problem this investigation addresses is what happens when those living in poverty are unable to escape it. Using a lens of development economics and historical context, it becomes evident that the problems of poverty and immobility in Bangalore are a direct result of bad governance on local, national, international levels. An area escapes poverty only when it receives recognition from local policymakers and can receive much needed public aid. The process of gaining political recognition naturally occurs in only a few slums that have a unique demographic and economic makeup. When slum dwellers are all from the same region or all work in the same industry, they are able to politically organize and appeal to politicians by leveraging votes for infrastructure development. However, many areas are unable to accomplish this feat and become stuck in poverty. Ultimately, the most viable solutions for addressing immobility is to create policies that allow Bangalore's government to officially recognize the existence of slum areas.

Social Sciences, 11:30-12:30

Alexandra Lewis
Examining the Influence of Friends on Latino and Non-Latino Students' Academic Outcomes
Research Advisor: Stephanie Wormington
Psychology and Neuroscience

The current study examined how friends' performance and peer group racial composition related to Latino and non-Latino adolescents' academic performance. Sixth, seventh, and eighth-grade students (N = 359) completed questionnaire measures of their friendships, as well as their task value and classroom engagement during the fall and spring semesters of a single school year; grades were collected from school records for each student. Results suggest that whether or not a student was Latino did not impact their spring performance. Students' fall performance, friends' performance, and percentage of peer group that was Latino did predict grades in the spring, however. Moreover, the influence of non-Latino students' friends was stronger than the influence of friends on Latino students' outcomes. Friends' task value and classroom engagement also predicted students' performance, a relation that was mediated by friends' performance.

Psychology Graduation with Distinction, 12:00-1:00

Rebecca Leylek
Ndel1 Function in Epithelia
Research Advisor: Terry Lechler
Cell Biology

A cell's cytoskeleton gives it a characteristic shape and drives cell migration. The cytoskeleton consists of microtubules, actin filaments, and intermediate filaments like keratin. Previous work from our lab suggests that Ndel1 promotes local keratin assembly and organization at the desmosome, the prominent cell-cell adhesion structure between keratinocytes. Epidermis-specific Ndel1 conditional knockout (cKO) mice demonstrate desmosome instability and keratin abnormalities, but survive to adulthood with no gross phenotype. However, keratin and desmosome defects weaken the tissue integrity of the epidermis and are associated with a number of inherited blistering diseases in humans. To further characterize the Ndel1 cKO, I designed experiments to assess the healing ability of the knockout epidermis. An in vitro scratch assay was performed on knockout and wild-type keratinocyte cell cultures to compare migration rates. This assay showed that the knockout cells were able to migrate more quickly, consistent with reports in the literature of faster migration with other disruptive keratin mutations. Additionally, a wound healing experiment was started on Ndel1 cKO and wild-type adult mice to assess cell migration in vivo. Punch biopsies were used to create four wounds on each mouse's back, and the wound closure was assessed at different time points. Preliminary data suggests that there is not a significant difference in wound healing between the wild-type and cKO mice. This observation could be attributed to the importance of steps in the healing process other than epithelial cell migration, such as wound contraction, which would not be affected by knocking out Ndel1. However, this experiment is ongoing and data from more time points is needed to make final conclusions.

Biological Sciences, 11:30-12:30

Daniel Li
Probability of Ovulation and Conception After One Random Act of Intercourse
Research Advisor: David Dunson
Statistical Science

Objectives: Previous estimates of the probability of conception assumed that intercourse and ovulation were independent. However, the frequency of intercourse has been observed to increase in the days leading up to ovulation. Taking this into consideration, we provide updated estimates of the probabilities of ovulation and conception after observing a random act of intercourse. Study Design: We looked at two prospective studies that collected daily urine samples and recorded daily intercourse behaviors from women for multiple menstrual cycles. One study included 68 sexually active women of reproductive age from North Carolina with either an intrauterine device or tubal ligation. A second study included 221 women from North Carolina who planned to become pregnant and discontinued any use of birth control. Subjects in both studies had no known fertility problems. Monte Carlo simulations and Bayesian methods were used in analyses. Results: Given a random act of unprotected intercourse, the probability of ovulation on the same day is 4.2%, and the probability of ovulation within 5 days is 24.7%. After observing an act of intercourse on day 13 of the menstrual cycle, the probability of conception peaks at 9.7%, a value higher than previous estimates. The updated probabilities of conception on days 1 through 28 were also found to be greater than previous estimates. Conclusions: The probability of ovulation increases after observing a single act of intercourse, and the probability of conception increases after accounting for an increase in the frequency of intercourse near ovulation. mplication Statement: Women engaging in unplanned and unprotected intercourse have a higher risk of ovulating and conceiving than previously thought, possibly impacting their decision to use post-coital contraception.

Biological Sciences, 11:30-12:30

Melody Lim
Observation of Shockwaves in a Suspension of Soft Particles
Research Advisor: Robert Behringer
Physics

Dense suspension of starch particles in fluids display significantly counter-intuitive behaviors. For instance, at high enough particle concentrations, the normal force generated by the suspension is sufficient to support the weight of a person. However, the mechanism underlying such behavior is still not well understood. One possibility is that there is some interaction between the starch particles and the interstitial fluid of the suspension. We perform experiments that show that starch particles soften in fluids. By recording impacts on quasi-2D suspensions of cornstarch in water with a high speed camera, and performing particle image velocimetry on tracer particles in the suspension, we show that the nonlinear force response of the suspension can be characterized elastically. We also observe shockwave fronts in the suspension, which appear qualitatively similar to shockwaves found in soft dry granular materials. A strong correlation is found between the dynamics of the intruder and the dynamics of the suspension.

Physical Sciences, 11:30-12:30

Eileen Lu, Kyle Rand, Homa Boms
Age Differences in Economic Decision Making
Research Advisor: Roberto Cabeza
Psychology and Neuroscience

Decision making is a complex cognitive process that relies on several, more basic domains of information processing. In particular, short-term memory is likely to play a significant role in everyday economic decisions as people often learn new information about competing products that they later retrieve during purchasing decisions. Aging is associated with changes in consumer decision making, and age differences in economic decision making may be partly explained by deficits in memory and learning from outcomes of recent choices. The current study sought to determine the neural correlates of a simple choice task in which value information for pairs of competing products were presented at different delays. The study examined age differences in this functional network during choice processing. Healthy younger and older adults completed the consumer choice task during functional MRI data collection. In both age groups, accurate choices were associated with recruitment of fronto-parietal networks, visual processing regions, and regions responding to the magnitude of product values (e.g., intraparietal sulcus). Across age groups, faster correct responses were associated with greater functional recruitment from bilateral hippocampus, amygdala and the ventromedial prefrontal cortex. However age differences were observed such that, at choice, older adults showed less activation in regions associated with product-value encoding, but greater activation in the medial prefrontal cortex at longer delays. These findings suggest a functional posterior-anterior shift in aging for choices involving retrieval of recently learned value information, particularly at longer delays.

Bass Connections, 11:30-12:30

Jacob Martin
Novel Enrichment Strategy for Methionine Containing Peptides
Research Advisor: Michael Fitzgerald
Chemistry

Described here is the development of a novel methionine enrichment protocol for mass spectrometry-based, shotgun proteomics analyses. This protocol employs a tag, modify, and release strategy that utilizes a reversible and selective alkylation of methionine residues in peptides and click chemistry to isolate methionine-containing peptides from complex peptide mixtures. The isolation of methionine-containing peptides is an especially important step in an energetics-based protein-ligand binding assay, Stability of Proteins from Rates of Oxidation (SPROX). SPROX probes the global stability of proteins to characterize the binding affinities of ligands to proteins. The described strategy involves alkylation of methionine residues with 4-bromomethyl-N-propargyl-phenylacetamide (BPPA), a chemoselective alkylating reagent. Once methionine-containing peptides are alkylated, BPPA's terminal alkyne group can participates in a stereospecific azide-alkyne cycloaddition reaction with an azide functional solid phase resin. The azide-alkyne cycloaddition reaction anchors methionine-containing peptides to an azide-agarose resin and peptides without methionine residues are washed away. The captured methionine-containing peptides are later released via a dealkylation reaction that releases the methionine-containing peptides in an unmodified form. We have completed tests to optimize conditions for the alkylation reaction, and work is in progress to optimize the cycloaddition and dealkylation reactions. The ultimate goal of this work is to compare the efficiency of this novel methionine pull-down strategy to that of a commercially available kit, whose cost currently limits its widespread application in the SPROX protocol. Once optimized, the described strategy has the potential to be both more efficient and cost-effective than the currently available commercial kit.

Physical Sciences, 12:00-1:00

Elizabeth McGlamry
Investigating Differences in Northerners' and Southerners' Memories of the US Civil War
Research Advisor: Elizabeth Marsh
Psychology and Neuroscience

Collective memories are memories that are held by members of a group and that are culturally significant to the identity of that group. The goal of this study was to investigate the collective memory for the U.S. Civil War in two groups: people who grew up in the North (Northerners) and people who grew up in the South (Southerners). We explored the similarities and differences in how these two groups remembered the U.S. Civil War and World War II (a comparison event for which we expected much fewer differences). In the study, Northerners and Southerners completed a series of three tasks. First, they listed the 10 most important events that occurred in each war. Second, they wrote a narrative about each war. Third, they rated the importance of 25 events from each war that were pre-selected based on previous research and historical importance. The data from these three tasks were analyzed to examine the similarities and differences in the content (i.e. what was remembered; e.g., specific events, themes, etc.) and subjective interpretation of the content (i.e. how it was remembered; e.g., language use, importance ratings, etc.) between the two groups. The results revealed a great degree of overlap in content between the collective memories of Northerners and Southerners; however, there were also some differences in content and subjective interpretation between the two groups.

Behavioral Sciences, 11:30-12:30

Madeline McKelway
Micro-Banking and Health: Evidence from Self-Help Group Involvement and Child Nutrition
Research Advisor: Erica Field
Economics

Low income is only one financial problem that poor families in developing countries face; impoverished households must also face saving and credit constraints. By giving poor households the ability to save and borrow money, self-help groups (SHGs) can soften financial hardship. In this study, I investigate the extent to which SHGs improve a particular dimension of household wellbeing: child nutrition. To do so, I analyze households affiliated with the SHGs started by the People's Education and Development Organization (P.E.D.O.) in rural Rajasthan, India. Children who had greater levels of exposure to household SHG membership at a young age have healthier anthropometric statuses than their siblings who had relatively less. This relationship does not appear to be driven by events coinciding with SHG involvement or by the tendency for certain children, who were also exposed to SHGs, to receive better nutrition than their siblings. These findings suggest that SHGs could improve child nutrition.

Social Sciences, 12:30-1:30

Josh McMenemy
Purification and Activity of Recombinant Cas9
Research Advisor: Charles Gersbach
Biomedical Engineering

Genome engineering – the ability to precisely alter DNA information in cells – is an emerging tool in gene therapy and genomic research. Genomic manipulations are carried out by targeted nucleases which can be designed to modify desired sequences with high specificity. Cas9 has a unique advantage among targeted nucleases because only a guide RNA (gRNA) complementary to the target sequence has to be synthesized. Other targeted nucleases require engineering new proteins to target specific DNA sequences, which is laborious and time intensive. A common limitation in the delivery of these nucleases is the use of plasmid, virus, or mRNA. Plasmids and viruses can insert themselves into the host genome, potentially causing mutagenesis or gene disruption. Therefore, direct delivery methods of the Cas9 protein would be advantageous. The cell penetrating peptide (CPP) from HIV's trans-activating transcriptional activator (Tat) has been used to deliver a variety of protein cargos with high efficiency. Our protein construct containing the Tat-CPP and His-tag on Cas9 was purified from E. coli expressive host using Nickel affinity chromatography. Nuclease activity of the purified Cas9-CPP was confirmed in vitro against PCR product containing a target sequence complimentary to the gRNA sequence. This technology holds promise as a direct delivery method of Cas9.

Biological Sciences, 12:00-1:00

Kurren Mehta
Regulation of NOS2 by B30.2/SPRY domain proteins
Research Advisor: Matthew Foster
Pulmonary, Allergy, and Critical Care Medicine

The NOS2 isoform of nitric oxide synthase is upregulated in lung inflammation. Previous research has shown that the B30.2/SPRY proteins FBXO45, SPSB1, and SPSB2, that recruit ubiquitin ligases to their targets, interact with the 23DINNN27 motif of NOS2. Mutation of N27 to alanine disrupts these interactions, but the functional relevance has not been shown in human cells. We hypothesized that mutation of N27 would decrease ubiquitination of NOS2, which would result in increased levels of NOS2 protein. To test this, wild type and N27A NOS2 were overexpressed in several human cell lines, including A549 airway epithelial cells. We found that there was no difference in gene expression levels of wild type and N27A NOS2. However, NOS2 protein levels and activity were higher in cells expressing N27A versus wild type. These data suggest that the B30.2/SPRY proteins play a role in post-transcriptional regulation of NOS2 in human airway epithelial cells.

Biological Sciences, 12:00-1:00

Audrey Melville
The Role of Anisotropy in Hopper Flows
Research Advisor: Robert Behringer
Physics

In this work, we examine granular flows in a quasi-two-dimensional hopper. We use two high-speed cameras to record granular flows composed of photoelastic disks. Our dual camera approach provides synchronized particle tracking data and the force response of each particle. The photoelastic measurements allow us to extract a measure for the local anisotropy of the stress field. Using this data, we probe the relationship between the local flow dynamics with local measurements of the stress anisotropy, particle density, and pressure in the system. Current work includes correlating these quantities in the context of a shear jamming picture.

Physical Sciences, 11:30-12:30

Anays Murillo
Increased Response to Corticosteroids in the Presence of Pioglitazone in Obese Asthmatic Subjects
Research Advisor: Monica Kraft
Medicine - Pulmonary

Asthma is characterized by airway inflammation, reversible airflow limitation, and airway hyperresponsiveness. In the obese, asthma leads to a more severe disease and decreased responsiveness to standard steroid therapy. Dexamethasone, a corticosteroid, can be used for asthma exacerbations. Overweight and obese asthmatics have reduced responsiveness to the anti-inflammatory effects of corticosteroids. Dexamethasone and other corticosteroids exhibit activity by binding to the glucocorticoid receptor (GR), increasing mitogen-activated protein kinase phosphatase 1 (MKP-1) expression, and decreasing downstream inflammatory cytokines by dephosphorylating mitogen-activated protein (MAP) kinases. Peripheral blood mononuclear cells (PBMCs) from steroid-resistant asthmatic patients show reduced responsiveness to dexamethasone. A novel approach to this problem is to reverse steroid resistance. Pioglitazone, a peroxisome proliferator-activated receptor gamma (PPARg) agonist, has been shown to be as effective as dexamethasone in reducing airway hyperresponsiveness in a murine model of asthma. Furthermore, pioglitazone is a partial agonist of the GR. Thus, we hypothesized that pioglitazone would increase glucocorticoid sensitivity in PBMCs obtained from overweight and obese subjects with asthma. PBMCs from 4 lean, 7 overweight and 16 obese asthmatic subjects were treated with pioglitazone (10 micromolar), dexamethasone (1 micromolar), and a combination of pioglitazone/dexamethasone for 4 hours. IL-5, GR and MKP-1 mRNA expression was determined by RT-PCR. Pioglitazone induces a statistically significant decrease in the inflammatory cytokine IL-5 when used in conjunction with dexamethasone. Overweight and obese subjects had significantly lower MKP-1 expression in response to dexamethasone. Pioglitazone restores glucocorticoid sensitivity in overweight and obese subjects as demonstrated by increased MKP-1 and GR expression in the presence of combined exposure to pioglitazone and dexamethasone. This novel finding identifies a potential use of pioglitazone and other thiazolidinediones as steroid sensitizing treatments in a subpopulation of asthmatic patients that does not respond to conventional asthma therapies.

Biological Sciences, 11:30-12:30

Rowan Murray
The Effects of Age on Behavioral Thermoregulation in Lemur catta and Propithecus coquereli
Research Advisor: Leslie Digby
Evolutionary Anthropology

Older mammals experience a decrease in physiological function that impairs their ability to internally regulate body temperature. Behavioral mechanisms can be used to alleviate thermal stress on the body, and thus could be an effective strategy for coping with such deficiencies that accompany the aging process. I studied geriatric and younger individuals of five semi-free ranging groups of Lemur catta and Propithecus coquereli to determine whether or not older lemurs were utilizing behavioral thermoregulation more often than younger lemurs across a range of temperatures. Using focal animal sampling, I examined activity level, the use of heat-retaining and heat-dissipating postures, and sun exposure preference. I found that older lemurs changed their own behavior more than younger individuals to utilize low-energy thermoregulatory behaviors, such as decreasing activity level as temperature increased, shifting to utilize heat-retaining postures in cooler temperatures, and shifting to utilize heat-dissipating postures in warmer temperatures. These patterns, however, were not statistically significant and therefore only suggestive of their function in varying ambient temperatures. Still, this information is useful preliminary data, and future study with more focal individuals over a wider range of temperatures may be able to highlight these subtle, but potentially meaningful differences between age classes. By examining the thermoregulatory potential of all members of lemur social groups we can make more informed conservation decisions for these species in changing climatic environments.

Biological Sciences, 11:30-12:30

Jasmine Nee
Stroma biology identifies heparins as differentiating agents in neuroblastoma
Research Advisor: Gerard Blobe
Pharmacology & Cancer Biology

The neuroblastoma tumor stroma is thought to suppress neuroblast growth via release of soluble differentiating factors. Here we identify these factors and design a novel therapy based on their mechanism of action. We show that expression of heparan-sulfate proteoglycan co-receptors (HSPGs), including TBRIII, GPC1, GPC3, SDC3, and SDC4, is decreased in neuroblasts, localized to the stroma and correlates with improved prognosis. Treatment with soluble HSPGs promoted neuroblast differentiation via FGFR1, Erk, and Id1. HSPGs also enhanced differentiation from FGF2 released by the stroma. The anticoagulant heparin had similar differentiating effects, leading to decreased neuroblast proliferation. Dissection of individual sulfation sites identified 2-O, 3-O-de-sulfated heparin (ODSH) as a differentiating agent that suppressed orthotopic xenograft growth while avoiding anticoagulation. These studies uncover the critical components of the differentiating stroma secretome in neuroblastoma and the central mechanism by which they act. We translate these biologic insights into novel prognostic and therapeutic biomarkers, as well as therapeutic differentiation strategies for clinical development. More generally, our work demonstrates that tumor stroma biology can inform design of targeted molecular therapeutics.

Biological Sciences, 12:30-1:30

Emily O'Loane
Healthy Lifestyles: Integrating the "Healthy Lifestyles" curriculum into the Children's Defense Fund's Freedom Schools program
Research Advisor: Jan Riggsbee
Education

The purpose of this research is to look at how a health and nutrition curriculum created by Duke students could change children's attitudes towards healthy living in Bennettsville, South Carolina. Also, this research project seeks to see whether this same curriculum will meet the standards set in the goals of the Freedom School program's fifth essential component of promoting nutrition and health in its scholars. Most of the research was based on how well the curriculum was integrated into the classroom. Student interviews and testimonies were utilized as well. Each student who was interviewed was given the curriculum over the course of the six week long program.

Social Sciences, 12:30-1:30

Margaret Oliver
How C.A.A.R.E Builds a Community in Durham
Research Advisor: Alma Blount
Public Policy

Healing with CAARE is a non-profit organization in Durham, NC that promotes a holistic, community approach to health. They provide a wide variety of services, from medical and dental clinics to exercise classes, substance abuse counseling, and job-readiness programs – all free of charge. When I began working with CAARE, the director (Dr. Sharon Elliott-Bynum) and I discussed some of the organization's wellness services, such as exercise classes and acupuncture. While they seemed to be generally well-liked, it was unclear what kind of impact they really had. Were people coming to these services consistently? Had they actually helped improve their health? Why did people come to CAARE instead of another community center? / After surveying a total of 68 people from 5 different exercise classes, we found that the organization has managed to foster a very tight-knit community with diverse backgrounds, united through common interests. What people love about this organization is not just that the classes are free, but that they offer health benefits, socialization, and an opportunity to meet new people. CAARE doesn't really "recruit" anyone; almost everyone hears about its programs through a friend, and then they start consistently going on their own. / This organization has not just created a model wellness program, where people can exercise and learn about balanced nutrition, work on their GED, and get job readiness training, but also a strong community built on friendship and trust. This helps with the success of the wellness program, I think, because the friendships and consistent weekly attendance lead to a level of accountability and motivation that other places (such as the average gym facility) may not be able to replicate.

Community Engaged Research, 12:00-1:00

Kirsten Osborne
Boys in Tutus, Girls in Bowties: Gender Representations in Picture Books
Research Advisor: David Malone
Education

Children actively construct ideas of gender from the books they read, and they can be positively or negatively affected by the messages they receive. Though gender representations in children's literature have become more equitable over time, picture books still favor males in number of pictured characters and characters who hold occupations. A sample of 38 picture books read by children in a local elementary school was compiled through teacher surveys and an interview with the librarian. The books were coded for gender of author and/or illustrator, gender of title character, gender of main character, number of male, female, and un-gendered characters, gender of occupation holders, and behaviors of the main character. Gender was determined using a combination of identifying language in the text and social norms of appearance. Males made up 44% of the pictured characters, while females were 27% and un-gendered characters were 29%, for a male to female ratio of 1.66:1. When considering just animal characters, the ratio was slightly more skewed, at 1.77 males for every female. Males held three times as many text-identified occupations than females. Main characters were a majority male (56%), while 38% were female. Further research is needed into how children interpret gender in picture books and the gender of children that are reading each series, author, and type of book.

Community Engaged Research, 11:30-12:30

Ajay Parikh
Health-Seeking Behaviors, Health Information, and Health Awareness in Bangalore City Slums
Research Advisor: Anirudh Krishna
Public Policy

The urban population in India is projected to exceed 550 million by the year 2030. As cities are becoming more concentrated, so are low-income slum settlements, areas typically inhabited by people of low socio-economic status with limited access to education and public health services. Studies have shown that people living in urban spaces generally make more income, and are also closer in proximity to health providers and resources. However, despite what seems to be an abundance of resources in cities, there are still major disparities in health indicators amongst individuals living in the same urban area. This study is focused on understanding how urban slum-dwellers negotiate the urban health system in its current state, and how health information flows across individuals of different settlements and socioeconomic backgrounds. The study intends to address two main research objectives/questions: 1) Understand the health-seeking behaviors of the urban poor, and how health-seeking behaviors differ across individuals and settlements. What are the main factors that affect health-seeking behaviors?, and 2) What are the main sources of health information for people living in urban slums, and how do these sources of information differ across individuals? Data on health-seeking behaviors, health information, and health awareness was collected by administering a detailed questionnaire to 95 individuals in 16 different slum settlements in Bangalore, India. The 16 slum settlements were identified and mapped by using GIS technology. Findings from this study exposed the differences in health-seeking behaviors and sources of health information between migrant slum-dwellers and native slum-dwellers.

Social Sciences, 12:00-1:00

Sagar Patel
Glia-Secreted Proteins Hevin and SPARC Control Synaptic Maturation in Mouse Visual Cortex
Research Advisor: Cagla Eroglu
Cell Biology

During early brain development, there is a critical period during which strong synapses are strengthened and weak synapses are eliminated. This process of synaptic refinement is fundamental to shaping the neuronal circuitry of the developing brain, yet the factors that regulate it are poorly understood. Astrocyte-secreted signals are known to regulate synaptic connectivity in neuronal circuits. Previously, we identified two highly homologous proteins, hevin and SPARC, as important regulators of excitatory synapse formation. Hevin increases the number of synapses in retinal ganglion cell cultures, while SPARC is antagonistic to hevin's synaptogenic activity. In addition, hevin-null superior colliculus (SC) has fewer excitatory synapses while SPARC-null SC has more synapses than age-matched wild-type (WT) SC. Here, we investigated the effects that these proteins have on synapse formation and overall cortical architecture. Specifically, by comparing spine morphology of SPARC mutant and hevin mutant (KO) neurons with WT mice, we identified the morphological effects of these proteins on post-synaptic neurons in the visual cortex. Through quantification of microglial activation in KO and WT mice, we determined the relative effects of SPARC and hevin on phagocytic activity in microglia. These results identify hevin as a maturation factor for excitatory spine structure, while we hypothesize SPARC functions as both an antagonist to hevin and a signal for axonal pruning by microglia.

Biological Sciences, 12:00-1:00

Freddie Peng
Metabolic Analysis of Mechanical Load as a Muscle Cell Culture Model of Exercise
Research Advisor: Deborah Muoio
Pharmacology & Cancer Biology

Whereas the mechanisms that mediate exercise-induced improvements in fitness are well understood, the molecular pathways underlying the health benefits of habitual physical activity remain largely unknown. The purpose of this study was to develop a cell culture model that can be used to better understand exercise-induced metabolic remodeling of skeletal myocytes at a molecular level. To this end, C2C12 murine myoblasts and primary human skeletal muscle cells (HSkM) were fed every other day with prepared growth or differentiation medium, incubated at 37°C until the cells reached ~60% confluence, and seeded onto collagen coated silastic membranes in flexible culture plates. Growth medium was subsequently shifted to differentiation medium as C2C12 and HSkM myocytes underwent cyclic uniaxial stretch via vacuum pressure for 0-7 days through the Flexcell FX-5000 tension system. Then, we proceeded to examine fuel use changes and gene expression differences to determine whether traditional metabolic pathways associated with exercise were similarly active during stretch. Specifically, our study produced three main outcomes. Compared to the control condition, myocytes grown under the stretch regimen produced more lactate and exported more acylcarnitine metabolites – which was indicative of a shift in mitochondrial fuel metabolism. Additionally, transcriptional profiling of several candidate metabolic regulators known to be induced by exercise training revealed modest changes in gene expression, while analysis of musculoskeletal genes responsible for mechanotransduction and structure is ongoing. In sum, metabolic adaptations to intermittent mechanical load were evident, but subtle. Although these preliminary results suggest that the Flexcell mechanical tension system might have utility as a model of exercise adaptation, further studies to optimize and characterize the system are necessary. Future directions will likely involve adjustments to the stretch regimen that subject the experimental group to longer periods of tension.

Biological Sciences, 11:30-12:30

Chelsea Pieroni, Julia Huang, Franklin Morgan
Visualizing Venice
Research Advisor: Kristin Lanzoni
Art, Art History, Visual Studies

Imagine being able to experience Venice in the 17th and 18th centuries. Well now you can. Two Bass Connections projects have reconstructed architecture and the urban environment of early modern Venice. A first year seminar challenged students to combine art and architectural research with a program called SketchUp to recreate and visualize demolished churches. Ranging from altarpieces to arcades and various vaulting styles, students created a final 3D model that can be shared with students and scholars around the world. In addition, Humanities Writ Large undergraduates worked closely with faculty and graduate students to recreate a lost district of the city in a virtual space. Students reconstructed churches, aristocratic palaces, bridges, gondolas, gardens, avatars and costumes according to historical research. A gaming narrative encourages visitors to move through the environment as it existed in 1741.

Bass Connections, 12:30-1:30

Karishma Popli
Lighting the Future with Technology: The efficacy of solar lamp use in rural villages in India
Research Advisor: Alma Blount
Public Policy

The purpose of this program evaluation was to determine whether solar lamps are an effective and feasible technology that can easily be introduced in rural villages to help students study productively at night when they have little or no access to electricity. Addressing the use of alternative energy resources in rural villages is important, as most people in developing nations are unaware of the effects of climate change and its harmful impact on our environment. It is our global responsibility to work together to learn about and utilize alternative, sustainable sources of energy. Additionally, the lack of electricity in most rural villages around the world hinders education, economic growth and productivity. Students are unable to study productively at night when they do not have adequate lighting to read, study and complete homework. Three years after initially distributing solar lamps to students at a rural village school in Tasing, Rajasthan, India, an evaluation was conducted to determine whether students had incorporated use of this simple, easy to use sustainable technology, how students utilized the solar lamps, and whether the introduction of this technology helped them study more effectively. The findings of this evaluation suggest that both students and their parents found the solar lamps useful to study, perform household chores at night, and to work outside in the field when dark. Most students interviewed used the solar lamp to read, study, and do homework at night. After the introduction of solar lamps, families no longer used kerosene, which is dangerous to their health and the environment. However, students were unable to explain what alternative energy is and why it is important to use sustainable energy resources such as solar technology. An interactive lesson plan on the importance of solar technology and alternative energy resources was prepared and presented to all teachers at the village school in their native language to incorporate into the Science unit for grades 6-12. Home visits and parent interviews were conducted after presentation of the solar energy lesson plan to the entire school community. Students were assessed on their understanding of the material through questionnaires before and after the lesson was presented. Responses indicate students understood the beneficial impact of utilizing solar energy, and welcomed the introduction of this new technology in their community.

Community Engaged Research, 11:30-12:30

Meredith Rahman
Effects of habitual loading on bone material properties: a comparison of primate and non-primate mammals
Research Advisor: Daniel Schmitt
Evolutionary Anthropology

It is well-documented that primates maintain a set of unusual biomechanical features during quadrupedal locomotion that are thought to be associated with arboreal movement. Perhaps most notable is a reversed limb-loading pattern in which greater loads are applied to the hindlimbs than forelimbs, a pattern that is reversed in most non-primate mammalian species. Theories of bone biomechanics suggest that osseous remodeling will behave predictably, with an overall strengthening of bone based on habitual loading. We tested this hypothesis by taking advantage of primate versus non-primate limb loading patterns. We evaluated elasticity in the limb bones of primate (Lemur catta and Varecia variegata) and non-primate (Dasypus novemcinctis and Felis domesticus) species via microindentation to determine whether differences in habitual loading patterns are reflected in limb bone material properties. To do this we measured Vickers hardness from one transverse section from both the distal radius and tibia. Hardness values were converted to elastic modulus via regressions specific for bone tissue. Analysis of variance reveals that primates tend to have significantly more compliant bone in the forelimb (9.77GPa) than the hindlimb (12.13GPa). The pattern is reversed in non-primate species (15.38 versus 13.41GPa). This finding lends support to our hypothesis that differences in habitual loading patterns are reflected in material heterogeneity between forelimbs and hindlimbs. Overall more compliant bone observed in the primate forelimb suggests a reduced ability to withstand high loads when compared to other mammals. This pattern may elucidate why certain locomotor modes are observed in primates and others are not.

Biological Sciences, 11:30-12:30

Lydia Ran
Conditions for human endothelial cell and skeletal muscle lamellar co-culture in vitro
Research Advisor: George Truskey
Biomedical Engineering

In vivo muscle fibers are surrounded by capillaries, which are made of a single layer of endothelial cells (ECs). Reproducing the physiological proximity of ECs and skeletal myoblasts (HSkMs) in vitro is important in understanding effects, such as drug and toxicity testing, on skeletal muscle in its native environment. We examined culture medium composition necessary to co-culture human ECs and human HSkMs in 2D and 3D. HSkMs are usually cultured in high glucose DMEM-based differentiation media (DM) with 2% horse serum. ECs are cultured in EBM2 supplemented with EGM2 Singlequot kit and 10% fetal bovine serum (FBS). Co-culture media consisting of 3.3% FBS in DMEM, a media used to support endothelialization in tissue-engineered blood vessels, and proportions of DM to EBM2 ranging from 3:1 to 1:9 were tested. 2D experiments were conducted in monoculture, indirect co-culture through a Transwell system, and direct co-culture conformations, with HSkMs differentiated prior to EC seeding. ECs were added 4-6 days later. Monoculture and indirect co-culture experiments demonstrated that 1:3 DM:EBM2 media promoted EC growth and HSkM fiber formation. Direct co-culture resulted in 93% EC coverage in 1:3 DM:EBM2 using an EC seeding density of 125,000 cells/cm2. EC coverage and function of endothelialized tissue-engineered 3D muscle bundles were assessed in 3D experiments. HSkMs were seeded into fibrin hydrogels and cultured in DM for 10-12 days. ECs were then added for 48-96 hours. Isometric force testing was performed after 2 weeks. 3D co-cultures in 1:3 DM:EBM2 did not demonstrate substantial forces but 3D co-cultures in 3.3% FBS in DMEM after 48h in co-culture showed a significant increase in twitch and tetanus forces in comparison to 1:3 DM:EBM2 and DM. This study has identified conditions that can be used to co-culture ECs and differentiated HSkMs in 2D and 3D. It was found that 2D lamellar co-cultures can be maintained using a 1:3 DM:EBM2 media condition at an EC seeding density of 125,000 cells/cm2. Additionally, function of endothelialized tissue-engineered 3D muscle bundles was demonstrated, suggesting that a co-culture with ECs in 3.3% FBS in DMEM can increase the force output.

Biological Sciences, 12:30-1:30

Kyle Rand
Modulations of cognitive load during value-based decision making
Research Advisor: Roberto Cabeza
Psychology and Neuroscience

Value-based decision making is a complex cognitive process that is dependent on several domains of information processing. The reliance on short-term and long-term memories, along with integrated deliberative and affective processing creates a large cognitive network that works in everyday decisions. Value processing in particular plays a significant role in economic decisions, as people are constantly interpreting the prices and ratings of different consumer products. In every purchasing decision, areas associated with these executive functions play a role in determining the best possible product. In the broader decision making realm, there exists a large body of evidence that points to the role that cognitive load plays on decision quality. The current study seeks to elucidate the negative effect of cognitive load in economic decisions that are specifically value-based by determining the neural correlates of a simple choice task. The paradigm presented participants with value information for competing product pairs, with memory load modulated by differing delays between value information. The study examined modulation of this functional network based on the types of intermittent events (either encoding of new information or judgment based on previous information) during decisions with long retrieval delay. Healthy younger adults completed this consumer choice task during functional MRI data collection. Within this group, the proportion of decisions made within the retrieval delay caused a modulation of decision accuracy in a linear fashion. If functional results show decreased recruitment of dorsolateral prefrontal cortex and hippocampal areas with increasing decision proportions, then we can ascertain that transitions between executive function systems and long-term memory systems are affected by cognitive load in value-based choices.

Behavioral Sciences, 12:00-1:00

Lillie Reed
Predictors of engagement in transactional sex behaviors: A study of Patrons of Alcohol-Serving Venues in A Cape Town Township
Research Advisor: Kathleen Sikkema
Psychology and Neuroscience

Transactional sex is the exchange of sex for services, money or material goods, including food, alcohol and drugs. Such sex exchange has been linked to gender-based violence and mental illness, and sexual behaviors and relationship dynamics common among transactional partnerships may increase the risk of HIV and other STD infection. In South Africa, where HIV is endemic, studies have shown that many women and men engage in transactional sex for both subsistence and consumption. In order to best understand how to prevent HIV infection and other health issues in South Africa, transactional sex must be better understood. Currently, there is little research examining the intersections of transactional sex behavior and gender and race, or examining the predictors of the amount of sex exchange. The current study seeks to reduce these gaps in research, examining the differences between "exchangers" and "non-exchangers", as well as analyzing within-group differences between those who engage in transactional sex, examining differences across race and gender, "buyers" and "sellers", and different modes and amounts of engagement in transactional sex.

Psychology Graduation with Distinction, 12:00-1:00

Ana Restrepo
Ant or elephant? The brain's response to hierarchical classification
Research Advisor: Jennifer Groh
Psychology and Neuroscience

It has been found that the speed for the categorization of stimuli is not determined only by perceptual salience but rather by selectively attending to relevant features. Furthermore, modifying variables within stimuli presentation will affect reaction time for categorization without influencing object detection. In the present study, the conceptual scope of stimuli was tested to determine whether this could be a relevant variable in affecting reaction time by modulating the selective attention given to relevant stimulus features. Participants were shown three sets of trials: the first included pictures centered in the middle of the screen and of the same size, the second modified the pictures by randomly choosing from five possible locations and sizes, and the third utilized words by employing the same paradigm of shifting size and location. Two categories were chosen at random from a predetermined pool from which to display pictures or words and the subject was tasked with correctly categorizing each stimulus by a specific key press, through which reaction time was recorded. Within each category, the stimuli were ranked hierarchically according to conceptual scope. The present experiment is an ongoing study where the first set of trials was run as a form of pilot for the structure. Forty-three participants between the ages of 18 and 25 participated in the experiment, though invalid trials were excluded from the data analysis. When comparing reaction time to the hierarchical level of classification of the stimuli in each category, there were no conclusive results. The correlation for all three sets of trials together was -0.02 ($p < 0.301$). A correlation of -0.01 ($p < 0.265$) was found for the trials with the centered images. A similar correlation of -0.01 ($p < 0.167$) was observed for the set of trials with pictures including the shifting sizes/locations paradigm. The words with shifting sizes/locations paradigm resulted in a correlation of 0.00 ($p < 0.961$). As of yet, the study has not provided any evidence that the conceptual scope of a stimulus influences or correlates with the time required to categorize the stimulus. Nonetheless, this is an ongoing study whose pilot trials are documented here and will be used to drive new research by modifying the nature of the stimuli used in the study.

Rachel Roberts

Math is demanding: Increased parieto-frontal connectivity during approximate arithmetic

Research Advisor: Elizabeth Brannon
Psychology and Neuroscience

Humans are able to quickly estimate number without the use of language or symbols using the approximate number system (ANS). Recently a causal link has been discovered between the ability to perform approximate arithmetic, or add and subtract dot arrays, and the ability to perform three-digit symbolic addition and subtraction. This suggests that the brain regions important for approximate arithmetic may be the regions responsible for our math ability at its most basic. We hypothesized that a right parietal seed region would show increased functional connectivity to its neighboring parietal cortex as well as frontal regions important for working memory. To test this hypothesis, we used functional magnetic resonance imaging (fMRI) to explore functional connectivity that exists during an approximate subtraction task but not during a similar matching task. We found increased parieto-frontal connectivity during approximate arithmetic when compared to matching, which may reflect overlap between the brain regions responsible for approximate and symbolic arithmetic.

Psychology Graduation with Distinction, 12:00-1:00

Rachel Roberts, Florian Craan, Seamus Fitzpatrick, Rachel Freedman, Cayley Larimer

Doing math with dot arrays: behavioral implications for NC Pre-K 4- and 5-year-olds

Research Advisor: Elizabeth Brannon

Psychology and Neuroscience

The approximate number system (ANS) allows quick estimation of number without the use of language or symbols. Because knowledge of symbols is not required, the ANS allows the study of math understanding in young children and primates. It has recently been discovered that training approximate arithmetic, the addition and subtraction of large dot arrays, improves three-digit addition and subtraction performance in adults. A question arises: can we train young children to improve their math skills before they understand symbols or number words? We test this with an iPad intervention project which trains North Carolina state-funded preschoolers to add and subtract dot arrays. Preliminary results indicate that this approximate arithmetic training does in fact improve early math ability in preschoolers.

Bass Connections, 11:30-12:30

Nicole Rudden
From Le Brun to Hitler: How the Art of Human Physiognomy has Codified Stereotype in our Visual Culture
Research Advisor: Hans Van Miegroet
Art, Art History, Visual Studies

French academic painter Charles Le Brun (1619-1690) sought to understand how human facial structure reflected the soul within. This project argues that the stereotypical depictions of physiognomy popularized by Le Brun's lectures and artworks came to define some of the racist undercurrents of Western visual culture in the 17th Century. Le Brun's code persisted through art schooling systems into the 18th and 19th Centuries, with dangerous repercussions. As the Western worldview shifted from the Age of Enlightenment to the Age of Industry, the approach to solving philosophical questions became more empirical. Le Brun's visual work in demonstrating how innate characteristics are discerned from physical attributes was quantified and tested in the 18th Century. Pseudoscientific fields like phrenology and craniometry used biased data collection to scientifically support Le Brun's ideas. With the publication of Charles Darwin's "On the Origin of Species" in 1859, racist interpretations of evolutionary theory renewed support for an ethnic hierarchy, with Germanic peoples at the top, and African groups at the bottom. This ideology, known as Social Darwinism, motivated movements such as eugenics and Nazism. This project aims to illuminate the aesthetic traditions that link Le Brun's work on physiognomy with the racist propaganda used by the Nazi Regime. It traces how and with what consequences an Enlightenment theory on the physical expression of the soul became reified as the science of biological determinism. The connections demonstrated in this paper call for a critical reevaluation of the underlying, racist patterns that still persist in our visual culture.

Humanities, 12:00-1:00

Bailey Ryan, Sammie Truong, Dominic Le, Tania Hassanzadeh
Why Mom Matters: Environmental Justice and the Early-Life Origins of Health Disparities
Research Advisor: Staci Bilbo
Psychology and Neuroscience

Our Brain and Society team investigates the effect of perinatal nutrition on maternal health and offspring development. We are particularly interested in how diets high in fat and in branched-chain amino acids may influence risk for postpartum depression, developmental disorders, and metabolic syndrome, via nervous-immune-endocrine interactions in mother and child. Our work integrates behavioral, molecular, metabolic, and histological data from diet-manipulated mice with clinical data from early-postpartum women in the Durham area.

Bass Connections, 12:30-1:30

Lindsay Samuel
Separation Anxiety and Depression in College Freshmen
Research Advisor: Timothy Strauman
Psychology and Neuroscience

This paper analyzes data collected from freshmen at a research university in the Southeastern United States regarding the experience of separation anxiety and depression. It looks at factors that might influence the development of these symptoms, such as distance from home, familial communication, and prior separation experiences. By examining these factors, it is possible to target populations that might be at risk for experiencing separation anxiety, which could influence future interventions. Through a series of Pearson correlations and T-tests, the associations between variables as well as the differences between groups were analyzed. It was found that separation anxiety and depression have a significant association for international and domestic students. For domestic students it was also discovered that distance from home was related to depression and that whether a student lives with their parents during breaks is related to separation anxiety. Other variables were inconclusive, and future research is needed to determine what the risk factors are for separation anxiety in college freshmen.

Psychology Graduation with Distinction, 12:00-1:00

Akshay Save

Development of a Three-Dimensional Model to Assess Tumor Growth Progression and Evaluation of Biomarkers in Inflammatory Breast Cancer

Research Advisor: Gayathri Devi
Pathology

Inflammatory breast cancer (IBC) is a rare but particularly invasive subtype of breast cancer known for its extremely poor prognosis and proclivity towards metastasis. These cancers are frequently resistant to standard treatment options, including chemotherapy, targeted drug therapy, and radiation therapy. Notably, these cancers form tumor emboli – tightly packed three-dimensional tumor cell spheroids surrounded by lymph-endothelial cells – that infiltrate the dermal lymphatic vessel. Preliminary data from our laboratory suggest that the formation of these tumor emboli and resistance to treatment is correlated with overexpression of X-linked inhibitor of apoptosis protein (XIAP). We have previously developed modified cultures of the parental SUM149 IBC cell line with varying expression levels of XIAP. Though the emboli present themselves as three-dimensional masses, the majority of our work so far has been done in two dimensional cultures. For the past semester, I worked on optimizing two three-dimensional models to study tumor embolus formation in vitro. With the first model, I used a matrigel solution that simulates the extra-cellular matrix to grow mammospheres of the different XIAP modulated cell lines and compare their growth patterns. Surprisingly, there was not a notable difference in the number of mammospheres formed between the different cell lines, though certain cell lines did form larger mammospheres. With the second model, I was able to grow non-adherent IBC aggregates in solution. These aggregates were then collected to create cell pellets that will be used to gather protein and mRNA signaling information using western immunoblots and qtPCR.

Biological Sciences, 12:30-1:30

Meghan Scanlon
Strengthening Families: Evaluating Nurses for Newborns' Child Abuse and Neglect Prevention Program
Research Advisor: Dalene Stangl
Statistical Science

This research examines the implementation of an evidence-based program for prevention of child abuse and neglect within a home visitation program, which introduces the complications of an informal setting and high attrition rates. I focus specifically on Nurses for Newborns (NFN), a non-profit organization that provides in-home nursing services to at-risk families with infants. This organization introduced the complementary AAPI-2 assessment and Nurturing Parenting educational curriculum into their Tennessee program in 2012, but experienced difficulties with the intervention's uptake. By measuring compliance with NFN's official guidelines for the program over its first year of use and identifying barriers to effective implementation, I sought to provide the organization with recommendations for the effective expansion of this intervention into Missouri. To do so, I conducted a quantitative analysis of relevant client records and interviewed a small sample of clients and nurses. This revealed that few clients were receiving all recommended program components and that there were inconsistencies in how nurses were using these tools and recording their usage. In general, nurses had a number of concerns about the program, including the fact that it was "thrust" upon them with little support and that it was not appropriate for all clients. This led me to recommend that NFN make changes in data collection, training and introduction, and implementation of the intervention, such as delaying its initiation until a client's 3rd visit and allowing more room for exercise of nurse judgment in the program guidelines.

Community Engaged Research, 12:30-1:30

Benjamin Schwartz
Molecular analysis of tooth development in chimpanzees
Research Advisor: Christine Wall
Evolutionary Anthropology

Teeth are masticatory tools whose morphologies are correlated with function and are key to understanding the evolutionary changes related to diet, feeding biomechanics, glucose transport, and cranial development within the primate lineage. A challenge associated with studying the evolution of human diet is the lack of any comparative data on gene expression or detailed morphology within developing chimpanzee teeth. In this study, the mRNA expression levels of four genes involved in enamel development - MMP20, AMELX, ENAM, TUFT1 - were measured using reverse transcription quantitative PCR within three distinct tissue sections of molars in two chimpanzees at different stages of early development. Complementary morphological data of chimpanzee teeth were obtained from micro-CT which were utilized for accurate extraction of the tooth samples. Our results indicate that enamel genes are expressed in a spatial and temporal pattern consistent with the known functions of these genes. The data gathered from this study represent a survey of gene expression across different tissues at different points of the developmental time series. The methods devised have laid the groundwork for current and future comparisons of tooth development among other enamel genes - ODAM, AMBN, AMTN, KLK4 - and other primate species in order to more holistically understand the evolutionary changes within teeth and their relationship with diet.

Biological Sciences, 12:30-1:30

Miray Seward
It's A Matter of Perspective: Examining Cultural Differences is Communication Styles
Research Advisor: Makeba Wilbourn
Psychology and Neuroscience

Effective communication requires the minimization of misunderstandings between communicative partners. However, Blacks and Whites come from different cultural backgrounds, which influence their interactions. Our biases, socialization, racial identity and past experiences all influence the way we view those from different racial groups. In this study, we examined cultural differences in communication styles, differences in perceptions of Blacks and Whites, and how racial identity and implicit biases impacted Blacks and Whites evaluations of other Blacks. Participants included 38 Black and White undergraduate students from Duke University. During the study, participants told a story, rated storyteller videos, completed the Implicit Association Task (IAT), and the Expressive Vocabulary Test (EVT). Blacks also completed the Multidimensional Scale of Racial Identity. A 3-way interaction was found between participant race, gesture, and gender for overall story length. Black males talked significantly longer than all other groups during a storytelling task. White participants rated White storytellers are more like to be a close friend. Blacks participants rated White storytellers as more attractive. Finally, Black participants scores on racial identity influenced their evaluations of Black storytellers. Findings point to differences in verbal and non-verbal communication between Blacks and Whites, and exhibit the impact implicit biases and racial identity have on our evaluations of others.

Psychology Graduation with Distinction, 12:00-1:00

Maggie Shannon
How can personal relationships prolong an addict's participation in treatment at TROSA and his or her sobriety?
Research Advisor: Alma Blount
Public Policy

TROSA is a two-year residential therapeutic community for substance abuse treatment with an experience-based hierarchical structure. As a voluntary treatment option, residents are free to leave at any time, so TROSA administration must focus on ways to encourage residents to stay. Due to the collaborative environment of TROSA, the relationships among residents are crucial for retention, and we sought to identify which relationships were most valuable and why. Surveys were created in collaboration with TROSA staff and select residents, and the survey was then administered to all 400 residents. The surveys revealed that mentor, mentee, and partner in recovery relationships are the most beneficial for retention. The survey also revealed a discouraging appreciation for the program's focus on accountability considered crucial for retention and sobriety. These findings suggest that more free time for residents to socialize with residents of different levels in the program would foster mentor/mentee relationships. More experienced residents are also more likely to hold others accountable, and setting this tone for newer residents could help the overall community's appreciation for accountability as a necessity for overcoming addiction.

Community Engaged Research, 12:00-1:00

Kelly Shen, Rahiel Alemu, Juanita Hazel
Effective Energy Communication Strategies for Low-Income Residents
Research Advisor: Brian Southwell
Duke University Energy Initiative

Social scientists are beginning to understand a number of ways in which low-income populations face resource challenges that affect not just their material standing, but also the ways they engage information. Those challenges, in turn, also constrain the success of programs charged with helping low-income consumers conserve energy through changes in home maintenance and household energy behavior. Led by Dr. Brian Southwell, a team of Duke undergraduate and graduate students in the Bass Connections in Energy program conducted a small set of in-depth interviews with applicants to the Low Income Energy Assistance Program in Durham County to inquire about their information needs, preferences, and tendencies. The interviews explored the time-orientation of residents, e.g., tendency toward immediate goals versus long-term goals, perceived social network norms regarding community energy education, and a variety of other factors that pose both opportunities and challenges for future energy education outreach efforts. From this, we were able to determine two separate "community meeting" and "free workshop" strategies for promoting energy use tips. Promotional materials were created and further pretested among Durham residents in order to determine their effectiveness. Furthermore, the group tackled energy behavior from the developer side by analyzing the accessibility of information in regards to gross rent and building retrofits that would yield the greatest short term gain. Working with a local non-profit called Clean Energy Durham, our recommendations will address promotional efforts as well as information accessibility in order to organize more effective energy campaigns and overcome barriers to energy-use change among low-income residents.

Bass Connections, 11:30-12:30

Arielle Shkedi
Trafficking of Newly Exported Ribosomes
Research Advisor: Christopher Nicchitta
Cell Biology

Ribosomes are components of the cell that function in mRNA translation/protein synthesis in the two primary protein synthesis compartments of the cell, the cytosol and the endoplasmic reticulum (ER). Ribosomes are assembled in the nucleolus and then exported into the cytoplasm, where they engage in mRNA translation. In current models all newly exported ribosomes reside in the cytosol, with trafficking to the ER only occurring upon translation of a secretory protein mRNA. To date, this model has not been experimentally verified. To test this model, we use a biosynthetic labeling approach to identify newly synthesized HeLa cell ribosomal RNAs as a proxy for newly synthesized ribosomal subunits. Using a pulse labeling/chase protocol, the subcellular location of the tagged ribosomal subunits were then monitored by cell fractionation and RNA gel/phosphorimage analysis. In preliminary experiments, we have obtained evidence that newly exported ribosomes are preferentially bound to the ER. Using this protocol, we will continue our investigations into the subcellular trafficking itineraries of ribosomes and determine if ribosome partitioning between the cytosol and ER is driven by mRNA translation.

Biological Sciences, 11:30-12:30

Anusha Singh
Investigating interactions between HDAC6 and AnkG190
Research Advisor: Chay Kuo
Cell Biology

Existence of an interaction between the proteins HDAC6 and AnkG190 was investigated. Evidence suggested that both proteins were associated with cilia formation processes in cells. Specifically inhibition of HDAC6 and upregulation of AnkG190 were associated with the differentiation of radial glial cells into multiciliated ependymal cells. Ependymal cells are an important focus of current research in the field of neurobiology, and this investigation has the potential to answer key questions about the developmental processes of these cells. In particular, ependymal cells exposed to epidermal growth factor (EGF) are thought to exhibit increased HDAC6 and decreased AnkG190 and subsequently revert back to radial morphology. EGF exposure can occur in the case of hemorrhage in the brain, and because ependymal cells play a critical role in cerebrospinal fluid (CSF) transport, dedifferentiation of ependymal cells back to radial glial morphology during hemorrhage in the neonate brain has important implications for aggravating congenital hydrocephalus. Co-immunoprecipitaton and Western Blot methods were used to investigate interaction between HDAC6 and AnkG190 proteins. Results demonstrated a binding interaction between HDAC6 and AnkG190. Important follow-up investigations include reacting purified HDAC6 with purified AnkG190 to determine whether interaction is direct or indirect.

Biological Sciences, 12:00-1:00

Alli Smalley
Single-sex vs. Coed Schools: Does single-sex high school attendance correlate with students' academic and social attitudes, beliefs, and behaviors in college?
Research Advisor: David Rabiner
Psychology and Neuroscience

Single-sex schools have been associated with increased academic achievement, academic-engagement, and academic self-esteem, but little research has explored whether these benefits persist during college. Single-sex schools have also been proposed as a way to encourage female students to pursue and be confident in fields that are more male dominated (i.e. STEM fields). However, a study of 432 university students who attended private high schools (either coed or single-sex), found very few effects for attending a single-sex school, although there were gender differences for academic performance, academic ambitions (i.e. choice of major, career plans), and academic engagement persisted. The results indicate that efforts to reduce gender disparities in these areas are necessary, but that single-sex schools are not an effective way to do so.

Psychology Graduation with Distinction, 12:00-1:00

Allison Smalley
Teaching the Personal Essay: How to Implement an Effective Summer Writing Program for High School Students
Research Advisor: Alma Blount
Public Policy

A four-week summer writing program was implemented in order to address the academic and personal needs of female high school students. The program sought to determine how to best teach personal essay strategies, writing clarity, ways to share a personal story, and the importance of story-telling in catalyzing social change. Students completed 10 page personal essays and presented their findings to friends, school faculty, and administrators.

Community Engaged Research, 11:30-12:30

Julie Stefanich, Esther Kim
Kenan Institute for Ethics Refugee Resettlement Project: How does displacement and resettlement process affect refugee mental health and well-being?
Research Advisor: Suzanne Shanahan
Sociology

For philosopher Jonathan Lear 'radical hope' is the ability to imagine a meaningful existence in the face of total cultural devastation. Building on recent findings on the impact of religion on refugee identity, health, psychosocial well-being, and social networks, this paper explores relationship between faith, religious practice and radical hope in two displaced communities—the Bhutanese in eastern Nepal and the Iraqis in Cairo. Why are some, but not all, refugees able to re-imagine a life of meaning after displacement? Based on more than 100 recent open-ended life story interviews with Bhutanese and Iraqi refugees, we illustrate how faith and religious practice differentially structures meaning and belonging in the daily life of displaced persons. While these detailed narratives highlight the importance of religion as a critical dimension of identity and source of social support, there are important differences between these two communities. Most significantly, while some Bhutanese express anxiety about being able maintain religious practices after resettlement others blithely express an expectation they will convert to Christianity once resettled as a means to assimilate and "fit in." Bhutanese subjects reveal a strong association between Christianity and "being American." Indeed, for some, religious conversion is a central part of the imagining of a new life after the resettlement. We argue that that experiences and trajectories of these two refugee groups differ in important ways—for example, the religious pluralism present in the Bhutanese refugee camps and the relatively clear and timely path to resettlement for the Bhutanese in comparison to the Iraqi refugees. And these differences help explain divergent views of religion and belonging. We conclude with a preliminary discussion of the differential impact faith based humanitarian organizations have on the narratives of Bhutanese and Iraqi refugees.

Bass Connections, 12:30-1:30

Caroline Steiblin
Comparing Monte-Carlo (MC) simulations of Z boson mass reconstruction from muons, photons, and electrons to LHC data, qualitatively showing the possibility of misrepresentations in Z boson reconstruction through an electron faking a photon
Research Advisor: Al Goshaw
Physics

The weak force interaction of the Z boson, a charge-less, spin 1, heavy particle, first observed at CERN in 1983, supplies more evidence in favor of the Standard Model, and has helped in the search and classification of the Higgs boson. Z bosons are useful as they are experimentally quite well understood, and are easier to reconstruct with low background. My research primarily focused on comparing Monte-Carlo (MC) simulations of Z boson mass reconstruction from muons, photons, and electrons to LHC data, to provide more evidence in favor of the Standard Model theory. I investigated the Z decay into a negatively and positively charged muon and a photon. Through a computer code, I used cuts to attempt to select the purest sample of photons to reconstruct into the Z boson. From this research, I successfully created a selection in which over 95% of the photons were pure, and found excellent agreement between the MC simulation and real data for the invariant mass of the Z boson. When analyzing detector data, Z boson decays also seemed to indicate the presence of an electron instead of a photon. I was able to qualitatively prove that the Standard Model allows the Z boson to decay into two leptons and a photon, but not three leptons, through the possibility of an electron faking a photon.

Physical Sciences, 12:30-1:30

Christopher Streiffer, Kevin Button, Thomas Klebanoff, Zachary Podbela
Live Processing and Live Art: Performance and Technology
Research Advisor: Martin Brooke
Electrical Engineering

Live Processing and Live Art: Performance Technology, a Duke Bass Connections project, is a highly interdisciplinary module which expands upon emergent design in practical engineering, live art, contemporary performance, and cultural and performance studies methodologies to encourage an expanded awareness of creative space and possibility surrounding information processing. This project blends together three very unique curriculums, Electrical and Computer Engineering, Dance, and African American Studies, to create an interactive work of art. The goal of this project is to create a "phase mirror" to be used in a performance. This mirror has the ability to interact with users in real time through live video, audio, and other information received through sensors. The motion and sensors of the mirror are controlled using Arduino Hardware, the video using Isadora Software, and the audio using MAX/MSP. Combined, these applications allow for processing-intensive engineering to transform the way we interact with the world. The module will include visits to the Museum of Contemporary Art (Raleigh), the North Carolina Museum of Art and the Nasher Museum on Duke's campus.

Bass Connections, 12:30-1:30

Jenny Su
Quantum Tunneling and Chaos in Classical Scale Walkers
Research Advisor: Bob Behringer
Physics

We study the behavior of `walkers'; small droplets bouncing on a fluid layer vibrated at amplitudes just below the onset of Faraday instability. It was shown recently that despite their macroscopic size, the droplet dynamics are stochastic in nature and reminiscent of the dual particle-wave dynamics in the realm of quantum mechanics. We use these walkers to study how chaos, which is macroscopically unpredictable, will manifest in a quantum setting. Pecora showed in 2011 that tunneling for particles that have a chaotic ground state is different from tunneling for particles with a regular ground state. In the experiment we gather data that illustrates the particle trajectory and tunneling behavior as particles transition across the barrier in the double well system with both integrable and chaotic shapes.

Physical Sciences, 11:30-12:30

Lillian Sun
Metabolism in Chronic Lymphocytic Leukemia (CLL) Cells
Research Advisor: Jeff Rathmell
Pharmacology & Cancer Biology

Chronic Lymphocytic Leukemia (CLL) is the most frequent form of leukemia in Western countries. The disease features the clonal expansion of neoplastic B-lymphocytes in the blood, bone marrow, lymph nodes, and spleen. Otto Warburg noticed in 1920s that even in the presence of ample oxygen, cancer cells prefer to metabolize glucose by glycolysis. This metabolic signature is commonly known as "Warburg Effect". The unusual dependence of cancer cells on glycolytic pathway for energy supply has been proposed to be a viable target for cancer treatment. According to the literature, leukemic cells from CLL patients also exhibit "Warburg Effect". In the preliminary studies, we observed that CLL cells have a low baseline metabolism. In addition, while anti-IgM stimulates healthy B cells through antigen receptor signaling, increasing glucose uptake and Glut1 expression, anti-IgM only weakly stimulates CLL cells and fails to upregulate glucose uptake and Glut1 expression by an appreciable amount. It was hypothesized that the antigen receptor signaling is decoupled from the normal metabolic response in CLL cells. To test this, the CLL cells were treated with PMA and Ionomysin, which target downstream components to increase glycolysis, while bypassing antigen receptor signaling. The treatment with PMA and Ionomysin indeed induced a normal metabolic response in CLL cells, suggesting that CLL antigen receptor signaling is probably decoupled from the glycolic pathway.

Biological Sciences, 11:30-12:30

Vaibhav Tadepalli

Development of a method for large scale synthesis of high aspect-ratio copper nanowires and mechanistic analysis of the role of ethylenediamine within the synthesis as a means of developing a better replacement for conventional transparent conductors

Research Advisor: Benjamin Wiley
Chemistry

Transparent conductors (TCs) are the primary component of a variety of modern-day devices including capacitive touchscreens, solar cells, and LEDs. Currently, the most popular TC is indium tin oxide, or ITO. However, ITO could be replaced by metal nanowires, which aside from having a lower cost, also demonstrates comparable conductive abilities and transparency as ITO. Moreover, metal nanowires can be deposited more quickly than ITO, significantly speeding up production rates of TC containing devices. High-aspect ratio silver nanowires (Ag NWs) have been used with considerable success and have exhibited qualities on par with, if not better than, ITO. / Copper nanowires (Cu NWs) have been shown to have similar conductive properties to the Ag NWs but copper is 1000 times more abundant and about 100 times less expensive. These factors alone make high-aspect ratio Cu NWs an attractive alternative to both Ag NWs and ITO. The method, developed in the Wiley lab, involves the use of ethylenediamine (EDA), a hypothesized capping agent, and hydrazine, a reducing agent, at atmospheric pressure and enables the production Cu NWs with aspect ratio as high as 5700 in 30 min. However, this method has only proved successful in small scale (~3 mg per batch). / The primary goal of this research was to build upon the synthesis method developed in the Wiley lab to allow for large-scale synthesis of high aspect ratio copper nanowires. The development of this method is critical if commercial applications of Cu NWs are to be realized. The secondary goal was to identify the mechanistic role of EDA within the reaction to both better understand the reaction and potentially improve various aspects of the reaction such as yield, nanowire thickness, etc. / Large scale synthesis was accomplished by conducting the reaction under an inert atmosphere to prevent unwanted reactions between the solution and the atmosphere trapped within the flask. The mechanistic analysis of EDA is still in progress, but preliminary results indicate that the presence of EDA prevents the formation of cuprous oxide particles in solution and seems to direct the formation copper nanowires. Very low concentrations of EDA result exclusively in the formation of particles, while mid-level concentrations of EDA show the growth of a few nanowires with particles studded on the wires. At high EDA concentrations, no particles are observed. Ultimately, this provides strong evidence in favor of EDA serving as a capping agent.

Physical Sciences, 12:30-1:30

Anne Talkington
Modeling Interactions among Migrating Species
Research Advisor: Dan McShea
Biology

Migrating species are affected by their interactions with one another, the biotic environment, and the abiotic environment. The ability to understand and predict their patterns of movement is of particular interest for purposes of conservation, development planning, and resource management. Attempts have been made to model the direction in which they move, and the extent of their movement. However, current models focus on a specific element of the ecosystem. The complexity of the organism's interactions and instinctual drive is often simplified. I am suggesting a matrix-based model that expands on previous models and allows the researcher to describe the ways in which an organism interacts with its biotic and abiotic environment, in as much detail as the research demands. This model can describe the strength of an organism's attraction to a particular place, or the relative speed at which it will migrate there. The matrix model is generalized, so it is applicable to any species; yet, it can be fit to specific organisms. The ability to determine a migration pattern is a significant step in making an educated decision regarding human intervention in a natural migration pattern.

Biological Sciences, 11:30-12:30

Caroline Taylor
Validation of a model for estimating sarcomere length operating range of the superficial masseter muscle in primates
Research Advisor: Andrea Taylor
Evolutionary Anthropology

Sarcomere lengths vary with muscle stretch and influence a muscle's physiological output. For the jaw muscles, variation in sarcomere length (Ls) across jaw gapes affects jaw-muscle forces, bite forces and jaw movements. Obtaining in vivo estimates of sarcomere-length operating range (LsOR) for the jaw muscles has proven difficult for most primate species. In lieu of measuring LsOR in vivo, investigators have modeled LsOR using jaw-muscle architectural parameters collected from cadavers with jaws fixed in occlusion to estimate Ls at maximum jaw gape. To model superficial masseter LsOR, we collected three-dimensional landmark data to estimate muscle excursion as a function of joint angle from occlusion to maximum gape in an adult female M. fascicularis skull. We incorporated estimates of jaw-muscle architectural variables from female M. fascicularis and our muscle excursion estimates from the dry skull into a model to estimate Ls as a function of jaw angle, fitting the excursion data with a quadratic polynomial using Matlab. At maximum jaw gape, our modeled estimate of Ls exceeded an in vitro estimate of Ls=4.39 μm measured from four adult female M. fascicularis cadavers with jaws fixed at maximum gape. While we consider this initial result sufficient to support the approach, additional species comparisons with in vitro Ls data at maximum gape are needed to further refine and validate the model.

Biological Sciences, 12:30-1:30

Sarah Teitell
Structural Brain Abnormalities Underlying Memory Deficits in HIV-Positive Individuals
Research Advisor: Sarah Teitell
Psychiatry

Previous studies have indicated that HIV-positive individuals often show memory deficits, but the structural brain abnormalities underlying these deficits remain unknown. To elucidate the effect of HIV status on memory, I examined the difference between HIV-positive and HIV-negative participants' scores on the HVLT-R, a verbal memory neuropsychological measure. On the delayed recall portion of the HVLT-R, HIV-positive individuals scored lower than their HIV-negative control counterparts ($p=0.056$). Analysis of DTI data from 21 HIV-positive adults and 18 controls, using TBSS and CMTK, indicated that there were no significant voxel locations or connections in the neural memory-related areas where white matter fibers were stronger, on average, in controls than HIV-positive individuals. It is possible that significant behavioral results were not obtained since only those participants who also had imaging data were included. Regarding the non-significant imaging results, it is possible that neural abnormalities only appear in a further progression of the disease, AIDS. The purpose of the results of this work is that it provides an objective evaluation of HIV patients' memory ability while on antiretroviral therapy, instead of merely considering the fact that these pharmacotherapies are extending these patients' lives, since impaired memory is related to poorer quality of life.

Behavioral Sciences, 12:30-1:30

Ishan Thakore, Jemi Galani, Ronnie Wimberly, McCall Wells
Juntos: A Digital Health Intervention
Research Advisor: Sara LeGrand
Bass Connections

Health disparities continue to disproportionately affect communities of color and diverse sexual and gender identities in the United States. At the intersection of these identities are queer people of color (QPOC). QPOC communities experience discrimination based on racial diversity, sexual and gender diversity, and for the intersection of those identities. In addition to stigma and lack of community support, inadequate access to health facilities makes members of this community more susceptible to health disparities, and more likely to experience worse health outcomes than lesbian, gay, and bisexual (LGB) white men and women. While the MSM (men who have sex with men) community has already been identified as a community that is particularly vulnerable to sexually transmitted diseases (STDs), drug abuse, violence, sex work, and HIV, disparities are disproportionately amplified for Black and Latino MSM. MSM of color experience higher rates of violence, drug use, and STD infection including HIV than white MSM even though QPOC are more likely to use condoms and have fewer sexual partners than white MSM. For Latino MSM, additional stressors like immigration status, language barriers, religious communities, and racism and discrimination experienced both internally and externally create poorer behavioral, social, mental health and physical health outcomes. During the project, the team will adapt an existing internet and mobile phone based intervention designed to reduce sexual risk behaviors, create positive norms around health behaviors, promote health and wellness, and provide a platform for community building for Latino MSM. The full Juntos team will complete formative research, comprised of in-depth interviews and surveys with Latino MSM and a comprehensive literature review, by the end of the spring semester. Formative research is designed to assess the needs of the Latino MSM community and determine how an online intervention might best meet those needs.

Bass Connections, 12:00-1:00

Chandler Thomas
The Women's Right to Know Act: A Barrier to Abortion?
Research Advisor: Katharine Bartlett
Duke University School of Law

The Women's Right to Know Act (WRTKA) was enacted in October 2011, mandating parental consent policies, a 24-hour waiting period between receiving abortion counseling and the abortion procedure, and a counseling script created by the Department of Health and Human Services. I examined the impacts of the law on abortion providers through telephone and in-person interviews with doctors and nurses of abortion clinics. I asked if providers hired new employees, if costs were raised, if the daily tasks of employees were rearranged, and how the requirements of the WRTKA affected each clinic. I investigated whether any clinics were shut down or closed due to the WRTKA, if the price of abortion was impacted, and how many visits were required at each clinic in order to measure how the law affected women's access to abortion services. None of the 12 providers that were represented reported that the WRTKA caused their prices to change. 6 of 12 clinics hired new employees and 1 clinic fired employees due to the added cost of paying an RN to counsel patients. 12 of 12 clinics had to redistribute the tasks of employees within the clinic in order to accommodate the counseling requirements. The main increases in costs for providers were paying the RNs to do counseling and the time-cost of counseling and the 24-hour waiting period.

Community Engaged Research, 12:30-1:30

Chandler Thomas
Model Practices for Low-Income, High Minority School Districts
Research Advisor: Shane Goodridge
Education

This research examines best practices in providing social support services, maintaining high-quality staff, and promoting positive school climate in school districts serving low-income, high minority populations. I examined school districts and Charter Management Organization (CMOs) that indicated higher rates of reading and math proficiency, college readiness and acceptance, and graduation rates than those of Durham Public Schools. These school districts included Philadelphia Public School District, New York City School District 21 (Brooklyn), Rockdale County Public Schools (GA). I also evaluated two Charter Management Organizations: North Star Academies of Newark, NJ, and Noble Network Charter Schools of Chicago, IL. Over 50% of students in each of these school districts and CMOs are eligible for free and reduced lunch. The counties in which they are located resemble the racial demographics of Durham County. This research aims to answer the question: What programs and policies do these successful school districts practice that can inform the practices of Durham Public Schools? I examine each school district and CMO's characteristics in the following categories: High quality teacher recruitment, training, and evaluation, community buy-in and confidence in school district quality, school social support services for students and families, efforts to ensure a safe and supportive school environment and community, allocation of resources based on per-pupil expenditures.

Community Engaged Research, 12:30-1:30

Danielle Thompson
Mind the Gap: The Effects of African American English and Academic Achievement Motivation on the Black-White Achievement Gap
Research Advisor: Makeba Wilbourn
Psychology and Neuroscience

Research on the achievement gap has consistently shown vast disparities in achievement and educational outcomes between African American and White students. Although this gap has narrowed in recent years, it is still very much present. There have been numerous factors that have been shown to contribute to the gap including racism, discrimination, racial socialization, cultural differences in parenting styles, and disparities in income and access to resources. However, little research has examined the role language and motivation may play in the Black-White reading achievement gap. This study sought to investigate the interrelations between children's African American English (AAE) use, achievement motivation, and receptive vocabulary. Measures, such as the Diagnostic Evaluation of Language Variation (DELV) to assess AAE, the Peabody Picture Vocabulary Test (PPVT) to assess receptive vocabulary and the Children's Academic Intrinsic Motivation Inventory (CAIMI) to assess intrinsic motivation, were used in a local elementary school. Correlation and regression analyses were conducted to explore the interrelations between children's AAE, achievement motivation, and receptive vocabulary. The findings are discussed in terms of (1) the degree to which children's motivation predicts receptive vocabulary and (2) how the relationship between children's AAE and academic vocabulary may impact literacy skills.

Psychology Graduation with Distinction, 11:30-12:30

Jacob Tobia
Documenting LGBT History in South Africa
Research Advisor: Karin Shapiro
African and African American Studies

From the mid 1980's through the ratification of the new constitution in the mid 1990's, the LGBT community in South Africa has undergone profound transformations: from persecution under the apartheid state, to inclusion as a protected class in the South African Constitution. In a strictly legal sense, the struggle for LGBT rights has been successful, but what are the limits of that success? And more importantly, given the vast racial and economic differences that were created by the apartheid state and a history of colonialism, how did the dynamics of race and class impact the LGBT activist community between the 1980's and the 1990's? Was there a sense of racial unity in the movement? What tensions arose between white, black, and colored LGBT South Africans during this time, and how were those tensions resolved? This summer, I traveled to Johannesburg and Cape Town for three months to research the history of the South African LGBT movement. Through working with archival material at the University of the Witwatersrand and interviewing LGBT activists across the country, I was able to gain an incredible understanding of South Africa's rich history. This year, I have worked to compile my research into a thesis that I'm writing under the advisement of the history department. Furthermore, I am also editing a documentary film with the interviews that I completed in South Africa. Collectively, I hope that these materials represent an exciting and innovative foray into South African history.

Humanities, 11:30-12:30

Pooja Utamsingh
R.E.S.P.E.C.T: Find Out What It Means: Heteronormativity & the Doctor-Patient Interaction
Research Advisor: Laura Richman
Psychology and Neuroscience

Heteronormativity, or the assumption that everything and everyone is heterosexual, is a form of indirect discrimination towards the non-heterosexual population. In the United States, many doctors graduating from medical school do not feel comfortable or confident in appropriately and respectfully treating patients that identify as non-heterosexual. Using information from qualitative interviews, this study serves as one of the first experimental studies to look at heteronormative communication and its effects in the doctor-patient dynamic with non-heterosexual patients. We created heteronormative and non-heteronormative vignettes that participants were randomly assigned to read. Following which, we analyzed how much health-relevant information they would disclose to the doctor in the vignette and how much they trusted the doctor. We found that heteronormativity causes participants to want to disclose less health-relevant information to a doctor and causes them to trust the doctor less than those who are exposed to non-heteronormative communication. With this lack of disclosure, a patient cannot get the care he or she needs and a doctor cannot give the best health advice possible. We strive for advocacy for more education for the health staff in order for all health professionals to feel confident and be comfortable while respectfully treating non-heterosexual patients.

Psychology Graduation with Distinction, 12:00-1:00

Bhavya Varma
Affects of Starvation on Anchor Cell Development in C. elegans
Research Advisor: David Sherwood
Biology

Anchor cell (AC) invasion through basement membrane is a developmental process in the Caenorhabditis elegans life cycle that connects the uterine and vulval tissue. When starved, invasion arrests for extended durations of time and resumes upon re-feeding. The signals that promote arrest and invasion in response to feeding conditions are unknown. We examined the expression of numerous genes in an attempt to characterize those that change expression between arrest and growth. These were divided into three categories: no change in expression, low expression to high expression after recovery from starvation to food, and high to low expression after recovery. We starved the worms with reporter genes for 1 day and quantified expression of starved worms as well as those who had been recovered on food for 4 hours. We have found most genes to fit the second category, changing to higher expression after recovery. However, nhr-25 weakens in expression post-recovery and mir-84 oscillates in expression through various stages of recovery and AC development. We continue to identify specific genes with peculiar behavior so that we can concentrate on their function and role in AC invasion under poor nutritional conditions. Identification and analysis of gene function under these conditions can lead us to target genes in tumor cell metastasis, which invade the basement membrane and survive under similar nutritional constraints.

Biological Sciences, 12:30-1:30

Yvette Vasquez
The Undocumented Experience: The Intersectional Geographies of Space, Identity and Activist Philosophy in Southern California
Research Advisor: Charles Thompson
Cultural Anthropology

Nestled in between mountains to the east and the Pacific ocean to the west, San Diego finds itself to be California's second largest city and the eighth largest in the entire country. Two hours north lies Los Angeles, and immediately to the south rests the threshold of the national border. San Diego boasts itself as 'America's Finest City.' Indeed, the city has long-lastingly held the description of a fine city, but the point as to whose fine city-Mexico or America-is an angle for debate, contingent on historical claims to territory and space. Withstanding this history has been the many contributions Latinos have provided throughout the centuries. The status of these communities has likewise changed with historical eras and social attitudes, however their contributions remain the same; many of which standing as concretely as the structures that attempt to divide such history. This current work delves into the experience of a particular community of individuals, who in this current historical positioning are legally labeled as undocumented. Calling on a history of activism, this community utilizes the very spaces built to divide and cause tension in order to create a concrete platform upon which they can reclaim space on behalf of their community. Working within a space that finds itself at the threshold of America and Mexico, this research explores identity and activism among undocumented student activists in Southern California. It rests on ethnographic fieldwork as a means to explore both the legal and social challenges that this collective faces in their efforts to garner comprehensive immigration reform. Areas of focus include identity formation separate from a nation-based understanding, the social implications inherent in the use of terminology, and the utilization of space as an essential point for activism. While the movement often referred to as the DREAMer movement is credited to be young in its current form, California's history of immigration and immigration policy provides a basis for understanding the social justice work at present, reaching beyond a conceptualization of the DREAMer. It is within and between this historical acknowledgement and present day observation that my research takes place as a medium for understanding.

Social Sciences, 12:00-1:00

Christophe Viret
Hill Center Alumni Postsecondary Education and Occupations
Research Advisor: Nicole Lawrence
Duke Center for Child and Family Policy

Administrators at The Hill Center are interested in soliciting the perspectives of alumni and their parents regarding programmatic impacts. It is expected that this will be a multi-step evaluation process that will include surveying former students in addition to their parents. This paper highlights findings from the first step in the process, an online survey of parents. The questionnaire determined overall satisfaction with The Hill Center as well as probed how parents perceived Hill's effects on child confidence, grades, performance in post-secondary educational pursuits, and career aspirations and outcomes. Parents of alumni believe The Hill Center fosters high self-confidence among its students and improves academic performance in high school and college. This leads its students to high educational attainment and often, amongst the alumni who have finished their schooling, prestigious careers. Hill Center strengths pointed out by parents included its individualized attention, innovative curriculum, and nurturing teachers. Parent suggestions ranged from expanding existing academic programs, to increasing communication between Hill, and original schools and increasing the center's accessibility.

Community Engaged Research, 11:30-12:30

Jennifer Walker
Deep ocean conditions in the western tropical Atlantic and their relationship to climate cycling over the last 110,000 years
Research Advisor: Gary Dwyer
Earth and Ocean Sciences

This paleoceanographic study used a 30.5 meter long core from the Brazilian continental margin to connect deep ocean conditions of the western tropical Atlantic to ocean circulation – specifically the Atlantic Meridional Overturning Circulation – and to evaluate how this circulation affects climate. Benthic ostracod Krithe Mg/Ca ratios were used to reconstruct bottom water temperatures. Oxygen and carbon stable isotope data from benthic foraminifera provided a proxy for global continental ice volumes and deep water masses (North Atlantic Deep Water and Antarctic Bottom Water), respectively. In addition, deep ocean data was compared to surface ocean conditions and sediment chemistry XRF data from the same cores (Nace et al. 2014). The results provide some evidence for delayed change from the surface ocean to the deep ocean, especially in terms of temperature changes. While carbon isotope data demonstrated deep ocean water mass changes, there was a lack of evidence for a relationship between these deep ocean water masses and Heinrich events at this study site. Therefore, this suggests that this location is not experiencing great circulation effects from changes in Atlantic Meridional Overturning Circulation specifically during Heinrich events. There are weak relationships between other deep ocean conditions and Heinrich events, such as when looking at shell abundances and temperature.

Physical Sciences, 12:30-1:30

Katie Walter
A Developmental Approach to Conventional and Unconventional Leadership in Adolescence
Research Advisor: Christina Grimes
Psychology and Neuroscience

Seventh- (n=327) and ninth-grade (n=247) students completed sociometric nominations to identify leaders and describe peers, questionnaires to assess their behaviors, and social centrality maps. Teachers also completed a checklist assessing students' leadership. Both conventional and unconventional leadership were associated with popularity, social impact, and relational aggression. Unconventional leadership was associated with aggression, low teacher ratings, and other deviant behaviors (e.g. drug use and general delinquency) in both 7th and 9th grade. Conventional leadership was associated with high academic performance, high teacher ratings, and extracurricular activities in 7th and 9th grade. From 7th to 9th grade social preference and social impact remained high for girl conventional leaders but significantly declined for boy conventional leaders. Individual and social network centrality did not have any significant changes with unconventional leadership from 7th to 9th grade. However, conventional boy leaders' social network centrality significantly declined from 7th to 9th grade.

Psychology Graduation with Distinction, 12:00-1:00

Catherine Wang
Understanding the biological foundation of IDH1-mediated gliomagenesis
Research Advisor: Hai Yan
Pathology

IDH1 mutations are present in the vast majority of progressive gliomas, including oligodendrogliomas, astrocytomas, and secondary glioblastomas. While normal IDH1 functions to produce alpha-ketoglutarate, the mutant enzyme confers neomorphic activity by producing D-2-hydroxyglutarate, an oncometabolite responsible for aberrant methylation in IDH1-mutated tumors. However, the full breadth of the effects of mutant IDH1 on the behavior of cells is largely unknown. This study will aid in understanding the oncogenic potential of mutant IDH1 by generating a genetically faithful mouse model of gliomagenesis. These experiments will allow for the study of the effects of mutant IDH1 on the neural stem cell population of the mouse brain in vivo, offering a comprehensive look at the biological effects of the most common mutation profile found in progressive gliomas while shedding light on its malignant progression in a robust model system. These findings will offer a unique view of the disease and encourage the development of novel cancer therapies, not only for progressive gliomas, but for the many other cancers that present with mutations in IDH1.

Biological Sciences, 12:30-1:30

Hannah Ward
Spirituality and Health in an Increasingly Secular Age
Research Advisor: Mark Goodacre
Religion

Incorporating spirituality in health care practices has been correlated with health benefits such as reduced stressed, increased perception of well-being, and overall confidence in care regimen. However, despite the known benefits of including spirituality in healthcare practices, it continues to be underutilized in established healthcare institutions and rarely discussed when training future healthcare professionals. The United Kingdom's healthcare system known as the National Health Service (NHS) is divided into Trusts which govern regional health care services. Throughout my research I explored several Trusts in the United Kingdom and learned the difficulties of including spirituality in healthcare practices (legal, social, and medical) and how the secular system of the NHS has contributed to these difficulties.

Humanities, 11:30-12:30

Daniel Wei
Empathy under Stress: Emotionally Impaired, Cognitively Spared
Research Advisor: Kevin LaBar
Psychology and Neuroscience

Empathy is the ability to recognize and vicariously experience the emotions of another person. Typically empathy is typically defined along two dimensions: cognitive and emotional. Cognitive empathy is the capacity of an individual to understand and identify another's emotional state independent from his or her own affective state. By contrast, emotional empathy is a shift in affective state towards that of another person. Cognitive and emotional empathy are thought to have differential effects on behavior motivation, with emotional empathy more closely linked to helping behavior. Investigating the effects of stress on empathy is important for understanding helping behavior in real-world contexts, as stressful situations often elicit the greatest demand for empathic responding. To date, no studies have directly manipulated and examined the effects of stress on multiple dimensions of empathy. In this study, cognitive and emotional empathy were evaluated in ecologically valid context under a controlled stress manipulation with a social component. Stress induction was corroborated using psychophysiological measures. Analyses revealed that stress has differential effects on cognitive and emotional empathy. Stress and control groups performed equivalently on the cognitive empathy task, but the stress group was significantly impaired on the emotional empathy task. These results suggest that stress may shift individuals to a less emotionally empathic state with cognitive empathy intact, perhaps as an evolutionary adaptation for self-preservation. This study has implications for understanding how prosocial helping behavior is informed in stressful situations, especially in the context of professions that operate in stressful contexts with high empathic demands.

Behavioral Sciences, 11:30-12:30

Johnny Wei
Investigating the Crosstalk between HER2 and the type-III TGF-β Receptor in Breast Cancer
Research Advisor: Gerard Blobe
Pharmacology & Cancer Biology

The TGF-beta signaling superfamily regulates a wide range of cellular functions, including proliferation, angiogenesis, migration and apoptosis. It also plays a role in cancer, primarily as a tumor suppressor in early stages of disease but switching to a tumor promoter in later stages. A key mediator of TGF-beta signaling is the type-III TGF-beta co-receptor (TBRIII). Loss of TBRIII function has been linked to a more aggressive and invasive cancer phenotype, suggesting TBRIII as a key mediator of cancer development and progression. Previous studies have found that TGF-beta signaling can interact with other oncogenic cellular signaling pathways to potentially promote tumorigensis in a synergistic manner. In this study, I examine the axis between TBRIII and HER2, a receptor tyrosine kinase that is a member of the EGFR family, in the context of breast cancer. I investigated the molecular and phenotypic effects of differential receptor expression across multiple breast tumor cell line models: 4T1, MCF-7, and HMEC. I demonstrate that differential expression of TBRIII and HER2 affect cells in a context-dependent manner, with co-expression of both receptors promoting expression of TGF-beta signaling proteins and showing increased cellular migration, while showing more attenuated effects in MCF-7 and HMEC cells. This study examines a potentially novel role of TBRIII and how it regulates TGF-beta signaling in conjunction with other cellular signaling cascades.

Biological Sciences, 12:00-1:00

McCall Wells, Jemi Galani, Ishan Thakore, Emma Zhao, Ronnie Wimberely
Juntos: A Digital Health Intervention
Research Advisor: Sara LeGrand
Global Health

Health disparities continue to disproportionately affect communities of color and diverse sexual and gender identities in the United States. At the intersection of these identities are queer people of color (QPOC). QPOC communities experience discrimination based on racial diversity, sexual and gender diversity, and for the intersection of those identities. In addition to stigma and lack of community support, inadequate access to health facilities makes members of this community more susceptible to health disparities, and more likely to experience worse health outcomes than lesbian, gay, and bisexual (LGB) white men and women. While the MSM (men who have sex with men) community has already been identified as a community that is particularly vulnerable to sexually transmitted diseases (STDs), drug abuse, violence, sex work, and HIV, disparities are disproportionately amplified for Black and Latino MSM. MSM of color experience higher rates of violence, drug use, and STD infection including HIV than white MSM even though QPOC are more likely to use condoms and have fewer sexual partners than white MSM. For Latino MSM, additional stressors like immigration status, language barriers, religious communities, and racism and discrimination experienced both internally and externally create poorer behavioral, social, mental health and physical health outcomes. During the project, the team will adapt an existing internet and mobile phone based intervention designed to reduce sexual risk behaviors, create positive norms around health behaviors, promote health and wellness, and provide a platform for community building for Latino MSM. The full Juntos team will complete formative research, comprised of in-depth interviews and surveys with Latino MSM and a comprehensive literature review, by the end of the spring semester. Formative research is designed to assess the needs of the Latino MSM community and determine how an online intervention might best meet those needs.

Bass Connections,

Elizabeth Wiley
Evaluation of Individual Aye-Aye Enrichment Usage
Research Advisor: Leslie Digby
Evolutionary Anthropology

This project sought to assess the effectiveness of different types of enrichment in engaging the attention of and eliciting natural behaviors in members of the aye-aye colony at the Duke Lemur Center. The Lemur Center has been working to evaluate and enhance enrichment efforts for its aye-ayes, as this species demonstrates destructive tendencies and several individuals appear to be under stress during their captivity. This project involved direct observation of multiple individual aye-ayes through the process of receiving an enrichment item, processing it, and returning to previous behavior after finishing using it. The enrichment items used were those the Lemur Center typically gives to the aye-ayes. The enrichment items used were bamboo feeders, metal feeder cylinders, peanut butter and wood sandwiches, wood feeders, and simple cardboard box/paper enrichment. Each animal was presented with each enrichment item three times through the course of the research and observed for as long processing lasted. Each trial was ascribed a completion level based on how completely the animal processed the item. The trials were analyzed with descriptive statistics of the time spent with each item, the percent time spent eating and tapping with each item, and the average completion level for that individual with each item. These statistics reveal several individual differences, as well as an overall preference for bamboo feeders that are not tied onto the structure in the enclosure, as opposed to ones that are. In addition, two aye-ayes included in the trial were moved to be housed together during the trial. Enrichment trials were still carried out with them, but their statistics were not included with the others. Observation showed that enrichment processing was affected by the presence of another aye-aye in the enclosure, and that dynamics between the two animals based around enrichment changed during the weeks of trials.

Behavioral Sciences, 12:00-1:00

Jillian Williams
The Devil and the Deep Blue Sea: A Comparative Constitutional Approach to Understanding (In)Equality
Research Advisor: Jedediah Purdy
School of Law

The bedrock of American citizenship is the assumption that all men are equal, that they are endowed with such unalienable rights as life, liberty, and the pursuit of happiness, and that governments are then instituted among men in order to secure these rights. Yet, history has shown us the opposite. Black men and black women have systematically been considered "less-than," and even more recently, black bodies lie at the crux of what it means to be treated equally (or unequally) in the eyes of the law. In light of this, my research project looks first at American constitutional theory and the relationship between race, racial identity, property, and ownership in the United States, and argues that while in theory we might live in a world without inequality, in practice this is rather impossible. Hence, my paper both poses and answers the question, "how much inequality is too much?" by comparing American understandings of "equality" with that of Indian and South African constitutional approaches to "socio-economic" rights to food, shelter, healthcare, and education.

Social Sciences, 12:30-1:30

Angela Woods
Directed Evolution of a Malonate Semialdehyde Dehydrogenase
Research Advisor: Michael Lynch
Biomedical Engineering

Malonic acid and its derivatives represent an annual worldwide market of greater than 1 billion U.S. dollars, and the applications include flavors and fragrances, vitamins, carpet and fabrics, adhesives, construction materials, and pharmaceutical products. Malonate is currently produced from petroleum, a nonrenewable source that is environmentally harmful. Advancements in fermentation science, synthetic biology, and metabolic engineering have made the possibility of converting to renewable feedstocks attainable. In this study, I propose to develop a novel engineered microbe and fermentation process to produce malonate through the directed evolution of a malonate semialdehyde dehydrogenase. In this study, directed enzyme evolution will be used. Wild type E. coli succinic semialdehyde dehyrodgenase (SSADh), encoded by the gabD gene, shows a low level of activity against malonate semialdehyde (MSA). The goal of this study is to identify beneficial mutations in the SSADh scaffold that improve malonic semialdehyde dehydrogenase activity by using a selection screening based approach. For the experiment, baseline growth studies for selection strains will be conducted, and boundary conditions will be identified. Secondly, selection conditions will be designed based on those boundary conditions. Thirdly, I will construct a mutant library of gabD variants. Next, selection of improved variants will be conducted, followed by enzymatic assay for MSADh. Finally, gabD mutants with improved MSADh activity will be confirmed. This work will aid in addressing the research question of how to efficiently use sustainable processes to produce important substances like malonate.

Biological Sciences, 11:30-12:30

Danwei Wu
Exon junction complex component RBM8a is needed for neurogenesis
Research Advisor: Debra Silver
Molecular Genetics & Microbiology

Asymmetric division is necessary for the generation of diverse progeny as well as the shaping of cortical layers that define a developed brain. During asymmetric division, neural stem cells (NSC) undergo a simultaneous process of self-renewal and differentiation, producing additional NSCs and intermediate neural progenitors (INPs) or neurons, respectively. This investigation evaluates the role of RBM8a in neural development. RBM8a is a component of the exon junction complex (EJC) that forms a heterodimer with Magoh and enables eIF4a3 to bind stably to mRNA. Our findings show that RBM8a haploinsufficient mice exhibit a reduction in cortical size characterized by increased ectopic neuronal differentiation and a decrease in INPs. These ectopically differentiated neurons undergo apoptosis, depleting the neuronal population and leading to microencephaly. The RBM8a mutant phenotype is a phenocopy of the Magoh haploinsufficient mutant phenotype. These findings suggest that the Magoh/RBM8a heterodimer may be involved in regulating neurogenesis via EJC facilitated mRNA surveillance pathways; however, further data is needed for support of this mechanism.

Biological Sciences, 11:30-12:30

Ege Yalcinbas
Multisensory Integration Differences Between Older and Younger Adults
Research Advisor: Michele Diaz
Psychology and Neuroscience

It is known that with age, sensory functioning declines. Previous studies have suggested that although older adults' ability to perceive sensory information in a single modality deteriorates, they may benefit from multimodal sensory integration more than younger cohorts, a phenomenon coined "inverse effectiveness." The McGurk effect is a well-established example of how the perception of two different sensory stimuli can change when they are presented concurrently and information is integrated in the brain. In this event-related fMRI experiment, 18 healthy younger and older participants were asked to identify phonemes. Trials were either consistent (i.e., auditory and visual representations were of the same phoneme) or inconsistent (i.e., auditory and visual representations were of different phonemes and elicited the perception of a third phoneme - namely, the McGurk effect). In both the fMRI and behavioral analyses, we used a 2 x 2 ANOVA with Age and Condition as factors. Behavioral analyses revealed that consistent trials were responded to significantly faster than inconsistent trials for both age groups. Moreover, younger participants responded significantly faster than older participants. fMRI analyses revealed that, for both consistent and inconsistent trials, older participants had greater bilateral activation in lateral occipital cortices and superior parietal lobes compared to younger participants. Younger participants had greater activation in orbital frontal cortices, insular cortices, and superior temporal gyri compared to older participants, which could have accounted for their faster reaction times. These findings do not support an inverse effectiveness in multimodal perception for older adults.

Bass Connections, 12:00-1:00

Jessica Yan
Characterization of F-actin Stress Fibers in in Aging Endothelial Cells
Research Advisor: George Truskey
Biomedical Engineering

Development of atherosclerosis is a result of elevated endothelial cell (EC) permeability and accelerated aging. Previous research has found that increased cell contractility due to age-related intimal stiffening contributes to increased permeability. We further characterize the mechanism of contractility by studying F-actin stress thickness and localization with increasing cell age. We hypothesized that F-actin stress fibers become thicker and denser with increasing EC age. ECs were seeded onto 15kPa polyacrylamide gels and stained with phalloidin for F-actin after 24 hours. Stress fibers in aged ECs (population doublings > 44) were found to be thicker than those in young ECs (population doublings < 31) ($p<0.01$). In addition, fibers in young cells were localized to the periphery of the cell, while fibers in aged ECs were distributed along the length of the cell. Because glycocalyx degradation is important in aging EC dysfunction, we examined actin stress fibers after treatments that enhance (angiopoietin-1) or deplete (heparinase III) the glycocalyx. Stress fiber thickness in young cells increased after heparinase treatment compared to the untreated control ($p<0.05$). Fiber thickness in aged ECs with angiopoietin-1 treatment decreased ($p<0.05$) compared to untreated controls. In conjunction with traction force experiments that show differences in contractile force, these results suggest that contractility increases with cell age due to thicker and higher density of actin stress fibers along the length of the cell, and that loss of glycocalyx is related to this increase in contractility.

Biological Sciences, 12:00-1:00

Zohair Zaidi
Genetically Targeted Non-Invasive Self-Regulation of Neurons
Research Advisor: Ute Hochgeschwender
Neurobiology

Combining optogenetics with bioluminescence, i.e. combining light-sensing molecules (opsins) with biologically produced light through luciferases, provides a non-invasive approach to optogenetic manipulations. Different opsins can serve a range of functions, including neuronal activation and inhibition. Further, to have a genetically targeted luciferase act as the light source for these opsins would allow for the construction of a non-invasive self-regulation system. Specifically, if light emission of the luciferase is made to be dependent on calcium, opsin activation will be regulated by calcium influx upon depolarization of the neuron expressing the luciferase and opsin. In pursuing this concept, our project aimed to experimentally test the feasibility of this calcium-regulated light production for opsin activation. The calcium sensitive CAM-M13 complex was cloned into a split luciferase; in the absence of calcium, light production is expected to be minimal, while in the presence of calcium the two halves of the luciferase would be re-united, resulting in a functional luciferase. We present work in progress on several versions of such split luciferases. Success with this technology will not only grant for new investigations to explore the unusual brain patterns observed in various neural disorders, but will also provide a calcium indicator which is independent of fluorescent light activation

Biological Sciences, 11:30-12:30

Yuqi Zhang
Deciphering the Role of Drosophila Beta-Spectrin and Ankyrin in the morphogenesis of Drosophila melanogaster
Research Advisor: Daniel Kiehart
Biology

The molecular basis of morphogenesis, the process of an organism's development, is an interdisciplinary problem that is of great interest and significance. Failure in the processes of cell shape change and cell migration can lead to developmental defects in all organisms, such as cleft palates in humans. In Drosophila melanogaster development, the process of drawing epithelial tissue from the lateral surfaces of the embryo over a dorsal opening in a process termed "dorsal closure" provides a model system for studying morphogenesis and wound healing. This project is investigating the role of the spectrin protein, a cytoskeletal protein that lines the intracellular surface of the plasma membrane and interacts with actin filaments. Spectrin molecules have ankyrin-binding domains (ABD) that bind ankyrin, an adaptor protein that acts as a linker between spectrin and the integral membrane proteins of the plasma membrane. The goal of the project is to examine if the elimination of the ability of spectrin to bind to ankyrin has a phenotypic effect on dorsal closure. Preliminary experimentation shows that there is no phenotypic effect on the process of dorsal closure of embryos when ABD of human spectrin is expressed. Thus, this project created transgenic fly lines expressing ABD of Drosophila spectrin because the lack of phenotype may be due to lack of functional homology between the species. These fly lines are currently being studied in various tissue types to investigate how the network of the plasma membrane cytoskeleton relates to and/or affects dorsal closure.

Biological Sciences, 11:30-12:30

Emma Zhao
Assessing Cross-reactivity of Anti-alpha3(IV)NC1 (Goodpasture) Autoantibodies
Research Advisor: Mary Foster
Medicine - Nephrology

Goodpasture's syndrome is caused by an autoimmune response to the non-collagenous-1 (NC1) domain of alpha3(IV) collagen in the lungs and kidneys. In healthy humans, anti-alpha3(IV)NC1 IgG antibodies are not detected in serum using conventional assays. This suggests that human alpha3(IV)NC1 B cells are regulated by exposure to the alpha3(IV)NC1 antigen during B-cell development. In fact, the Foster Lab used transgenic mice expressing an anti-alpha3(IV)NC1 B cell receptor to show that B cells of this specificity undergo deletion or antibody editing in the bone marrow, consistent with response to antigen contact. However, knocking out the alpha3(IV) collagen gene did not rescue alpha3(IV)NC1-specific B cells from deletion, refuting the hypothesis that this regulation is mediated by alpha3(IV)NC1 collagen. We hypothesize that anti-alpha3(IV)NC1 B cells are regulated by exposure to a second antigen, which normally triggers editing and deletion of the developing autoreactive cells. Failure to do so would lead to alpha3(IV)NC1 autoreactivity and potentially to Goodpasture's syndrome. To begin to identify the second antigen, I purified IgG from Goodpasture patients and healthy individuals, and assayed IgG binding to protein arrays. Initial tests show binding to multiple proteins, but results vary considerably between individuals; further analysis will identify those proteins bound exclusively by Goodpasture IgG. I also conducted competitive enzyme-linked immunosorbent assays (ELISAs) to identify small molecules that inhibit IgG binding to Goodpasture antigen. I identified two small ringed organic compounds as potential crossreactive antigens. Candidate second antigens identified by these assays will be further tested in ex vivo and in vivo models to confirm crossreactivity with Goodpasture IgG.

Biological Sciences, 12:30-1:30

Yiqiu Zhao
Jamming Transition in Pentagon Particle System
Research Advisor: Robert Behringer
Physics

Granular Jamming has been widely investigated during the last several decades and has shown its significant role in understanding disorder system behaviors like glass transition. However, although non-spherical shape particle systems are numerous in nature, previous researchers mainly focused on 2d disks and 3d spheres. In this work we performed isotropic compression on 2D mono-disperse pentagon-shape particles and track the critical behavior of system during the granular jamming transition. Due to the geometry difference, the average coordinate number shows a lower growing rate than disk jamming. The "Edge-contact" number shows a nonlinear increase during the transition, which implies the significant role of the edge-contact network. By analyzing the percolation of such schematic chains, we have shown that the jamming of pentagon going through three different regions before finally end in mechanical stable state. Those features might be interpreted by the higher degree of freedoms of pentagon and the rotation-resistance of edge-contact.

Physical Sciences, 11:30-12:30

Olivia Zhu
The role of dopamine in zebra finch learning
Research Advisor: Richard Mooney
Neurobiology

Dopamine has been associated with reward in reinforcement learning theory. In previous experiments, dopaminergic neuron activity has been found to be elevated in anticipation of external reward. Dopamine's role in internal reward, as occurs in speech learning or playing a musical instrument in humans, though, remains unclear. Zebra finches provide a model of this system: as juveniles, they learn to copy a tutor's song after many repetitions: dopamine is likely very involved in this process. The primary source of dopaminergic input to the anterior forebrain pathway, which mediates song learning, is a projection from the ventral tegmental area (VTA) to the striatum. There is extensive evidence that increased firing of dopaminergic neurons during directed singing to females results in stabilization of bird song; conversely, ablation of dopaminergic neurons by caspase in juveniles increases variance of learned song. We have attempted to confirm the characteristics of the dopamine projection to the striatum and to learn more about its activity. Here we tried to determine which cell types are found in the avian VTA by double immunohistochemistry of TH+ and GAD67+ and retrograde labeling from Area X. We also tried to elucidate the specific mechanism by which dopamine contributes to learning by imposing optogenetic control over the VTA-Area X projection. Various viral vectors containing channelrhodopsin have been surgically injected into VTA; injected brains were then analyzed for local infection of virus and anterograde infection in Area X. Together, these experiments represent advances in discovering the specific function of dopaminergic VTA-Area X projections.

Biological Sciences, 12:00-1:00