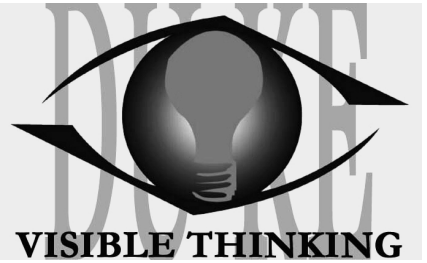

Fitzpatrick/CIEMAS Atrium
Wednesday, April 20, 2016
11:30 a.m.-2:00 p.m.

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

Ron Grunwald, Director
Brittany Kelly, Staff Specialist
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Acknowledgments

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The Duke Undergraduate Research Society
The Academic Deans of Trinity College of Arts and Sciences
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Funding Provided by Trinity College of Arts & Sciences

Undergraduate Research Support at Duke University

Duke undergraduates have received support from the following College and University programs in AY 2015-2016:

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Undergraduate Research Support at Duke University
(cont'd)

Humanities and Social Sciences *(cont'd)*
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NSF-PRUV - Department of Mathematics
Physics - High Energy Physics Program
Physics Department Summer Fellows Program
Pratt Fellows Program
Summer Undergraduate Research in Pharmacology
Research Internships in Toxicology & Environmental Health

Biological Sciences

Student	Advisor	Title	Time
Rishav Adhikari	Susan Gurley	Integrated Control of Blood Pressure by the Renin-Angiotensin System in the Kidney	12:00-1:00
Stephanie Asdell	Guido Ferrari	Non-human primate vs. human effector cells in detecting antibody-dependent cell-mediated cytotoxicity responses to HIV	12:00-1:00
Tianyu Bai	Hashim Al-Hashimi	N1-methylated DNA destabilization measured thermodynamically with UV spectroscopy	11:30-12:30
Stella Belonwu	Nirmala Ramanujam	Hs-27, a Novel Hsp90 Inhibitor, Exhibits Diagnostic and Therapeutic Potential in Triple Negative Breast Cancer	12:30-1:30
Ben Brissette	Nina Sherwood	Possible interaction of pak3 in glia in the production of the spastin phenotype in Drosophila Melanogaster	11:30-12:30
Min Tong Cai	Henry Yin	AgRP neurons and delay discounting in feeding behaviors	12:30-1:30
Sung Min Choi	Benny Chen	F-FDG PET/CT for the assessment of GVHD: results of a pilot study	12:00-1:00
Brian Chung	Tso-Pang Yao	The Effect of Nutrient Utilization on Mitochondrial Morphology	12:30-1:30
Matthew Cummins	Thomas Van de Ven	5-hydroxymethylcytosine and Ten-eleven translocation 1-3 proteins: expression and regulation in neuropathic pain	12:30-1:30
Reena Debray	Jenny Tung	Social behavior affects transcription and regulation of the rhesus macaque mitochondrial genome	12:00-1:00
Stephen DiMaria	Mark Rausher	Finding a sense of self: The evolution from outbreeding to selfing in morning glories	11:30-12:30
Katharine Ellis	Eric Spana	Characterization of Drosophila Wing Curvatures In Relation to the IP3 Pathway	11:30-12:30
Toyokazu Endo	Kenneth Poss	Bridging the Gap in Spinal Cord Regeneration in Zebrafish	12:30-1:30
Samantha Epstein	Christine Drea	Masculinization in Meerkats: Using Anatomy and Endocrinology to Examine the Development of Meerkat Pups	12:00-1:00
Matthew Farnitano	John Willis	One gene or many? Different genetic mechanisms drive convergent evolution in monkey flowers	12:00-1:00
Charlotte Farquhar	Emily Derbyshire	The Expression, Purification, and Characterization of Plasmodium Falciparum Protein Kinase 9	11:30-12:30
Jemi Galani	John Perfect	The Construction of Point Mutations in Cryptococcus neoformans Tps1 for Characterization of Enzymatic Activity	12:30-1:30

Biological Sciences (cont'd)

Student	Advisor	Title	Time
Elizabeth Ginalis	Cameron Bass	Differences in Performance on the Antisaccade Task in Football Athletes During Childhood and Late Adolescence	11:30-12:30
Vinay Giri	John Perfect	Transcription factors required for the survival of Cryptococcus neoformans in the central nervous system	12:30-1:30
Brittany Glassberg	Marty Woldorff	The influence of stimulus-reward associations on auditory processing	11:30-12:30
Kunal Goel	Nina Sherwood	Categorizing Spastin NMJ phenotypes in Drosophila as Wallerian degenerative via WldS and dSarm	12:30-1:30
Kylie Grady	Tom Schultz	Go with the Tidal Flow: Circatidal Gene Expression in Mole Crabs	12:00-1:00
Alyssa Greenhouse	Frederik Nijhout	A Mathematical Model for Celiac Disease	12:00-1:00
Anthony Hung	L. Ryan Baugh	High-throughput identification of starvation resistance genes through next-generation sequencing	12:30-1:30
Kavita Jain	Christine Wall	Iodine-Enhanced MicroCT Imaging for Primate Skull Anatomy and Biomechanics	12:30-1:30
Varun Jain	David Sherwood	Exploring the regulation of type IV collagen in the development of basement membranes in C. elegans	12:30-1:30
Alcida Karz	Ann Marie Pendergast	Investigating the role of Abl kinases in the Cancer Stem Cell phenotype	12:30-1:30
Hannah Kwak	Michael Murias	Paired-Stimulus Paradigm Validation via P50 Analysis in Typically Developing Adults	11:30-12:30
Eric Lakey	Emily Derbyshire	Expression and Purification of Chorismate Synthase in Plasmodium	12:30-1:30
Chalette Lambert	Cameron Bass	Memory Guided Saccade Task Performance in Adolescent Football Players Post-concussion	11:30-12:30
Laura Lewis	Brian Hare	Memory of Social vs. Non-Social Content in Chimpanzees	12:00-1:00
Joy Li	Katherine Garman	Esophageal submucosal glands contain cells that exhibit progenitor characteristics in vitro	12:30-1:30
Hui Yi Grace Lim	David Sherwood	How Do Cells Invade? Identifying Novel Regulators of Invasion	12:00-1:00
Margaret Locke	Scott Soderling	Identification of Novel Actin Cytoskeletal Regulators of Synapse Development	11:30-12:30
Bianca Lupan	Stacy Horner	Identification of FKBP8 as a MAVS regulator during RIG-I signaling	12:00-1:00
Thomas Meister	Michael Boyce	Dynamic regulation of COPII vesicle trafficking via O-GlcNAc modifications	12:00-1:00

Biological Sciences (cont'd)

Student	Advisor	Title	Time
Emilie Melvin	Charles Nunn	Sleep Quantification & Effects of Sleep on Cognition in Lemurs	12:00-1:00
Jacob Miller	Ahmad Hariri	Genome-wide risk for schizophrenia is associated with altered prefrontal cortex activity and functional connectivity	12:30-1:30
Briana Mittleman	Mohamed Noor	Genetic Architecture of Variation in Sex Comb Tooth Number in Drosophila subobscura	12:00-1:00
Christopher Monti	Angel Zeininger	Gel Electrophoresis to Assess the Concentration of Collagen in Human, Gorilla, and Chimpanzee Heel Pads	11:30-12:30
Aditya Mukund	Bruce Donald	Ellipses for Continuous Flexibility in Protein Design	11:30-12:30
Sagar Patel	Cagla Eroglu	Astrocyte-Secreted Hevin is Required for Experience-Dependent Microglial Pruning in Visual Cortex	12:00-1:00
Roshni Prakash	Blythe Williams	Musculoskeletal effects and injury risk in collegiate Indian classical and ballet dancers	11:30-12:30
Michael Rogers	Don Fox	The secret behind "silent" nucleotide changes: Novel tools to uncover cell and tissue-specific differences in codon bias	12:30-1:30
Michael Shih	Amanda MacLeod	Arginase 1 in Myeloid Cells Mediates Allergic Contact Hypersensitivity	12:00-1:00
Anisha Singh	George Truskey	Characterizing the insulin response of cultured human myotubes	11:30-12:30
Kyle Smith	Charlie Nunn	Water choices and disease: how lemurs avoid exposure to parasites	12:00-1:00
Sriramkumar Sridharan	Christina Meade	Effects of Heavy Marijuana Use on Brain Activation during Stroop Task in Individuals Living with HIV	12:00-1:00
Vivek Sriram	Lawrence David	Computational Analysis of Bacterial Growth Rates in the Human Microbiome	12:00-1:00
Alexandra Stonehill	Christine Drea	Effects of prenatal testosterone and maternal social status on immune health in meerkats (Suricata suricattae	12:00-1:00
Shobana Subramanian	Ornit Chiba-Falek	Investigating the role of PPAR-gamma in TOMM40-APOE-APOC1 expression regulation	12:30-1:30
Philippa Tanford	Jonathan Shaw	Fungal endophytes in moss: host or site specific?	11:30-12:30
Kelly Tomins	Susan Murphy	Effects of Tobacco Smoke on the Sperm Methylome Using a Zebrafish Vertebrate Model	12:00-1:00
Taylor Trentadue	Daniel Schmitt	Musculoskeletal health and limb biomechanics in Mandena, Madagascar: Understanding gait patterns	12:00-1:00

Biological Sciences (cont'd)

Student	Advisor	Title	Time
Lauren Waskowicz	Emily Derbyshire	Investigating species selectivity of inhibitors between Human and Plasmodium heat shock protein 90	12:30-1:30
Karen Xu	Brenton Hoffman	Investigating the Role of Vinculin Tension in Cell Spreading and Polarization	12:30-1:30
Aiwei Yan	Lindsey Glickfeld	Investigating a mechanism of modulation of visual cortical circuits by goal-directed attention.	12:30-1:30
James Yu	Charles Nunn	The Skin Microbiome and Soap Use: A study of a rural population in Madagascar.	12:30-1:30
Sangwon Yun	Anthony Sung	Investigating the Therapeutic Efficacy of Fibrinogen-Coated Albumin Nanospheres as a Treatment for Thrombocytopenia	12:30-1:30
Yingying Zhang	Jenny Tung	Identifying Enhancer Regions in the Baboon Genome using ChIP-seq	11:30-12:30
Emma Zhao	Mary Foster	iBALT, a tertiary lymphoid tissue, is a potential mediator of silica-induced autoimmunity	11:30-12:30
Roger Zou	Carlo Tomasi	Deformable Graph Model for Tracking Epithelial Cell Sheets in Fluorescence Microscopy	12:00-1:00

Community Engaged Research

Natalie Atyeo	Joan Clifford	The Dental Care Gap: Barriers to Dental Care Services among Underinsured Adults	12:30-1:30
Ben Brissette	Alma Blount	An Analysis of the Efficacy and Possible Reform of the United States Special Education System	12:30-1:30
Tina Chen	Bei Wu	Mobile app usage of volunteer first responders in Dhaka, Bangladesh	11:30-12:30
Sarah Du	Alma Blount	Impact of the Summer Research Initiative (SRI) on Self-Determination	11:30-12:30
Tianlin Duan	Dalene Stangl	Utilizing existing resources for better elderly care in Harbin, China	11:30-12:30
Medha Gudavalli	Mine Cetinkaya-Rundel	Law Enforcement Response and Sexual Violence: The Thought Process behind Arrest and Prosecution in Colorado.	11:30-12:30
Komal Kinger	Sumedha Ariely	Gender Differences In Mental Health Outcomes For An OSC Population In New Delhi, India	11:30-12:30
Helen Liu	Eve Puffer	Assessing mental health needs of pediatric oncology staff in Kuching, Malaysia	11:30-12:30

Student	Advisor	Title	Time

Community Engaged Research (cont'd)

John Lu	David Toole	Schistosomiasis Prevalence, Mass Drug Administration Efficacy, and Risk Factors in Rural Tanzania	12:00-1:00
Cam-Ha Nguyen	Amy Anderson	Developing a Summer Literacy Program for Children in Durham's Transitional Housing	12:30-1:30
Malcolm Nowlin	Anna Gassman-Pines	Addressing the racial imbalances in Durham Public Schools	12:30-1:30
Philipp Oberbeck	Alma Blount	Policy Barriers to Successful Integration of Refugee Populations in Resettlement, Employment and Language Provision in Germany	12:00-1:00
Carolyn Peterseim	Charmaine Royal	Accessibility of Treatment in Cameroon for Malaria and Sickle Cell Disease	11:30-12:30
Roshni Prakash	Carol Ripple	Voices Together: Music Therapy and Autism in Elementary Schools (2015-2016)	11:30-12:30

Humanities

Logan Beyer	Margaret Swezey	Multimodality, Learning Disabilities, and the Writing Center	11:30-12:30
Michael Courtney	David Malone	How do labels serve society?	11:30-12:30
Elizabeth Djinis	Martin Eisner	Depictions of Odysseus' Death in Literature: A Study in Myth Reception	12:00-1:00
Kathy Huang	Hans Van Miegroet	Zeng Fanzhi and the Global Art Market	11:30-12:30
Vania Ma	Richard Rosa	Cesar Nicolas-Penson's "The Galindo Virgins" as Edenic Creation Myth and Foundational Fiction	12:30-1:30
Indrani Saha	Mark Olson	Perceptual Disruption and Action: a multidisciplinary analysis of Carlos Cruz-Diez's Chromosaturation	11:30-12:30
Henry Washington	Wahneema Lubiano	"No Hiding Place:" Running as Complexly Vexed and Historicized Relay in James Baldwin's If Beale Street Could Talk"	12:00-1:00

Physical & Quantitative Sciences

Student	*Advisor*	*Title*	*Time*
David Builes	Richard Hodel	The Large Cardinal Hierarchy	11:30-12:30
Shivram Chandramouli	Miguel Nicolelis	Direct Cortical Control of Navigating Robots	12:30-1:30
Rebecca Culver	Amanda Hargrove	Oxazolidinone-Based Small Molecule Libraries for Selective Recognition of Therapeutically Relevant RNA	11:30-12:30
Chris Eckersley	Cameron 'Dale' Bass	Foul Tip Impact Attenuation of Baseball Catcher Masks Using Head Impact Metrics	12:30-1:30
Dylan Eiger	Stephen Craig	Effects of Backbone Structure on Polymer Mechanochemistry	12:00-1:00
Brody Kellish	Kyle Bradbury	Automated Rooftop Solar PV Detection and Power Estimation Through Remote Sensing	11:30-12:30
Jason Luo	Steven Malcolmson	Selective, and Enantiospecific Synthesis of 1,3-Amino Alcohols via Azaallyl Anion Ring-Opening of Epoxides	12:30-1:30
John McDermott	Alan Boudrerau	Evidence for Volatile Modification of Compacting Crystal Assemblages	12:30-1:30
Katrina Miller	Phillip Barbeau	Advancements in Tracking Detector Technologies	12:30-1:30
Michael Shih	Jennifer Roizen	Catalytically Inducing a Site-Selective Asymmetric Cyclopropanation Reaction	11:30-12:30
Avery Silverman	Gleb Finkelstein	Graphene Sample Preparation Methods Improvement and Analysis	12:00-1:00
Grace Wang	emily derbyshire	Biochemical characterization of Plasmodium falciparum prolyl tRNA synthetase	12:00-1:00
Jason Xu	Amanda Hargrove	Synthesis of a Diphenylfuran-Based Small Molecule Library to Target the MALAT1 Triple Helix	11:30-12:30
Ashling Zhang	Jennifer Roizen	Exploring the directing effect of iminopyridine-oxazaline-based cobalt complexes on C-H amination	12:00-1:00

Psychology – Graduation with Distinction Candidates

Student	*Advisor*	*Title*	*Time*
Ada Aka	Elizabeth Marsh	Retrieving Foundational Concepts to Improve Reading Comprehension	12:30-1:30
Rebecca Austin	Greg Appelbaum	Transcranial Magnetic Stimulation enhances working memory	11:30-12:30
Stephanie Banks	Rick Hoyle	Self-Control Forecasting: How Do We Predict Our Self-Control?	11:30-12:30
Nourhan Elsayed	Kathleen Sikkema	The Ecology of Resilience: Indicators and Predictors of Psychological Health in Disadvantaged Lebanese Youth	11:30-12:30
Caitlyn Gold	Steve Asher	The Cost of Co-Rumination: Excessive Problem Discussion, Anxiety, and Depression in Young Adults	12:30-1:30
Nadine Goldberg	Mark Leary	It's [Not Just] About Time: Time Management Difficulty in First-Year Undergraduates	12:30-1:30
Mary Hagan	Elizabeth Brannon	Mad about Max's Math: Training the approximate number system in preschoolers	12:30-1:30
Rachel Hennein	Eve Puffer	Poverty and HIV Risk in Rural Kenya: Options and Sources of Support for Youth and Adolescents	12:30-1:30
Ashley Heywood	Zach Rosenthal	Intense Emotional Responses to Sound: Difficulties in Auditory Sensory Over-Responsivity	11:30-12:30
Byung Cheol Lee	Scott Huettel	Tracing Consumer Food Decision In A Realistic Shopping Environment	12:30-1:30
Xin Tong Lim	Timothy Strauman	Predicting Depressive Symptoms: Big Five, Self-Compassion, and Rumination	12:30-1:30
Lauren Miranda	Karen Murphy	Disconnected Dyads: the dynamics of the coach/athlete relationship in lesbian, gay, and bisexual athletes	12:00-1:00
Christine Nunez	Zachary Rosenthal	Habituation in a Laboratory Emotion Regulation Paradigm: Diagnostic, Trait, and State Anxiety	11:30-12:30
Ana Restrepo	Rick Hoyle	Does everyone do it? The general tendency to underestimate capacities in self-control forecasting	12:30-1:30
Paige Scarbrough	Makeba Wilbourn	How infants learn about food: Discrimination and associative learning of food-related emotions	11:30-12:30
Clarissa Schilstra	Robert Thompson	Who helps and how? Social support and quality of life of adolescents with chronic illness	11:30-12:30

Psychology & Behavioral Sciences

Student	*Advisor*	*Title*	*Time*
Logan Beyer	Karen Murphy	Sensory sensitivity in typically developing adults, typically developing children, and children with autism spectrum disorder	12:30-1:30
Yike Chen	Angela Tunno	Race and Hopelessness: A Comparative Group Study on Suicidality	12:00-1:00
Erica Ortiz	Edward Levin	Neurobehavioral Effects of D1R and D2R Antagonists on TDCIPP Treated Zebrafish Larvae	12:00-1:00
Lauren Rivkin	Geraldine Dawson	Affective state of children with autism influences frontal brain activity while viewing of social stimuli	12:30-1:30
Natasha Sakraney	Greg Appelbaum	The Semantics of Cognitive Neuroscience: Mapping Structure and Evolution	12:30-1:30
Danielle Sumner	Kearsley Stewart	Social Responsibility of the Global Health Researcher: Ethics Training Workshops	11:30-12:30
Noah Triplett	Eve Puffer	Addressing the Gaps in Mental Health Care for Spanish-Speaking Individuals in Durham, N.C.	12:30-1:30
Daniel Ye	Christina Meade	Neural Substrates of Choice & Impulsivity Associated with Long-Term Cocaine Dependence and HIV	12:00-1:00

Social Sciences

Student	*Advisor*	*Title*	*Time*
Abi Amadin	Truls Østbye	Household CHAOS and SES during infancy at 6 and 12 months.	11:30-12:30
Sachet Bangia	Jonathan Mattingly	Quantifying Gerrymandering	11:30-12:30
Nourhan Elsayed	Zachary Rosenthal	An exploratory evaluation of blended learning for CBT dissemination	12:30-1:30
Zachary Faircloth	Michael Hardt	The Politics of Rejection in Ramallah and Nabi Saleh	12:30-1:30
Zachary Fowler	Sherryl Broverman	Health Correlates of Secondary School Attrition among Female Youth in Rural Kenya	12:30-1:30
Beatriz Hayes-Meizoso	Joseph Grieco	Public Perceptions of International Organizations and the American Use of Force	11:30-12:30
Suhani Jalota	Michelle Connolly	The Effect of Slum Redevelopment on Child Health Outcomes: Evidence from Mumbai	12:00-1:00
Emily Kragel	Charles Thompson	Barriers to Healthcare Access Faced by Indigenous Women in the Palajunoj Valley, Guatemala	12:00-1:00
Leslie Niiro	David Malone	How to Teach Traumatic History: A Case Study in Buenos Aires, Argentina	12:00-1:00
Ruici Ong	Chantal Reid	Perceptions Matter: Smallholder Farmer Views on Climate Change	11:30-12:30
Connor Phillips	Edmund Malesky	The Experiential Connection?: Asymmetric Polarization and Political Experience	12:00-1:00

Rishav Adhikari

Integrated Control of Blood Pressure by the Renin-Angiotensin System in the Kidney

Research Advisor: Susan Gurley, Nephrology

High blood pressure (BP) afflicts 1.5 billion people, but in the majority of patients the precise etiology of hypertension cannot be identified. The renin-angiotensin system (RAS) is a major regulator of BP and pharmacologic RAS inhibitors are used to lower BP in many patients. However, the specific cellular targets of the RAS that control BP are not known. Our study suggests that RAS signaling in the renal proximal tubule and the vasculature may have critical roles in BP regulation by modulating fluid reabsorption and sodium excretion by the kidney. These studies were conducted using two novel transgenic mouse models in which the primary receptor for RAS signaling, AT1R, was eliminated from either the renal proximal tubules (PTKO) or the vasculature throughout the body (SMKO). Our lab previously showed that both the PTKO and SMKO mouse lines are protected from hypertension induced by treatment with exogenous angiotensin II, the ligand for AT1R. Here, we show that abrogation of RAS signaling in both of these tissue targets results in enhanced sodium excretion by the kidney (natriuresis), which could lead to lower blood volume and BP. We found that RAS signaling at these two tissue targets modulates the expression and physiologic activity of key sodium transporters along the nephron. This RAS-mediated regulation of natriuresis may explain a key mechanism of protection from hypertension. Better understanding of RAS signaling will contribute towards the larger goal of elucidating the pathogenesis of hypertension and identifying useful targets to treat and prevent the highly prevalent disease.

Biological Sciences, 12:00-1:00

Ada Aka

Retrieving Foundational Concepts to Improve Reading Comprehension

Research Advisor: Elizabeth Marsh, Psychology and Neuroscience

Improving reading comprehension, a fundamental skill for students at all levels, is essential in the current education system. Having foundational knowledge (the knowledge an individual has and can bring into mind) facilitates reading comprehension. In our study, we developed an intervention using retrieval as a tool to target foundational knowledge with the goal of supporting reading comprehension. Participants engaged in one of three activities before reading a passage: retrieving concepts required to comprehend the passage (test group), only studying these concepts (study group), or not engaging in any activity (no exposure group). All participants took a reading comprehension test immediately after the pre-reading activity or two days later. Results demonstrated that pre-reading activities successfully increased foundational knowledge about the foundational concepts; however, reading comprehension did not benefit from this increase in foundational knowledge. Parallel to what is hypothesized, participants who had lower structure building capabilities performed better on the reading comprehension test after being exposed to the foundational concepts, more than participants with higher structure building capabilities did.

Psychology GwD, 12:30-1:30

Abi Amadin

Household CHAOS and SES during infancy at 6 and 12 months.

Research Advisor: Truls Østbye, Duke Medicine Department of Community and Family Medicine

Household chaos is a parameter that takes into account the level of environmental confusion present in a home and is identified by factors such as disorganization, lack of routine, excessive noise and crowdedness. The environment a child grows up in has the power to affect many aspects of that individual's life and it is known that increased levels of chaos can negatively affect a child's long term behavioral and social skills. Household CHAOS has been found to be its own parameter, and not just a proxy for socioeconomic status (SES), but we are interested in whether there is such a correlation between SES and chaos present within a birth cohort of predominately black and white mothers. The Confusion, Hubbub, and Order Scale (CHAOS) is a 15-item questionnaire designed to assess the level of chaos in the household. A sub-sample of 354 mothers completed the CHAOS and a questionnaire that obtains their SES, based on self-reported income, when their infants were 6- and 12-months old. We explored the degree to which there is a correlation between household CHAOS and SES. Additionally, this study aimed to discover if SES or the number of people living in a household is a better indicator of household chaos within a cohort of mothers with infants.

Social Sciences, 11:30-12:30

Stephanie Asdell

Comparison of non-human primate vs. human effector cells in detecting antibody-dependent cell-mediated cytotoxicity responses to HIV

Research Advisor: Guido Ferrari, Molecular Genetics & Microbiology

Antibody-dependent cell-mediated cytotoxicity (ADCC) integrates antibody (Ab)-mediated adaptive and Fc-gamma receptor on effector cell-mediated innate immunity to recognize and kill HIV-infected target cells, which is detected as delivery of Granzyme B (GzB) into the effector cells. Examining the selective recruitment of non-human primate (NHP) and human effector cells side-by-side informs in characterizing the ADCC NHP immune response, which is often studied in pre-clinical trials used to design novel AIDS vaccine strategies. The flow cytometry-based GranToxiLux assay was used to monitor ADCC. Peripheral Blood Mononuclear Cells from 6 human donors, representing the three Fc-gamma receptor IIIa phenotypes, and splenocytes from 5 NHP donors, for which phenotypic data has not been characterized, were used as source of effector cells. As source of ADCC-mediating Ab we used: 1) NHP and human plasma pre- and post-vaccination with an AIDS vaccine; 2) chronically-HIV-infected human sera; and 3) NHP and human monoclonal antibodies (mAbs). Overall, the data indicated that ADCC responses detected by NHP effectors were below that detected using human effectors. Additionally, NHP effectors promoted higher levels of cytotoxic activity with post-viral challenge NHP sera than post-vaccine NHP sera. These results indicate that utilization of human PBMC as a source of effector cells enables us to detect ADCC responses mediated by human and NHP Ab. However, differences in the frequency of effector cells and polymorphisms of Fc-gamma receptor IIIA between humans and NHP must be taken into account when evaluating differences in Fc-mediated Ab functions in the two species.

Biological Sciences, 12:00-1:00

Natalie Atyeo

The Dental Care Gap: Analyzing Barriers to Dental Care Services among Underinsured Adults in Durham County, North Carolina

Research Advisor: Joan Clifford, Romance Studies

Policymakers view dental care as a supplemental luxury rather than an essential health need. Medicare specifically excludes dental care coverage, and while the Affordable Care Act cites dental care as an essential health benefit for children, most state Medicaid plans and many private insurance plans provide limited to no dental benefits to adults. Underinsured Americans exhibit higher incidence of oral disease, and this untreated dental decay often escalates into more serious health problems such as abscesses and even heart disease. The number of individuals turning to the Emergency Department for untreated dental issues continues to rise. This project analyzed major gaps in access to dental care among underinsured adults in Durham, North Carolina. The three part methodology involved (1) a literature review of the national policies regarding dental coverage and a review of the oral health status of Durham residents (2) an updated grid of resources for free and low cost dental care available in Durham County and (3) a case study of the major dental issues reported by patients served by LATCH, a program of the Duke Division of Community Health which provides healthcare management for underinsured Durham residents. Through our analysis we found that the largest unmet needs for Durham adults were affordable specialty dental care (such as oral surgery procedures) and coverage for lab fees (such as costs for dentures). While Durham provides some resources for low cost care, these services are limited to basic treatments, and care is often targeted towards children rather than adults.

Social Sciences, 12:30-1:30

Rebecca Austin

Transcranial Magnetic Stimulation enhances working memory

Research Advisor: Greg Appelbaum, Psychology and Neuroscience

Cognitive decline associated with aging affects a large proportion of America's progressively older population. To remedy this decline, various working memory (WM) training protocols are emerging, the most novel of which utilize Transcranial Magnetic Stimulation (TMS) to excite neuronal activity, induce long-term potentiation, and enhance cognitive functioning. Ultimately aiming to remediate WM decline in aging adults by using TMS, this study first sought to establish ideal TMS parameters to induce WM improvements. Using a delayed match-to-sample (DMS) WM task with both maintenance and manipulation conditions, it was hypothesized that active TMS, relative to sham TMS, would differentially impact task performance depending on its timing of administration, either before encoding or at the end of the delay phases. Following screening and practice, subjects trained on the DMS task for 4 hours over 2 days, receiving 5s of either active 5Hz TMS at 100% of motor threshold to the dorsolateral prefrontal cortex (DLPFC) or sham TMS. The phase of active versus sham TMS stimulation was counterbalanced across participants. The results suggest that active TMS improved DMS reaction time and accuracy as compared to sham TMS. Specifically, maintenance task performance improved with TMS before encoding, while manipulation task performance was aided by TMS during the delay period. Although promising, these results should be bolstered by increased sample sizes and individualized fMRI-based DLPFC targeting before deciding on the optimal timing of TMS for each DMS task condition in aging adults.

Psychology GwD, 11:30-12:30

Tianyu Bai

N1-methylated DNA destabilization measured thermodynamically with UV spectroscopy

Research Advisor: Hashim Al-Hashimi, Biochemistry

DNA is known to form a double-helical structure in concordance with the widely-accepted Watson - Crick Model, but under certain conditions, base-pairs within the structure of DNA may adopt a unique flipped orientation and become a Hoogsteen base pair. We turn to N1-methyl adenosine and N1-methyl guanosine, which occur in DNA as a form of alkylation damage, and in RNA as a posttranscriptional modification, that have dramatically different consequences. They create Hoogsteen base pairs in duplex DNA that maintain the structural integrity of the double helix, but block base pairing all together and induce local duplex melting in RNA, providing a mechanism for modulating RNA structure through posttranscriptional modifications. Hoogsteen base pairs have also been observed across a variety of different DNA complexes and may have a structural role in targeting certain drugs and proteins to the DNA strand. My research focused on screening varied DNA sequences for Hoogsteen base-pairs stabilities without the use of advanced, high-cost NMR spectroscopy. The overall goal for this project was to measure DNA sequence contexts that are more likely to form Hoogsteen with low-cost and efficient UV melting experiments, which will streamline and guide areas of future HG base pair studies. Results showed that Gibbs free energy of the DNA melting compared similarly to NMR investigations of Hoogsteen base pair destabilization energetics, but enthalpy and entropy deviated from the NMR results.

Biological Sciences, 11:30-12:30

Sachet Bangia
Quantifying Gerrymandering
Research Advisor: Jonathan Mattingly, Mathematics

This project) devised a diagnostic tool to quantify the effect of gerrymandering on congressional elections across a number of states. Using a Markov Chain Monte Carlo method (Metropolis-Hastings algorithm), we produce a sample of possible districtings that take into account the following: population division among districts; compactness; division of counties and the percentage of minority voters. These samples have a similar profile to the actual district map across the four factors. We tally the votes for these sample districtings and compare the outcomes and competitiveness of these fictional congressional districts with those in the actual districts, to gauge whether the observed outcome is substantially different. In states where a partisan legislature drew the district map, we find that nearly every district that had the potential to be competitive went to the party in control of the legislature. The party in power achieved this by packing the opposing party's voters into as few districts as possible. We also find that majority-minority districts are demonstrably hurting Democrats in North Carolina and Maryland as they concentrate minorities into a few districts, diluting the voting power of Democratic voters within the state.
(https://services.math.duke.edu/projects/gerrymandering/

Social Sciences, 11:30-12:30

Stephanie Banks

Self-Control Forecasting: How Do We Predict Our Self-Control?

Research Advisor: Rick Hoyle, Psychology and Neuroscience

Self-control is a fundamental trait that can lead to a variety of positive life outcomes. Though self-control historically has been studied as a present or past ability, little is known of how we think of or predict self-control futuristically. The current study assessed aspects of a relatively new concept called self-control forecasting, which involves individuals predicting future tempting events and their behavioral reactions. A two-part study tested a variety of hypotheses related to self-control forecasting. In part one, participants completed various self-control measures, open-ended responses, and behavioral items in which they predicted their various self-control behaviors over the holiday. In part two, after the thanksgiving holiday, participants filled out the same behavioral measures and indicated the extent to which they performed each behavior. It was found that participants tended to overestimate their abilities to perform initiation self-control behaviors, and that they underestimated their abilities to perform inhibition self-control behaviors. Open-ended responses did not suggest a natural tendency for self-control forecasting. Trait self-control further was not a strong predictor of forecasting accuracy. These results suggest that forecasting accuracy is dependent on self-control type. Future directions for research in self-control forecasting are discussed.

Psychology GwD, 11:30-12:30

Stella Belonwu

Hs-27, a Novel Hsp90 Inhibitor, Exhibits Diagnostic and Therapeutic Potential in Triple Negative Breast Cancer

Research Advisor: Nirmala Ramanujam, Biomedical Engineering

Triple negative breast cancer (TNBC) is a highly aggressive and difficult to treat subtype of breast cancer. Since TNBC is unresponsive to hormone therapies, there is a possibility that heat-shock protein 90 (Hsp90) serves as a reasonable target for it and potentially other subtypes of breast cancer. Hsp90 is a molecular chaperone that is ubiquitously expressed in cells and essential for maintaining cell homeostasis by assisting in protein folding, aggregation, and degradation. Hsp90 is upregulated in tumor cells, where it is present on the surface, unlike in normal cells, and supports signal transduction pathways important for tumor progression. Thus, Hsp90 has emerged as an attractive anti-cancer target. Hs-27 is a novel Hsp90 inhibitor made by Dr. Timothy Haystead of Duke University's Department of Pharmacology and Cancer Biology with a fluorescein contrast agent which makes it great for diagnostics. At lower doses, Hs-27 introduces real-time, non-invasive imaging for cancer detection and at higher doses potential therapeutic benefits. Preliminary experiments with Hs-27 in human epidermal growth factor 2 (HER2) positive, estrogen receptor (ER) and progesterone receptor (PR) positive, and TNBC cell lines show that it binds to the ectopically expressed Hsp90 in tumor cells. In vitro therapy experiments also show that Hs-27 down-regulates client proteins implicated in tumor growth. In this study, I further establish Hs-27's diagnostic and therapeutic ability in vivo through hyperspectral and fluorescence imaging in dorsal skinfold window chamber tumor models, and through diffuse reflectance spectroscopy of TNBC tumor flanks and normal flanks in female nude mice.

Biological Sciences, 12:30-1:30

Logan Beyer

Multimodality, Learning Disabilities, and the Writing Center

Research Advisor: Margaret Swezey, Thompson Writing Program

Learning disabilities (LD) often go unnoticed on college campuses. Diagnoses of ADHD, ADD, and LD are subtle, and the fear of stigmatization powerfully incentivizes students with LD to adopt a "silent struggle approach" to complex assignments, especially those involving writing. The goal of this project was, first, to investigate the strategies that writing centers can employ to help LD students navigate these challenges; and second, to compile all available resources into a single, easily accessible location. The project began with research in relevant scholarship. It quickly became apparent that an environment with a universal design for learning, enriched with a variety of multimodal tools, holds the most promise to make the writing center a more inclusive campus resource. Based on this premise, a website was created as an online tool for writing center staff, administrators in campus disability access offices, as well as for individual students working independently on projects and assignments. Through a colorful, multimodal design that incorporates several different learning styles preferred by students with ADHD, ADD, and LD, the website aims to equip LD writers with the tools they need to succeed on even the most daunting assignments.

Humanities, 11:30-12:30

Logan Beyer

Operationalizing sensory sensitivity in typically developing adults, typically developing children, and children with autism spectrum disorder

Research Advisor: Karen Murphy, Psychology and Neuroscience

Forty percent of children with autism spectrum disorder (ASD) are also diagnosed with anxiety, a comorbidity that is associated with augmented impairments in social functioning. However, little is currently known about early childhood risk factors for the development of anxiety with ASD. The most promising current model postulates a causal relationship between childhood sensory over-responsivity (SOR) and the development of anxiety. It is proposed that an overreaction to an individual stimulus may be generalized to the environment over time via context conditioning, leading to the eventual development of anxiety in children with SOR. This research investigated the suitability of the paired click paradigm task, a physiological measure of sensory gating obtained via EEG, as a measure of auditory SOR. This was accomplished by determining the relationship between physiological sensory gating and survey-based measures of sensory sensitivity and anxiety in typical adults. Preliminary results with five subjects show a potential inverse relationship between improved sensory gating and both sensation seeking behaviors ($R2 = 0.738$) and low registration of sensory stimuli ($R2 = 0.236$). Thus, neurophysiological measures of sensory gating may be useful in identifying these sensory patterns. While the correlation between low registration and sensory gating is likely due to a diminished brain response to all sensory stimuli, the relationship between sensory gating and sensation seeking behaviors suggests that deficits in habituation may play a role in the development of seeking behaviors. Low registration to sensory stimuli additionally appears to be related to both trait anxiety ($R2 = 0.218$) and prevalence of anxiety symptoms ($R2 = 0.342$). In what appears to be a separate pathway, both trait anxiety and anxiety symptoms were also found to be highly correlated with sensation avoidance behaviors ($R2 = 0.615$, $R2 = 0.564$)..

Psychology, 12:30-1:30

Ben Brissette

Possible interaction of pak3 in glia in the production of the spastin phenotype in Drosophila Melanogaster

Research Advisor: Nina Sherwood, Biology

Loss of function mutations of the spastin gene in *Drosophila* lead to impaired neurotransmitter release and distinct synaptic morphology at the larval neuromuscular junction. Larval phenotypes in spastin mutants are suppressed by deletion of the gene pak3, which is highly expressed in glial cells. This suggests that an interaction between pak3-positive glial cells and neurons is required for the spastin phenotype. The goal of this project was to determine if pak3 in glia is important for the overall interaction of glia and neurons leading to the spastin phenotype. Glial pak3 was specifically targeted by using glia-specific driver lines and pak3-directed RNAi constructs in a spastin mutant background. The larvae were dissected and stained, and neuromuscular junctions were viewed under fluorescence microscopy to count total and terminal synaptic boutons on muscle 4 of each stereotypically repeated muscle segment. Data showed no effect of the RNAi lines on the spastin phenotype, suggesting either that RNAi is not strong enough to see this, or that glia are not the important cell type. To address this uncertainty and determine the level at which RNAi knocked down pak3, an RT-PCR was performed on larvae with globally expressed pak3 RNAi lines. To further test if pak3 is required in glial cells, a dominant negative form of pak3 was tested. Data from this assay suggest that pak3 expression in glia may be significant to the overall pak3-spastin interaction, and that indeed knocking down pak3 with RNAi may be insufficient to detect suppression of spastin.

Biological Sciences, 11:30-12:30

Ben Brissette

An Analysis of the Efficacy and Possible Reform of the United States Special Education System

Research Advisor: Alma Blount, Director, Hart Leadership Program

Why does our special education system function especially poorly? Students who remain in special education services perform worse than their general education peers on both academic and social assessments, and even perform worse than their peers who were in special education and were then removed from it. This project is an effort to dig deeply into the reasons behind why we are failing our students with special educational needs and what level of the system that failure is coming from. The attitudes and actions of teaching staff, school administrators, and legislators towards special education are all considered, and an analysis of the best level for intervention is conducted. Through a literature survey and research into representative situations, certain specific scenarios are analyzed and policy recommendations are offered. Finally, based on case studies of prior success at reforming the special education system, a few main ideas are presented that may help change the culture of special education and make these students a new, successful, priority.

Social Sciences, 12:30-1:30

David Builes
The Large Cardinal Hierarchy
Research Advisor: Richard Hodel, Mathematics

My research is on the justification, consequences, and extensions of the Large Cardinal hierarchy. Large cardinals are mathematical objects studied extensively by set theorists. They are particularly interesting because their existence is independent of the standard ZFC axioms. It is also a surprising fact that these large cardinals form a linear hierarchy, either in terms of direct implication or consistency strength. Large cardinals axioms also have strong philosophical motivations, as well as deep consequences for the structure of the real line. My research culminates with the study of large cardinals that are formulated in terms of elementary embeddings, ending up with the inconsistency of the Reinhardt Cardinal.

Physical & Quantitative Sciences, 11:30-12:30

Min Tong (Tannya) Cai
AgRP neurons and delay discounting in feeding behaviors
Research Advisor: Henry Yin, Psychology and Neuroscience

AgRP neurons are thought to be primarily implicated in feeding behaviors, weight gain, and energy homeostasis. However, the association of AgRP neurons to motivation in food-seeking behaviors has yet to be examined. Implementing optogenetics technique, we activated AgRP neurons in rodent models to examine the function of AgRP neurons in motivational behaviors during a delay-discounting task. We hypothesized that activation of AgRP neurons can facilitate consummatory behaviors and reduce the probability of disadvantageous choices. Specifically, satiated mice demonstrated preference for lever associated with immediate reward over the other delayed lever. Our results indicated that AgRP neurons conduct negative feedback signals to the consummatory system, promoting motivational food-seeking behaviors to reduce this signal.

Biological Sciences, 12:30-1:30

Shivram Chandramouli
Direct Cortical Control of Navigating Robots
Research Advisor: Miguel Nicolelis, Neurobiology

Brain-machine interfaces (BMIs) are bidirectional communication systems where motor commands extracted from neural data are used to control the movement of artificial devices. By enabling individuals to bypass the brain's normal output pathways, BMIs have been recognized for their clinical applications in paralyzed patients. The aims of this specific research are to expand this traditional application of BMIs to assess how the brain is able to assimilate an additional actuator. Previous studies have shown that human EEG signals can be used to navigate a robot, which shows great promise for clinical applications that could enable immobile patients to control an external robot to carry out their daily activities. However, before the full potential of this application can be realized, it is necessary to decode signals closer to the brain in order to better study this assimilation process. Thus, this research enables BMI control of navigating robots in rhesus macaques, from whom single neuron and multi-unit recordings can be obtained. The specific objectives of this work are to design the appropriate experimental paradigm, develop the hardware that allows monkeys and robots to interact, and establish BMI control of a robot in monkeys. The first two of these objectives have been successfully completed, and preliminary experimental data suggests that macaques are indeed learning to control the robot. Future work will strive to establish complete BMI control of the robot in macaques. Subsequently, we will use this novel paradigm to evaluate brain lesion and recovery.

Physical & Quantitave Sciences, 12:30-1:30

Tina Chen

Mobile app usage of volunteer first responders in Dhaka, Bangladesh

Research Advisor: Bei Wu, Global Health

This study examines how volunteers within a first responder organization, specifically CriticaLink, use mobile applications to receive dispatch data of scenes of roadside accidents. Dhaka, Bangladesh has the highest population concentration in the world. The large population, economic growth and urbanization are raising transportation demands. The increased number of vehicles, combined with poor infrastructure, has led to an increased number of roadside accidents. A short response time of first responders to these accidents is crucial to determining patient outcome. Dispatches of first responders to these accidents have traditionally been communicated through radios, or pagers. Very few first responder systems have ventured into using mobile applications. To explore the efficiency of CriticaLink's mobile application dispatch system, test dispatches were sent at various times of day to volunteers. The number of responses, and the response speeds were recorded. This test was used to determine the user attention to the CriticaLink app, and their access to data and wifi throughout the day. From the study we find that the number of responses to dispatches during the day, and during the peak times of roadside accidents, are highly dependent to access to internet connection, rather than data. Currently, CriticaLink's mobile application usage is dependent on user access to outside wireless networks, which may be difficult for all first responders to have in Dhaka.

Community Engaged Research, 11:30-12:30

Yike Chen

Race and Hopelessness: A Comparative Group Study on Suicidality

Research Advisor: Angela Tunno, Psychiatry and Behavioral Sciences

Due to the increasing recognition of disparities in psychiatric prevalence and resources within minority populations, there is a need to further investigate the relationship between racial characteristics and suicidal ideation. Previous studies indicate that Blacks are less likely to receive outpatient mental health care and more likely to be psychiatrically hospitalized. A strong predictor of suicide risk is hopelessness, which has been demonstrated to have a stronger relationship to suicidal thoughts and behavior for Blacks in comparison to Whites. The current study seeks to examine the relationship between race and hopelessness in a sample of individuals (n=74) recently psychiatrically hospitalized due to suicide attempts and ideation. A group comparison design was used to assess the differences in hopelessness for White and Black participants who had recent suicidal thoughts and behaviors. Data was derived from the Beck Hopelessness Scale and the Beck Depression Inventory, clinician-administered surveys, from a larger study assessing cognitive and affective mechanisms associated with suicidal thoughts and behavior. Findings indicated no significant difference between the two groups on reports of hopelessness. However, there was a significant difference in depressive symptom scores between the White group and the Black group, with Whites reporting more depressive symptoms than Blacks ($t = -2.098$, $p = .044$). The results of this study suggest that better understanding of racial disparities in psychiatric symptoms could have important implications in the development of culturally informed clinical interventions.

Psychology, 12:00-1:00

Sung Min Choi

F-FDG PET/CT for the assessment of GVHD: results of a pilot study

Research Advisor: Benny Chen, Pathology

This prospective pilot study aimed to evaluate the predictive value of 18F-FDG PET/CT for early diagnosis of GVHD in mice. Greater accumulation of FDG was predicted in lymph nodes, gut, liver, and spleen of the TCDBM + Tcell recipient mice compared to mice with just TCDBM cells. However, due to complications of the PET/CT machine and high brightness of the backgrounds in the scan, it was difficult to determine relative level of accumulation of FDG in these mice besides in major organs and muscles. Furthermore, the mice that received TCDBM + Tcells had to be sacrficied 8 days after TCDBM + Tcell transplant due to loss of over 30% original body mass, inhibiting further study for viability of PET/CT for assessment of GVHD.

Biological Sciences, 12:00-1:00

Brian Chung

The Effect of Nutrient Utilization on Mitochondrial Morphology

Research Advisor: Tso-Pang Yao, Pharmacology & Cancer Biology

Maintaining cellular energy levels during fasting and low glucose conditions demands a metabolic shift toward the increased utilization of fatty acids (FAs) within the electron transport chain (ETC) of the mitochondria, producing oxidative stress through the accumulation of reactive oxygen species (ROS). In response, mitochondria undergo fusion events to generate a physical barrier against oxidative damage and mitophagy; failure to produce this protective fusion has been implicated in a variety of clinical disorders ranging from type II diabetes to cancer. SIRT1 and SIRT3 are NAD+ dependent deacetylases widely touted for their ability to trigger mitochondrial fusion events, regulate calorie restriction-mediated longevity, and control cellular metabolism via the IGF/mTOR nutrient sensing pathway. Here, we utilize pharmacological and genetic manipulations to investigate the relationship between the metabolization of FAs and sirtuin-controlled mitochondrial morphology. We demonstrate that both administration of the SIRT1 activator Resveratrol (RES) and direct overexpression of the SIRT1/SIRT3 genes produce markedly increased rates of mitochondrial fusion in a manner dependent on FA metabolism. Furthermore, we demonstrate that Torin1-mediated inhibition of mTOR successfully produces mitochondrial fusion independently of -oxidation. The dependence of sirtuin-mediated mitochondrial fusion on the metabolism of FAs highlights -oxidation as an essential link between nutrient utilization and mitochondrial morphology. Understanding this relationship will provide important insight into the potential metabolic and therapeutic benefits of regulating mitochondrial morphology through controlled dietary intake.

Biological Sciences, 12:30-1:30

Michael Courtney
How do labels serve society?
Research Advisor: David Malone, Education

Labels have shaped the lives of the past and present. Specifically, this study aims to obtain information regarding labels in an educational context which will mimic the labels which are re-presented in a societal context. Thus, the psychological impacts of the labels will be compared in a microcosmic educational level to that of the greater societal level in order to draw conclusions on the state of labeling in America and the future ahead. The fact of the matter is that much of America's past has been influenced by stigmatization whether it was race, gender, or any creed deemed as the "other". Therefore, it is imperative to understand the ways in which labeling has changed and is changing in the world of education and greater society.

Humanities, 11:30-12:30

Rebecca Culver

Synthesis of Oxazolidinone-Based Small Molecule Libraries for the Selective Recognition of Therapeutically Relevant RNA

Research Advisor: Amanda Hargrove, Chemistry

For over a decade, it has been known that RNA is an important therapeutic target; however, there are few selective, drug-like small molecules that target RNA. It is proposed that commercially available libraries used in RNA-based screens are optimized for proteins, leading to low hit rates and the repeated identification of non-specific nucleic acid ligands. Therefore, there is a critical need to design small molecule libraries that are optimized for RNA. One scaffold in particular, oxazolidinone, has known affinity for biologically relevant RNAs, including ribosomal RNA and the T-box riboswitch. Therefore, we hypothesize that an RNA-targeted, combinatorial synthesis of mono-, di-, and tri- substituted oxazolidinones would lead to greater hit rates and selectivity for RNA targets. Toward this goal, a subunit library was developed, two synthetic routes have been explored, and an RNA-based screen has been conducted. In one synthetic route, phenylalanine methyl ester was cyclized to an oxazolidinone scaffold in a stereoconvergent and stereodivergent synthesis, allowing acsess to all four stereoisomers. The scaffold has been diversified at the C(4) position to synthesize a library of bis-substituted small molecules. In a second route, mono-substituted oxazolidinones were synthesized using a commercially available scaffold, which was diversified at the C(5) position. To date, one library member was screened against 12 model RNA secondary structures, and the oxazolidinone bound to two secondary structures with dissociation constants < 25 μM. Once the entire library is tested, we will use the oxazolidinone:RNA recognition information to further improve library-design for the targeting of medicinally relevant RNAs.

Physical & Quantitave Sciences, 11:30-12:30

Matthew Cummins

5-hydroxymethylcytosine (5hmC) and Ten-eleven translocation 1-3 (TET1-3) proteins in the dorsal root ganglia: expression and dynamic regulation in neuropathic pain

Research Advisor: Thomas Van de Ven, Anesthesiology

Despite the prevalence of chronic pain, not much is known about the biological mechanisms that contribute to its pathogenesis. Recently, researchers have found a link between epigenetic mechanisms and the experience of chronic pain. In particular, 5-hydroxymetyhlcytosine (5-hmC) has become increasingly recognized as an epigenetic modification with a wide variety of roles. While it has been extensively characterized in the central nervous system, not much is known about its role in the peripheral nervous system. The aim of this study was to characterize 5hmC and the proteins responsible for this modification in Dorsal Root Ganglia, the Ten-Eleven Translocation (TET1-3) proteins. We found that 5hmC is present in both the neurons and glia of DRG, and that 5hmC levels increase in the DRG after nerve injury. Furthermore, we found that all of the TET proteins are expressed in DRG, but in distinct cell types. TET2 was found in both neurons and non-neuronal cells, while TET1 and TET3 were localized to neuronal cells. Specifically, TET3 was exclusively expressed in small-diameter neurons, and it was the only member of the TET proteins that was differentially expressed after nerve injury. This finding may suggest that TET3 plays a pivotal role in the pathogenesis of neuropathic pain. Overall, this study indicates that 5hmC and the TET proteins may be important contributors to neuropathic pain, and should be subject to further research.

Biological Sciences, 12:30-1:30

Reena Debray

Social behavior affects transcription and regulation of the rhesus macaque mitochondrial genome

Research Advisor: Jenny Tung, Biology

In humans and other social mammals, low social status and social isolation are predictive of a number of disease outcomes. It is thought that this link is driven in part by chronic social stress, but the molecular underpinnings of this link are not well understood. Based on previous work linking psychological disorders to mitochondrial copy number and heteroplasmy, we examined the effects of social stress on mitochondrial copy number and gene expression in captive female rhesus macaques (Macaca mulatta). This study took advantage of experimental social status manipulations (i.e. dominance rank) based on order of introduction to the group; females introduced earlier into one of nine newly constructed groups attained higher ranks (n=45; 5 females per group). We measured mitochondrial copy number and gene expression levels in five purified populations of white blood cells. Using a meta-analytic approach that took into account heterogeneous effects across cell types, we found no effect of social rank on copy number (Bayes factor=0.69). However, grooming and proximity to other females, two measures of social integration, were positively correlated with copy number (grooming Bayes factor=15.81; proximity Bayes factor=51.40). We found that overall mitochondrial gene expression was positively associated with social status (effect size=0.0001, p=0.0008), grooming (effect size=0.010, p=0.031), and proximity (effect size=0.004, p=0.001), and negatively associated with the amount of harassment a female received (effect size=–0.009, p=0.055). Our results indicate that regulation of mitochondrial DNA—through alterations to both copy number and gene expression—may be a mediating factor in the link between social environment and health.

Biological Sciences, 12:00-1:00

Stephen DiMaria

Finding a sense of self: The evolution from outbreeding to selfing in morning glories

Research Advisor: Mark Rausher, Biology

The evolution from outbreeding to selfing is typically associated with various morphological changes: reduced pollen production, reduced nectar volume, reduced anther-stigma separation, and decreased corolla length and width. Since these traits have appeared convergently in many independent selfing lineages, the genetic and selective reasons for these changes warrant further attention. Our understanding of the genetics remains in its early days. A better understanding of the genetics will provide insight into the selective pressures and evolutionary trajectories that are associated with the evolution from outbreeding to selfing. To further understand the genetics of this transition, pollen production was quantified in an F2 mapping population developed between the two morning glories, *Ipomoea lacunosa* and *Ipomoea cordatotriloba*. The results demonstrate that there is no correlation between pollen production and the other phenotypes measured in the F2 mapping population. Furthermore, hybrid plants produce less pollen on average than either parent, suggesting a hybrid inviability. This study provides insight into the genetics of the selfing syndrome and of reproductive isolation behind the evolution of plants from outbreeding to selfing

Biological Sciences, 11:30-12:30

Elizabeth Djinis

Depictions of Odysseus' Death in Literature: A Study in Myth Reception

Research Advisor: Martin Eisner, Medieval & Renaissance Studies

Last summer I was able to travel to Greece—Kefalonia and Athens—and Florence. I examined two seemingly disparate topics: the Ancient Greek physical conception of the Underworld, and Dante's formative years. My research contributed to my senior thesis, "Depictions of Odysseus' Death in Literature: A Study in Myth Reception." In viewing a Greek temple to Pluto, the god of the Underworld, and the supposed beach where Odysseus would have made his homecoming, I was able to better understand the Homeric tradition in Greece. In Florence, I was able to understand Dante's academic background, helping me to analyze the patchwork of sources that led to his own portrayal of Ulysses in the Inferno. My thesis ultimately examines depictions of Odysseus' death, namely in Homer, Dante, Tennyson, and Primo Levi, through a combination of close readings of the texts and a broad survey of the mythical tradition around Odysseus. In my first chapter, I look at intertextuality in Dante's Ulysses, particularly in Vergil, Ovid and Cicero. My second chapter examines the Greek tradition—how Odysseus was reinterpreted from Homer into fifth century Greek tragedy. My third chapter explores post-Dante retellings such as Tennyson and Primo Levi, writers who were inspired by Dante's Ulysses but again made a figure all their own. My conclusion ties all these concepts together to prove that Dante's Ulysses was entirely separate from the classical Odysseus, and became a humanist hero for the quest for knowledge.

Humanities, 12:00-1:00

Sarah Du

Impact of the Summer Research Initiative (SRI) on Self-Determination

Research Advisor: Alma Blount, Public Policy

Self-determination - or how individuals interact with opportunities to achieve their goals - is a key component for student success and flourishing. By using a survey called the AIR Self-Determination Scale, the self-determination of eight students in an experiential learning program called the Summer Research Initiative (SRI) was measured. The scale was given at the beginning and the end of the SRI to determine whether participation in the program had an effect on their sense of self-efficacy. It was found that, for all but one of the students, the program had a positive effect on their self-determination. This has implications for the curriculum design of future learning programs hoping to increase students' motivation and self-confidence.

Community Engaged Research, 11:30-12:30

Tianlin Duan

Utilizing existing resources for better elderly care in Harbin, China

Research Advisor: Dalene Stangl, Statistical Science

In today's China, over 15% of the population is over 60 years old, and for Harbin, the most populous city in Northeastern China, the percentage is 2% above the national average: 1.7 million in total with 42% over 70 years old and 49% "empty nest" who are not able to be taken care of regularly of their children. While Harbin has become increasingly popular for institutional care among elders nationwide because of its warm weather in winter and the traditional medicine industry, the nursing facilities in Harbin can barely accommodates its own senior population. With more than 90% of the elders choosing to be taken care of at home or near their neighborhood, the city needs to find efficient approaches to provide caring services for the majority of its elderly population. During the stage of transition, huge potential and advantage can be seen in utilizing existing resources. By analyzing recent policy guidelines issued by different levels of government and data, both quantitative and qualitative, from surveys and interviews, this research project examines the characteristics and available resources of the local elderly care industry in Harbin, and identifies the resources that could be further utilized to cover the needs of elders choosing home-based or community-based care. Building on case studies of effective practice in other cities with similar condition, this project proposes a model consists of a partnership model between two types of nursing facilities most popular among elders and a service network that connects facilities and nearby neighborhoods to provide accessible, affordable, and convenient caring services to elders at or near home.

Community Engaged Research, 11:30-12:30

Chris Eckersley

Foul Tip Impact Attenuation of Baseball Catcher Masks Using Head Impact Metrics

Research Advisor: Cameron 'Dale' Bass, Biology

Major League Baseball foul tips may cause career ending injury to catchers. Catchers' first line of defense against foul tips is their mask – traditionally made of steel. Recently a lighter more comfortable titanium mask was introduced. Subsequent reported concussions due to foul tips spiked, leading many to speculate titanium masks were the cause. For fear of their safety, many catchers reverted to steel masks. We hypothesize that since the titanium mask is lighter and has a higher yield strength, wearing it will result in higher head injury metrics upon impact with a simulated foul tip. A number of studies have focused on catcher safety analyzing effectiveness of helmet styles; but none have examined the influence material change has on helmet performance. Our study looks to experimentally examine the effect both steel and titanium masks have on impact attenuation and compare the two based on peak resultant acceleration, Head Injury Criterion (HIC), and Head Impact Power (HIP). To conduct these tests, an air cannon was constructed to fire baseballs at 70 and 80 miles per hour at a catcher surrogate. The surrogate was a Hybrid III head and neck equipped with a six degree of freedom sensor package at the CG. A custom Matlab suite was then used to extract metrics from the linear acceleration and angular rate traces, and an ANCOVA was conducted to determine the significance of difference in metrics between the steel and titanium masks. Based on these metrics, the titanium mask performed better against simulated direct foul tips. As the hypothesis predicted, it is believed that this difference is due to the variation in mass and stiffness between the steel and titanium masks for all injury metrics observed.

Physical & Quantitative Sciences, 12:30-1:30

Dylan Eiger

Effects of Backbone Structure on Polymer Mechanochemistry

Research Advisor: Stephen Craig, Chemistry

Functional synthetic polymeric materials are made of simple repeating molecular units called monomers that can be chemically designed for a variety of applications. Materials fail in response to sufficiently applied mechanical force because the comprising molecular bonds break as they are stressed. Mechanophores are molecular architectures which convert this otherwise destructive mechanical energy into constructive chemical pathways which can lead to material strengthening and healing, stress-reporting signals, or activation of latent catalysis. A gem-dihalocyclopropane (gDHC) mechanophore undergoes mechanically induced electrocylic ring opening into either a 2,3-dichloroalkene or a diradical species, depending on the identity of the halogen. Previous research has shown that the reactivity of a gDHC mechanophore is not only dependent on its structure, but also on the composition of the polymer backbone. We strive to further understand how the backbone structure of a polymer chain can impact both the reactivity and functionality of a mechanophore. 1. To understand how the directionality of the applied force impacts reactivity, we synthesized stilbene-derived gDCCs incorporated into a polymer chain at different regiochemical points of attachment. 2. We are currently synthesizing two gDHC mechanophores that are covalently incorporated into a polymer backbone in parallel rather than in series to determine if this parallel configuration produces an additive, antagonistic, or synergistic response. 3. We plan to demonstrate how a stilbene-derived gDCC, after being mechanically activated, can serve as an effective atom-transfer radical polymerization initiator whereas a gDCC incorporated into a polybutadiene backbone will serve as an ineffective initiator. 4. We will measure both force and conductance across a single stilbene derived gDHC molecule as it is mechanically activated.

Physical & Quantitave Sciences, 12:00-1:00

Katharine Ellis

Characterization of Drosophila Wing Curvatures In Relation to the IP3 Pathway

Research Advisor: Eric Spana, Biology

Inositol 1,4,5-triphosphate (IP3) is an important secondary messenger molecule crucial to many signal transduction pathways in the cytoplasm of the cell. This molecule has many fates, including induction of calcium fluxes as well as conversion to higher order inositol molecules. When disrupted in a particular pathway via mutations in IP3K2, the enzyme responsible for converting IP3 to IP4, wing curvatures are visible in *Drosophila melanogaster*. Mutations of IP3K2 are consequently referred to as "wavy". Similarly, mutations in other genes of different cellular function confer a wing curvature in the same likeness as the wavy phenotype. One such gene, a dual oxidase called Duox, results in a curved wing in its mutant form. Mutations in the heme peroxidase CG5873, referred to henceforth as curly su, produce wings in which the wing cuticle disintegrates over time in adult flies. All three of these genes rely on calcium signaling to function, and their connection along the same pathway is possible due to the resemblance of all discussed phenotypes. As IP3K2 function is limited in wavy, IP3 buildup occurs and can be reallocated to inducing calcium releases from the endoplasmic reticulum. Thus, the aim of this study is thus twofold: to deduce the molecular genetic cause of each of the four wavy alleles in the IP3K2 gene, as well as to connect Duox, curly su, and IP3K2 in the same cellular signaling pathway.

Biological Sciences, 11:30-12:30

Nourhan Elsayed

The Ecology of Resilience: Indicators and Predictors of Psychological Health in Disadvantaged Lebanese Youth

Research Advisor: Kathleen Sikkema, Psychology and Neuroscience

More than a third of Lebanese youth report facing traumatic life experience; these adverse life experiences during childhood and adolescence can have lasting negative effects on youth's psychological development and well-being. Research on positive adaptation following exposure to adversity suggests that processes across multiple domains of an individual's life influence the likelihood of positive adaptation following adversity. Ecological resilience indicators are attributes and resources of an individual and their environment that indicate the presence of, as well as promote, positive adjustment in the face of adversity. Thus, the purpose of this study was to examine the presence of resilience indicators across three different ecological domains (person-level, micro-system, meso/exo-system) that are associated with psychological well-being and psychological distress in disadvantaged Lebanese youth. This study examined the presence of resilience indicators across three domains of a disadvantaged youth's ecology and determined how the indicators of resilience across different ecological domains predict psychological well-being and psychological distress. A self-report questionnaire was distributed to 187 disadvantaged Lebanese youth between the ages of 15 and 23 (M =17.96 years, SD = 2.42 years). Hierarchical multiple linear regression analyses supported the hypothesis that at each of the domains of the disadvantaged youth's ecology, resilience indicators were predictive of youth's psychological well-being. Only person-level indicators and micro-level indicators predicted psychological distress. These results suggested that resilience indicators influenced the development of psychological well-being and psychological distress in disadvantaged youth across the ecology of a youth's life. This study also supported that all domains of a youth's ecology should be studied and intervened upon to ensure that a youth can positively adapt in the face of adversity.

Psychology GwD, 11:30-12:30

Nourhan Elsayed

An exploratory evaluation of blended learning for CBT dissemination

Research Advisor: Zachary Rosenthal, Psychology and Neuroscience

Based on implementation barriers and the need for dissemination of CBT, and the potential of blended-learning to address the implementation and dissemination barriers, a blended-learning CBT course was designed to provide introductory level knowledge about CBT to clinicians across North Carolina. The course was designed to make CBT training available to a wide range of clinicians. The courses use both traditional didactic models of learning including seminars and case feedback, in combination with web-based modules delivered via Moodle online software. Using data from a cohort of 13 clinicians who were enrolled in the CBT-blended learning course in the fall of 2013, this poster offers information on the outcomes associated with this exploratory initiative. Data reported include information on user engagement with the website, and changes in user confidence, changes in perceived barriers to CBT use and changes levels of self-reported clinician use of CBT. Exploratory data on various indicators of clinician engagement with the blended learning course and it's relationship to course outcomes will be reported. The use of blended learning to administer CBT knowledge to clinicians has large implications for the future of CBT education to clinicians, this project is an effort to begin to understand which aspects of blended learning are related to clinician education.

Social Sciences, 12:30-1:30

Toyokazu Endo

Bridging the Gap in Spinal Cord Regeneration in Zebrafish

Research Advisor: Kenneth Poss, Cell Biology

In the U.S, there are approximately 10,000 people living with some form of spinal cord injury (SCI). In the field of medicine, there are deficiencies in ways to treat SCIs. Although mammals are unable to regenerate their own spinal cords, zebrafish are able to do so in 8 weeks. For this reason, zebrafish serve as a valuable vertebrate system to study SC regeneration. In this study, I investigate the mechanism in which zebrafish regenerate their SC. Based on RNA sequence data, connective tissue growth factor a (ctgfa) is upregulated in zebrafish after SCI. In this study, I determine how ctgfa is involved in the mechanism of SC regeneration by 1) using in situ hybridization to examine the expression profile of ctgfa in injured SC, and by 2) creating transgenic fish that overexpress ctgfa to visualize the effect of overexpression during regeneration. My results show that ctgfa is upregulated throughout the glial bridge that plays an intermediate step in SC regeneration. Furthermore, overexpressing ctgfa after injury enhances glial bridging and ultimately speed up regeneration. Although these results are significant, further studies are necessary to determine the exact mechanism in which ctgfa functions and whether ctgfa is in fact necessary for SC to regenerate. However, these findings underscore the importance of glial cell bridging which mediates SC regeneration. By furthering our knowledge of how zebrafish regenerate its SC, we may shed light on how to treat SCIs in humans.

Biological Sciences, 12:30-1:30

Samantha Epstein

Masculinization in Meerkats: Using Anatomy and Endocrinology to Examine the Development of Meerkat Pups

Research Advisor: Christine Drea, Evolutionary Anthropology

Previous researchers have shown that the prenatal environment can influence the sexual differentiation of mammals—prenatal androgen exposure can influence an offspring's physical development and have a lasting impact on its behavior. Certain morphometric and anatomical measurements, such as 2:4 digit ratios (2D:4D) and anogenital distance (AGD), are particularly sensitive to prenatal androgen concentrations. Meerkats (Suricata suricatta) are unique as a cooperatively breeding, female-dominant mammal, in which females are hormonally masculinized. Moreover, dominant females have greater androgen concentrations than do subordinate females, both while pregnant and not pregnant. To test for potential effects of prenatal androgen exposure on meerkat development, we treated several dominant dams with flutamide, an antiandrogen, during late pregnancy. Here, we examined 2D:4D and AGD as anatomical indicators of masculinization in meerkat pups. We measured testosterone (T) concentrations, 2D:4D, and AGD in the offspring of dominant control, subordinate control, and flutamide-treated dams. As expected, pups born to flutamide-treated dams had, on average, larger 2D:4D than pups born to control dams (whether dominant or subordinate) and 2D:4D decreased with increasing T concentrations. Although there were no significant differences in 2D:4D between the sexes, male AGD was significantly greater than female AGD. Pup AGD was positively correlated with T concentration, but was not significantly affected by the mother's status. We suggest that, owing to prenatal androgen exposure, female meerkats are morphologically masculinized in certain features, evident in their appendicular ratios, but not their genitalia. Therefore, differential, prenatal exposure to androgens may influence offspring development in unusual female mammals.

Biological Sciences, 12:00-1:00

Zachary Faircloth
The Politics of Rejection in Ramallah and Nabi Saleh
Research Advisor: Michael Hardt, Literature

Palestinians today engage themselves in a number of different resistance methodologies, from Palestinian Authority-sponsored boycott measures in cities in Area A to grassroots popular struggles in rural villages. These resistances, though they spring from under the same oppressive forces, are not uniform by any means. There are commonalities, to be sure: the use of Palestinian imagery and symbols, rhetoric about struggle, resistance, and other revolutionary terms, and the resounding agreement that the Zionist (not Jewish, as Palestinians refrain) occupation of Palestine is the primary target. Beyond those unifying factors, however, different methods splinter off, having different tactics, different motives, and different relationships to the "legitimate" body politic. With this in mind, an analysis of resistance methodologies in the West Bank will bring to light a number of the innovative characteristics of Palestinian movement, which is generally passed off as reactionary or unsophisticated. This paper will seek to examine three major methods of resistance in Ramallah and surrounding villages: economic, linguistic, and civil protest, the last of which refers to the long-term protests occurring on a regular basis in villages surrounding Ramallah.

Social Sciences, 12:30-1:30

Matthew Farnitano

One gene or many? Different genetic mechanisms drive convergent evolution in monkey flowers

Research Advisor: John Willis, Biology

Evolutionary history is riddled with examples of convergent evolution, in which the same adaptation appears independently across multiple populations as a result of similar selective pressures. Convergent evolution can proceed by identical, similar, or unrelated genetic mechanisms. The relative frequencies of these scenarios and the evolutionary constraints that produce them are poorly understood, partly due to a lack of diverse comparative models. One such promising model is repeated adaptation to serpentine soil, a soil environment characterized by abundant heavy metals, low nutrient content, and poor water retention. Many species of Mimulus monkey flowers have populations that can tolerate these soils, but most Mimulus populations cannot. I compared the genetic signatures of serpentine tolerance across the genomes of four tolerant Mimulus populations, in order to determine whether these different species employed similar genetic mechanisms. Previous work has identified a single locus connected with serpentine tolerance in M. guttatus tolerant populations. I found that M. glaucescens also likely has a single locus responsible for this adaptation. However, serpentine tolerance in M. nudatus appears to be controlled by many genes of smaller effect, rather than a single locus. This vastly different genetic mechanism is surprising given the close evolutionary and ecological relationships of these species. Whether the difference is purely accidental, or is driven by evolutionary constraints, remains to be seen.

Biological Sciences, 12:00-1:00

Charlotte Farquhar

The Expression, Purification, and Characterization of Plasmodium Falciparum Protein Kinase 9

Research Advisor: Emily Derbyshire, Chemistry

Malaria is a deadly disease prevalent in equatorial regions globally. As resistance to current pharmaceuticals grows, it is increasingly important to find new possible antimalarial drugs. We believe that Plasmodium falciparum Protein Kinase 9 (PfPK9), an orphan kinase involved in the P. falciparum life-cycle, may be a useful therapeutic target. We have optimized the expression of a GST-tagged recombinant PfPK9 in E. coli, and used a GFP affinity column and size-exclusion chromatography to purify the protein. The new expression and purification have a yield more than 10-fold higher than previous attempts at PfPK9 expression. We hope to use the pure protein generated in this experiment for X-ray diffraction crystallography and biochemical characterization assays, and begin generating and testing therapeutics specific for PfPK9.

Biological Sciences, 11:30-12:30

Zachary Fowler

Health Correlates of Secondary School Attrition among Female Youth in Rural Kenya

Research Advisor: Sherryl Broverman, Global Health

This paper investigates the causes and impacts of secondary school attrition among female students in rural Kenya in relation to subsequent negative health outcomes. Along Lake Victoria in Western Kenya's Migori County, there are a number of risks specific to female youth that may result in secondary school attrition. Young women may leave secondary school for a myriad factors, and these factors may have implications for female youth health outcomes. To explore the relationship between attrition factors and the determinants of health, a mixed-methods approach was taken to collect both qualitative and quantitative data. Semi-structured interviews were conducted among female youth that had terminated their enrollment in a Muhuru Bay secondary school between 2011 and 2015. Using grounded theory and thematic analysis, dominant themes were identified pertaining to determinants of attrition and implications for attrition-related health outcomes. In this analysis, themes emerged regarding female health in three distinct temporal categories: in-school correlates, out-of-school correlates, and new-situation correlates. Health correlates ranged from domestic violence and self-harm to abortion and birthing complications. Additionally, statistical data was collected in regards to the frequency of female and male student attrition, rates of early pregnancy and marriage in the last five years, and the prevalence of expressed causes of attrition. By analyzing these data, it is possible to better understand the conditions under which secondary attrition occurs, and thus, the conditions under which health risks are increased for school-age female youth. Furthermore, through this analysis, intervention tactics may be developed to address the challenges that have emerged in this research.

Social Sciences, 12:30-1:30

Jemi Galani

The Construction of Point Mutations in Cryptococcus neoformans Tps1 for Characterization of Enzymatic Activity

Research Advisor: John Perfect, Molecular Genetics & Microbiology

Cryptococcus neoformans are opportunistic fungal pathogens that mostly infect immunosuppressed individuals, resulting in meningoencephalitis. The trehalose pathway is essential for pathogenic Cryptococcus cells to survive within their hosts, where they encounter stresses such as elevated temperatures and oxidative stress. Trehalose, a disaccharide, is synthesized by a two-step process consisting of two enzymes – Tps1 and Tps2. Point mutations in the TPS1 gene were made to alter four key amino acid residues that are thought to be essential to the gene's catalytic activity and were transformed into Cryptococcus neoformans cells. The constructed strains will enable us to determine how the catalytic activity of the tps1 enzyme affects phenotypes such as growth at elevated temperatures, capsule and melanin production, and survival in mice. After verification of the presence of the point mutations in the four mutated constructs, phenotypic assays for capsule production, melanin production, and cell wall stress will be conducted.

Biological Sciences, 12:30-1:30

Elizabeth Ginalis

Differences in Performance on the Antisaccade Task in Football Athletes During Childhood and Late Adolescence

Research Advisor: Cameron Bass, Biomedical Engineering

There are currently few studies on saccadic eye movements in children and adolescents, especially those with mild traumatic brain injury (mTBI) suffered in a sports related environment. The antisaccade (AS) task in particular may be able to objectively assess for mTBI or the effects of subconcussive loading by comparing baseline to follow-up performance. Since the AS task specifically engages areas such as the prefrontal cortex (PFC), quantifying performance may further help to understand which brain regions may be injured during a mTBI or affected due to subconcussive loading. Age-based differences in oculomotor response resulting from differences in brain development are of importance when considering the use of an assessment modality across ages. Participants were males recruited from local football teams ranging from 5 to 18 years old and binned into five age groups. Oculomotor data were collected at baseline before the beginning of the football season and follow-up time points. Saccadic latency and percentage of wrong way trials were analyzed from baseline data. The latency of correct AS trials indicates that the oldest age group had the shortest latency, and the oldest two age groups showed the shortest corrected latency following a wrong way with correction trial. Additionally, the two youngest cohorts had the lowest percentage of correct AS trials and the highest percentage of wrong way trials. This may suggest that the younger groups were less likely to inhibit the reflexive prosaccade in accordance with development of the higher-order cortices in the PFC. Alternatively, the trend could be due to a misunderstanding of the AS task by the younger cohorts. With further analysis, this research will further our understanding of oculomotor performance in the AS task in relation to development of the brain, especially areas such as the PFC, across age groups.

Bass Connections, 11:30-12:30

Vinay Giri

Identification and characterization of transcription factors required for the survival of Cryptococcus neoformans in the central nervous system

Research Advisor: John Perfect, Department of Medicine, Division of Infectious Diseases

Cryptococcus neoformans is a fungal pathogen that can invade the central nervous system (CNS) of immunocompromised individuals. The resulting cryptococcal meningitis is responsible for approximately 625,000 deaths worldwide each year. It is hypothesized that C. neoformans possesses CNS-specific survival mechanisms that enable the fungus to tolerate the unique stresses of the central nervous system. To identify CNS-survival pathways, I screened C. neoformans knockout strains, each lacking a specific transcription factor, in human-obtained cerebrospinal fluid (CSF) and bovine blood. Twenty-eight genes were determined to be important for cryptococcal survival in CSF and likely function in CNS-specific pathways. Next, six of the most promising candidates were evaluated in a mouse model. The genes YAP1 and YAP2 were found to play a role in fungal virulence. After determining that an invertebrate model cannot detect strains that possess CNS-specific defects, I worked on the development of a more effective, high-throughput method for screening knockout libraries This new screening system incorporates a rabbit model for cryptococcal meningitis and next generation sequencing techniques that will enable the examination of hundreds to thousands of strains at once. If successful, this model will provide a new method for in vivo screening of large strain libraries.

Biological Sciences, 12:30-1:30

Brittany Glassberg

The influence of stimulus-reward associations on auditory processing

Research Advisor: Marty Woldorff, Psychology and Neuroscience

Recent work demonstrates stimulus-reward associations can enhance the attentional priority of visual stimuli; it is less known, however, how reward influences the processing of auditory stimuli. Here, we leveraged high-temporal-resolution electrical brain recordings (EEG) to investigate the influence of stimulus-reward associations in an auditory oddball task. The task consisted of standard tones (1000 Hz) and rare, deviant target tones (30% of stimuli; 900 and 1100 Hz, equally probable). Tones were randomly presented (100 ms duration, 800-1000 ms interstimulus interval). Participants were instructed to buttonpress whenever targets were presented and that they could earn monetary rewards based on their speed and accuracy. In the first half of the session, high-pitched targets were assigned to a high-reward condition and low-pitched targets to low-reward (high-reward pay rate 10 times low). Reward assignments were reversed in the second half of the session, with reward-assignment order counterbalanced across subjects. Behaviorally, high-reward tones had faster reaction times than low-reward ones. Event-related potentials (ERPs) time-locked to the tone onsets revealed that reward enhanced the amplitude of the early N1 sensory component (latency 70 to 130 ms) and the deviance-related mismatch negativity (130-200 ms). Reward also enhanced the amplitude of and decreased the latency of a central-parietal P3 component (240-800 ms). These data demonstrate stimulus-reward associations can enhance the early sensory processing and discrimination of auditory stimuli, as reflected by the N1 and mismatch negativity components, respectively, and that this enhanced processing then ramifies onto later processing stages, as evidenced by the P3.

Biological Sciences, 11:30-12:30

Kunal Goel

Categorizing Spastin NMJ phenotypes in Drosophila as Wallerian degenerative via WldS and dSarm

Research Advisor: Nina Sherwood, Biology

Spastin is a microtubule-severing protein that regulates microtubule size and structure in cells throughout the body. Spastin is important in neuronal cells, as the protein is known to participate in axonal branch formation. Mutations human Spastin gene have been linked to the neurodegenerative disorder autosomal dominant hereditary spastic paraplegia (AD-HSP). Moreover, mutations in the Spastin gene in *Drosophila melanogaster* produce altered larval neuromuscular junction (NMJ) phenotypes, where the synaptic boutons are more numerous and clustered. It is so far unknown how mutations in Spastin lead to this manifestation of axonal dysfunction, however the underlying mechanism may resemble the process of Wallerian degeneration (WD) - a form of axonal disintegration that follows injury to the axon. Several proteins have been implicated in the process of WD, two important ones being WldS (slow Wallerian degeneration) and dSarm (*Drosophila* sterile a/Armadillo/Toll-interleukin receptor homology domain protein). An overexpression of WldS leads to recovery of Wallerian-like symptoms, while a decrease in dSarm expression also lead to a similar recovery. To test if the Spastin mutated phenotypes may be due to WD, we altered the expression of WldS in flies with the Spastin mutation, and attempted to alter dSarm. We found that WldS expression did not rescue Spastin mutant NMJ phenotypes, and it is possible Spastin does not utilize WD to cause damage to axons in spinocortical tracts. Future work involves testing a correlation with dSarm and other Wallerian proteins (Hiw and Nmnat1), and exploring the possibility of a novel degenerative pathway involved in AD-HSP.

Biological Sciences, 12:30-1:30

Caitlyn Gold

The Cost of Co-Rumination: Excessive Problem Discussion is Linked to Anxiety, Depression, and Negative Friendship Features in Young Adults

Research Advisor: Steve Asher, Psychology and Neuroscience

Although girls have closer, higher quality friendships, and high quality friendships protect against emotional difficulties, girls still exhibit higher levels of internalizing symptoms (e.g., anxiety and depression) starting in adolescence and continuing into adulthood. Therefore, girls' close friendships are either ineffective or insufficient buffers against the risk of developing internalizing symptoms, or, alternatively, that aspects of the friendship are actually increasing girls' risk for depression and anxiety. One relationship process that might contribute to these seemingly contradictory findings is co-rumination – the extensive discussion and speculation about problems that occurs in dyadic relationships. Research on co-rumination with adolescents has found that co-rumination is linked to increases in internalizing symptoms, especially for girls. However, there is little research on co-rumination in young adults, and no studies have examined the link between co-rumination and specific positive or negative features of friendship. The current study examined whether co-rumination is linked to depression or anxiety for college-age men and women, and whether the links differ by gender. We also examined whether specific features of friendship were linked to co-rumination. Results show that co-rumination is indeed linked to depression and anxiety for young adults, and that it may be more dangerous for young women than men. Additionally, co-rumination was linked to all fifteen negative friendship features examined in this study but only four of the positive features, implying that friendships characterized by co-rumination are also especially likely to contain other negative features. Together, these results suggest that co-rumination has significant costs for young adults.

Psychology GwD, 12:30-1:30

Nadine Goldberg

It's [Not Just] About Time: Dispositional, Socio-Emotional, and Academic Correlates of Time Management Difficulty in First-Year Undergraduates

Research Advisor: Mark Leary, Psychology and Neuroscience

The aim of this study was to identify the dispositional, socio-emotional, and academic correlates of time management difficulty in first-year undergraduate students. Surveys were administered to first-year students through the Resilience Project, an ongoing longitudinal study of student well-being at Duke University, Furman University, Davidson College, and Johnson C. Smith University. Difficulty with time management was associated with depression, anxiety, somatization, perceived stress, and lower Grade Point Averages. Participants who reported difficulty with time management also scored higher on measures of openness and Internet addiction, and scored lower on measures of conscientiousness, self-control, self-management, and grit than those who did not struggle with time management. These results have important implications for student-support staff developing time management interventions for first-year students.

Psychology GwD, 12:30-1:30

Kylie Grady

Go with the Tidal Flow: Circatidal Gene Expression in Mole Crabs

Research Advisor: Tom Schultz, Nicholas School of the Environment

Biological rhythms enable organisms to adapt to changes in their environment and synchronize to external cycles through a process of entrainment. Circatidal rhythms are those in sync with the 12.4-hour rise and fall of the tides, and while their presence has been studied across species, the molecular mechanisms and genes responsible for them are unknown. Consequently, this project aimed to identify tidally regulated genes in the mole crab, Emerita talpoida. Swimming activity assays were used to assess tidally rhythmic behavior, and RNA was extracted over two 24-hour time courses. RNA-Seq libraries were constructed and sequenced, and reads were mapped to a reference transcriptome of 73,702 contigs. The change in read count over time for a single contig indicated change in gene expression, and the contigs were analyzed using MATLAB and visual inspection to find those with a 12.4-hour periodicity in expression and a phase shift with the tides. Mole crabs appeared to have tidally rhythmic swimming patterns, and over 80% of the reads for all samples mapped to the transcriptome. In addition, genes likely exhibiting circadian expression were found using MATLAB analyses, and one candidate gene for circatidal expression was discovered with visual inspection. Future work will need to normalize the data, account for low read counts, and use harmonic analysis to confirm and find tidally regulated genes.

Biological Sciences,12:00-1:00

Alyssa Greenhouse
A Mathematical Model for Celiac Disease
Research Advisor: Frederik Nijhout, Biology

Celiac disease is an autoimmune disorder resulting in the inability to correctly digest gluten and transport it across the intestinal membrane. Although disease prevalence is 1 in 100, it remains widely undiagnosed. An estimated 2.5 million Americans remain undiagnosed and at serious risk of long-term health complications, including the development of other autoimmune diseases and neurological conditions. It is not fully understood how celiac disease starts, with both genetic and environmental factors playing critical roles. One possibility includes the onset of inflammation, which then triggers the immune response. Somatic mutations in the various enzymes involved in the breakdown pathway could also lead to disease activation. In order to develop a better quantitative understanding of the development of celiac disease, we constructed a mathematical model of the pathway by which gluten is broken down, imported through the intestinal membrane, and then becomes the signal for immune attack. The model shows how celiac disease can be initiated by inflammatory reactions in the bowel, as well as from misregulation of several critical enzymes. Further, the model incorporates the important role that specific genes play in the pathway, and what effect their activation or inactivation has. Thus, the model provides a holistic view of the diverse processes leading to and arising from celiac disease. By providing a more complete understanding of the various factors, the model can be used to predict optimal places for medical intervention, and potentially, find strategies for preventing the disease from developing in the first place.

Biological Sciences, 12:00-1:00

Medha Gudavalli
Law Enforcement Response and Sexual Violence: The Thought Process behind Arrest and Prosecution in Colorado.
Research Advisor: Mine Cetinkaya-Rundel, service learning

The occurrence of sexual assault in the United States is frequent and far-reaching: a sexual assault or rape occurs every 2 minutes in the United States totaling to 207,754 victims a year and thousands of secondary victims; over 1 million Coloradans have been sexually assaulted, and 1 in 2 women in Colorado have experienced sexually violent crimes. Law enforcement has a responsibility to bring these perpetrators to justice; however, the criminal justice system falls short when holding offenders accountable: 32% of rapes or sexual assaults are reported to the police, 7% of rapes or sexual assaults result in an arrest, and 2% of rapes and sexual assaults lead to a conviction. This study interviewed 7 District Attorneys and 1 Sergeant from 3 different jurisdictions in Central Colorado investigating their attitudes towards sexual violence, thought process behind filing and arresting, and their views about their jobs and criminal justice system. Investigations like these are important to law enforcement agencies, interest groups, and the community in order to improve the criminal justice system. The results revealed that law enforcement are not biased towards victims showing no indication of adhering to rape myths. Some key trends include focusing on juror's attitudes, finding the process retraumatizing for victims, and varied decision processes for filing cases. Attitudes and beliefs surrounding sexual violence in Colorado still needs to be changed in order to adequately respond to sexual assault and rape. Awareness campaigns and studies on jurors were recommended to change culture and better understand jurors.

, 11:30-12:30

Mary Hagan

Mad about Max's Math: Training the approximate number system in preschoolers

Research Advisor: Elizabeth Brannon, Psychology and Neuroscience

Early math skills are a predictor of later academic performance, as well as adult success and well-being. Children of different socioeconomic status (SES) backgrounds often do not have the same exposure to math in early childhood as their counterparts of higher SES backgrounds. If there was a way to improve early math skills, all children could have equal opportunities for academic success. Research has shown a relationship between math ability and the Approximate Number System (ANS), used by humans to make quick, imprecise estimates of different quantities. Specifically, the ANS can be used to predict both past and future math performance. Therefore, by improving ANS acuity, early math skills may be able to be improved as well. The present study aims to test this idea by comparing an approximate arithmetic training game with two commercially available games, which focus on number and letter identification, in primarily children of low SES backgrounds attending Durham preschools. We hypothesized that the preschoolers playing the approximate arithmetic training game would improve their mathematical abilities. The results are important because although children in kindergarten and elementary school might benefit more from symbolic math exercises, preschoolers training their approximate arithmetic skills could easily improve their school readiness.

Psychology GwD, 12:30-1:30

Beatriz Hayes-Meizoso
U.S. Public Perceptions of International Organizations and the American Use of Force
Research Advisor: Joseph Grieco, Political Science

Do Americans value international organizations (IOs) such as the United Nations Security Council (UNSC) and the North Atlantic Treaty Organization (NATO)? How, if at all, do these organizations influence American foreign policy? In response to the first question, we found that they do: all else being equal, Americans are more likely to support a military mission proposed by their president if it has the support of one or more institutions than if it does not. However, we also found that Americans tend to value practical aid (in the form of troops, weapons, and so forth) and burden-sharing from institutions like NATO, more than they value normative support and theoretical authorization (in the form of Resolutions) from institutions like the UNSC. These findings corroborate the recent theory that, above all, it is the burden-sharing, that Americans value, not the institutional backing. Finally, we also found support for the findings of previous researchers, which propose that Americans interpret the support of the UNSC as a sign of legitimacy, or a "second opinion" confirming the prudence of a military operation, rather than as a sign confirming the mission's legality, in the way that most Europeans do. We discuss the implications this will have on future peacekeeping efforts and how IOs can use this to their advantage, to help influence the United States, a country which, as the world's largest military power, has been hard to constrain in the past.

Social Sciences, 11:30-12:30

Rachel Hennein

Poverty and HIV Risk in Rural Kenya: Options and Sources of Support for Youth and Adolescents

Research Advisor: Eve Puffer, Psychology and Neuroscience

This qualitative study explores the options and three sources of support (family, community leaders, and church) for adolescents to cope with poverty and HIV risk in a high-risk rural fishing community in Kenya. Semi-structured focus groups (n=22 groups; n=152 participants) were conducted with female youth, male youth, caregivers, community leaders, fishermen, and church leaders. Focus groups were posed four different vignettes illustrating common scenarios that adolescents face: two vignettes related to youth access to resources (one for each gender) and two related to youth sexual risk (one for forced sex and one for sexual decision-making). The results highlighted overarching challenges that adolescents face – debilitating gender norms, pervasive transactional sex customs, and confusing mixed messages about sex – which likely influence their disproportionately high HIV risk. In order to cope with such challenges, the family was the most commonly reported source of support in both adult and youth focus groups; support from community leaders was reported among mostly adult focus groups; and church support was reported least frequently across all focus groups. Adolescents in rural communities in sub-Saharan Africa might benefit from interventions that improve their access to education and integrate youth-centered HIV services and programs into clinics and churches.

Psychology GwD, 12:30-1:30

Ashley Heywood

Intense Emotional Responses to Sound: Understanding the Role of Emotion Regulation Difficulties in Auditory Sensory Over-Responsivity

Research Advisor: Zach Rosenthal, Psychology and Neuroscience

There is undoubtedly a bond between the sensation of environmental stimuli and emotional processing within the limbic and autonomic nervous systems. Specifically within the auditory modality, there exists little research on a newly identified disorder, misophonia. Misophonia, literally the hatred of sound, has been characterized by intense emotional responses of anger, annoyance, and disgust to hearing specific (usually) human sounds (e.g., chewing, breathing, foot tapping). This relationship between auditory processing and emotional outbursts has driven the present study to explore problems in emotion regulation to potentially explain such extreme reactions to sound seen within auditory sensory over-responsivity. The present study utilized a combination of clinical interview and self-report measures collected from an adult, outpatient sample (N=162) in order to gain insight into the role of problems in emotion regulation within auditory sensory over-responsivity. Self-report measures of interest include the Affect Intensity Measure (AIM), Difficulties in Emotion Regulation Scale (DERS), Distress Tolerance Scale (DTS), and the Toronto Alexithymia Scale-20 (TAS-20) to measure problems in emotion regulation. Problems in emotion regulation were seen to be significantly correlated with increased auditory sensory over-responsivity, and specifically negative emotionality. These results suggest emotion dysregulation may play a role in the extreme, specifically negative, emotional reactions to trigger sounds within misophonia. Implications from the present findings suggest emotion regulation difficulties and specifically negative emotionality to be significantly involved in auditory sensory over-responsivity. Future research will benefit from exploring problems in emotion regulation as a potential target for the treatment for auditory sensory over-responsivity.

Key words: auditory sensory over-responsivity, emotion regulation

Psychology GwD, 11:30-12:30

Kathy Huang

Zeng Fanzhi and the Global Art Market

Research Advisor: Hans Van Miegroet, Art, Art History, Visual Studies

Chinese contemporary artist Zeng Fanzhi (1964 –) is a paradigmatic example of a superstar artist born before the Cultural Revolution in China (1966 – 1976). The artist's most commercially successful series, Mask Series, features an oeuvre brimming with motifs reminiscent of this crucial period in modern Chinese history. This study observes more than a decade's worth of auction sales (2004 – 2015) using data collected from the Blouin Art Sales Index database to examine the market in Chinese contemporary art by assessing the auction sales of works by Zeng Fanzhi within the frame of global art markets. Data-driven analysis of his performance levels in auction are read against his biography and the presence of motifs from the Chinese Cultural Revolution in his works to explain his commercial success in the art world. The purpose of this study is to identify with specificity what factors contribute to Zeng's commercial success as a Chinese artist in the contemporary art market. Ultimately, Zeng's observed commercial success is affected by such factors including auction location, gallery representation, and motifs from the Revolution, among others.

Humanities, 11:30-12:30

Anthony Hung

High-throughput identification of starvation resistance genes through next-generation sequencing

Research Advisor: L. Ryan Baugh, Biology

Traditional gene discovery techniques require laborious, large-scale screening. For example, the process for identifying starvation tolerance genes in Caenorhabditis elegans has historically entailed experiments measuring the survival times of individual genetic mutants. These methods have been successful in pinpointing many genes involved in starvation response but are not particularly efficient. We have pioneered the use of a high-throughput method for identification of starvation resistance strains to streamline the process. This method leverages the genetic variation of aggregate populations of C. elegans wild isolates through the use of restriction-site associated DNA sequencing (RADSeq), a next-generation sequencing technology that allows for high-resolution genetic sequence data to be acquired for multiple organisms at once. Measuring the change in relative frequencies of unique wild isolates in these pooled populations over the course of extended starvation will enable bulk phenotyping, and performing a genome-wide association study (GWAS) on starvation-resistant wild isolates will allow us to locate regions of the genome containing genes involved in starvation response. Currently, we have performed traditional starvation-survival analyses on six isolate strains identified through experiments using the RADSeq method as being resistant or nonresistant to starvation to validate RADSeq's ability to correctly identify starvation-resistant strains. The data from these analyses follow the expected trends, with starvation-resistant strains displaying longer median survival times in extended starvation compared to non-resistant strains. The current results hold promise for this novel technique, and may open the door for streamlining gene discovery in the context of environmental conditions beyond starvation.

Biological Sciences, 12:30-1:30

Kavita Jain

Iodine-Enhanced MicroCT Imaging for Primate Skull Anatomy and Biomechanics

Research Advisor: Christine Wall, Evolutionary Anthropology

Feeding performance and behavior are key reasons for the evolutionary fitness and success of many organisms, including primates. Performance encompasses a broad range of abilities that an organism possesses and includes factors like prey capture rate, chewing rate, and bite force magnitude; it essentially includes all factors that affect how efficiently an organism can obtain energy. In order to understand and determine the fitness level of an organism, it is important to establish a measure of performance. In this research I have used morphology as the measure of performance, in particular bite-force morphology (BFM). Bite force can constrain access to foods and so studying differences in BFM will help us determine the performance of a primate and eventually the fitness level.Muscle structure and architecture are keys components of a muscle's ability to generate force and movement. Therefore, BFM is in part a function of fiber architecture.. By studying the fiber architecture of jaw muscles - masseter, medial pterygoid, and temporalis - we can identify their individual contributions to BFM. Previous studies have not been able to determine the exact fiber orientation or resultant force vector of these muscles due to tissue destruction during dissection. However, we used iodine-enhanced microCT scans to visualize the jaw muscles in situ. We analyze the visualizations reconstructed from CT scans to measure musclearchitecture relative to the occlusal plane . With these data on volume, force vector, fiber length, we create realistic biomechanical models of primate feeding performance in order to compare BFM across species and apply these data to better understand performance and evolutionary fitness on a broader level.

Biological Sciences, 12:30-1:30

Varun Jain

Exploring the regulation of type IV collagen in the development of basement membranes in C. elegans

Research Advisor: David Sherwood, Biology

Basement membrane (BM) is a thin, dense, cross-linked extracellular matrix that underlies all epithelial and endothelial cell layers. Type IV collagen is the most abundant and stiffest BM component, forming a cross-linked network that extends throughout the BM, suggesting that it confers BMs with their mechanical strength. Loss of type IV collagen across metazoans leads to embryonic lethality, BM ruptures, and misshaped organs, and causes a wide array of congenital developmental disorders in humans. Despite its fundamental importance in development and in determining the mechanical properties of BMs, it is not known how type IV collagen is recruited to BMs. Owing to the difficulty of visualizing and experimentally examining type IV collagen dynamics and BM components in complex vertebrates tissues in vivo, however it is unknown how type IV collagen is assembled in BMs. *C. elegans* encodes all major BM components with only a single gene representing each protein family. The *C. elegans* pharynx is encased in a BM and is a rapidly growing contractile organ that initiates pumping in the embryo. We have found that type IV collagen is strongly enriched around the terminal pharyngeal bulb, a region of high mechanical activity. Loss of collagen leads to pharyngeal pumping and morphological defects, indicating a critical role for collagen in pharyngeal development and function. To elucidate how type IV collagen is recruited to BMs, we combined live-cell imaging of collagen with genetic analyses in a targeted screen of matrix components. We observed that discoidin, agrin, perlecan, type XVIII collagen, and laminin are not required for type IV collagen addition to the pharyngeal BM. Reduction of SPARC and syndecan significantly reduced pharyngeal BM collagen levels. Remarkably, loss of laminin and SPARC affected the BM collagen of a different tissue, the gonad, differently from the pharyngeal BM.

Biological Sciences, 12:30-1:30

Suhani Jalota

The Effect of Slum Redevelopment on Child Health Outcomes: Evidence from Mumbai

Research Advisor: Michelle Connolly, Economics

Booming economic activities and growth in Indian cities has led to a surge in migrant population without a concurrent increase in housing capacity, making housing a distant dream for most of the cities' poor. This paper investigates the effect the slum redevelopment schemes on child health outcomes. Data was collected in four slum-redeveloped colonies in Mumbai and the study demonstrates through a sibling fixed effect regression analysis that exposure earlier in life, i.e. between the ages of zero and five, improves height for age Z-scores for children. While focus group discussions and anecdotal evidence suggest that water contamination, loss of livelihood and increased expenses have worsened the health outcomes for the residents, this is not reflected in the regression results of this study. Nevertheless, this study calls for more research on the health effects of slum redevelopment projects, which are becoming increasingly common in the rapidly urbanizing developing world.

Social Sciences, 12:00-1:00

Alcida Karz

Investigating the role of Abl kinases in the Cancer Stem Cell phenotype

Research Advisor: Ann Marie Pendergast, Pharmacology & Cancer Biology

The BCR-ABL fusion kinase has long been recognized for its role in promoting chronic myeloid leukemia. Recently however, evidence from our lab and others suggests that endogenous Abl kinases (Abl-1 and Abl-2, or Arg) have a role in promoting invasion, chemoresistance, proliferation, and survival of breast cancer cells. These are all characteristics associated with an exciting new concept at the forefront of cancer research: cancer stem cells (CSCs). Evidence suggests that cancer stem cells exhibit characteristics associated with the epithelial-mesenchymal transition (EMT), a process by which cells undergo a reorganization of their cytoskeleton and signaling networks in order to maximize their capacity for migration. Indeed, our data show that activated Abl2 gives differentiated breast cancer cells the characteristics of EMT-transformed cells, including increased capability of invasion, chemoresistance, mammosphere formation, and anchorage-independent growth in vitro, as well as a significantly increased tumor-initiating capacity in vivo. Activated Abl2 also drives upregulation of proteins commonly associated with EMT, such as Vimentin, Snai1, Twist, CD44, N-cadherin, and a downregulation of epithelial markers like CD24 and E-cadherin. During experiments with conditioned media we discovered that cells expressing activated Abl2 also secrete factors that confer on mammary epithelial cells in a paracrine manner an increased capacity for chemoresistance and mammosphere formation. Preliminary evidence suggests that this is at least partly due to Abl2 driving increased secretion of EGF.

Biological Sciences, 12:30-1:30

Brody Kellish, Arjun Devarajan, Cassidee Kido, Wuming Zhang, Nick Von Turkovich & Aaron Newman

Automated Rooftop Solar PV Detection and Power Estimation Through Remote Sensing

Research Advisor: Kyle Bradbury, Duke Energy Initiative

Increased attention to global warming and cleaner forms of energy has led to the rapid adoption of distributed rooftop solar photovoltaic (PV) installations across the United States. As solar PV continues to grow, the necessity for granular data regarding the location and power capacity of the solar installations simultaneously grows. Solar power providers and customers, urban planners, grid system operators, and energy policymakers would greatly benefit from a granular, nationwide, ground-truthed database of solar PV installations and their capacities. We have amassed a ground-truthed dataset of over 19,000 installations, and developed and validated a power capacity estimation algorithm. We have used this dataset to train a solar panel detection algorithm that will be used to identify and analyze panels from high resolution satellite imagery. This algorithm may be applied to temporal satellite imagery in order to conduct socioeconomic analyses to identify factors associated with the rate of solar PV adoption, and to identify candidate markets for future adoption.

Physical & Quantitative Sciences, 11:30-12:30

Komal Kinger

Gender Differences In Mental Health Outcomes For An OSC Population In New Delhi, India

Research Advisor: Sumedha Ariely, Global Health

Orphaned and separated children (OSC) tend to have worse mental health status compared to other children. In particular, females in OSC populations, on average, often exhibit low levels of self-concept, low levels of ego-resiliency, and greater trauma symptoms despite males experiencing similar levels of life trauma as females. However, there is still limited research on gender differences in mental health in institutionalized children. The purpose of our longitudinal study is to explore the relationship between gender and common mental health issues including self-concept, peer and guardian attachment, ego-resiliency, and trauma symptoms within a population of OSC children of a residential care program in New Delhi, India. Seventy-five children randomly selected across eleven different group homes were interviewed in 2014 and 2015. Our results indicate that on average, males in 2014 and in 2015 tended to exhibit better mental health, showing higher guardian attachment and peer attachment ($p < 0.05$), lower trauma symptom scores ($p < 0.05$), and higher self-concept scores ($p < 0.05$) than females. There was not a significant difference between ego-resiliency in males and females. The associations and patterns we found shed light on gender differences in mental health status and how various mental health indicators across time might differ based on gender. Further research on these relationships could lead to better understanding of gender dynamics in institutional settings and potential gender-based interventions to improve mental health outcomes in OSC populations.

Community Engaged Research, 11:30-12:30

Emily Kragel

Barriers to Healthcare Access Faced by Indigenous Women in the Palajunoj Valley, Guatemala

Research Advisor: Charles Thompson, Documentary Studies

Over forty percent of the Guatemalan population does not have access to affordable quality healthcare services; this percentage is even higher for indigenous populations living in rural areas. Potential barriers limiting healthcare access include geographic barriers, lack of time, lack of trust in medical providers, perceptions about the quality of care, cost, male dominance or machismo, and cultural beliefs relating to illness. In order to investigate the effects of these potential barriers to healthcare access in the rural Palajunoj Valley of Guatemala, interviews were conducted with 15 indigenous women who participate in the Nutritional Recuperation Program of the Primeros Pasos (a nonprofit clinic working to overcome health barriers) coming from the communities of Xepache, Chuicavioc, and Las Majadas on a voluntary basis. The interviews were transcribed and translated with the help of local community members. Responses were rated using established methods for quantifying similar qualitative data. The relative effects of potential obstacles were assessed in each of the three sectors of healthcare that exist within this region- the public sector (commonly under-equipped and understaffed government run health posts), the nonprofit sector (Primeros Pasos), and the folk sector (community healers and midwives). In all three sectors, trust in the provider and perceived quality of care were associated with a positive impact while geography and cultural beliefs relating to illness were identified as the major obstacles to healthcare services in this region. Further study and understanding of these barriers is critical to improving healthcare access.

Social Sciences, 12:00-1:00

Hannah Kwak

Paired-Stimulus Paradigm Validation via P50 Analysis in Typically Developing Adults

Research Advisor: Michael Murias, DIBS

The ability of the central nervous system to inhibit or suppress the response to incoming irrelevant sensory stimuli, or sensory gating, is an essential protective mechanism that prevents inundation of higher cortical systems. One of the most effective ways of measuring sensory gating in the auditory system is the paired-stimulus parading (PSP) using the electroencephalogram. In the normal population, when two identical auditory stimuli are presented with a short inter stimulus interval, the first click elicits a greater P50 event-related potential than that of the second click, reflecting habituation at a pre-attentive phase of information processing. Traditionally, P50 paradigm requires participants to sit still for an extended period of time. This method has been used extensively in adults, but is not suitable for young children. Behavioral compliance in children could be improved with the presentation of a low-volume cartoon, but the impact of a competing auditory stimuli on P50 response is unknown. To evaluate the feasibility of using an audible cartoon simultaneously with traditional auditory P50 stimuli, P50 response was measured in adult participants with and without an audible cartoon playing in the background. Preliminary results suggest an attenuation of the P50 amplitude with competing auditory stimuli, but similar P50 ratios, compared to the silent condition.

Biological Sciences, 11:30-12:30

Eric Lakey

Expression and Purification of Chorismate Synthase in Plasmodium

Research Advisor: Emily Derbyshire, Chemistry

Malaria is a deadly and widespread disease caused by unicellular Plasmodium 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. The shikimate pathway is a biosynthetic pathway for the production of essential aromatic compounds within Plasmodium parasites. It is hypothesized that inhibition of chorismate synthase, the final enzyme in the pathway, will prevent the production of downstream essential aromatic compounds in Plasmodium parasites. Because the shikimate pathway is essential for Plasmodium viability at all lifecycle stages and absent in humans, it is hypothesized that successful inhibition of the shikimate pathway may represent a promising therapeutic for the treatment of malaria in both the liver-stage and blood-stage. Multiple sequence alignment and codon optimization were performed for both P. falciparum and P. knowlesi chorismate synthase in order to optimize expression in an E. coli expression system. The expression and purification scheme contained herein has yielded 95% pure Plasmodium chorismate synthase. Future studies on the activity and inhibition of this pure Plasmodium chorismate synthase may lead to the identification of parasite chorismate synthase inhibitors to aid in the fight against malaria.

Biological Sciences, 12:30-1:30

Chalette Lambert

Memory Guided Saccade Task Performance in Adolescent Football Players: Observations at baseline and Post-concussion

Research Advisor: Cameron Bass, Biomedical Engineering

Mild traumatic brain injury (mTBI) is major public health concern, yet there is a lack of objective diagnostic tools available to identify the presence or measure the level of injury. Prior human surrogate studies evaluating mild to severe brain injury show that a biochemical cascade occurs that can disrupt many functional networks of the brain, including the networks recruited in acquiring and remembering visuospatial information. The extent of injury to these networks after mTBI in human subjects is unknown. One potential test of motor function and spatial working memory is the memory guided saccade (MGS) task. Previous MGS studies in adult populations show increases in latency and inhibitory errors in concussed groups when compared to healthy groups, but do not compare to a baseline time point within the concussed population. Increased latency and percentage of inhibitory errors (PIE) for this task after concussion could indicate possible damage to the frontal networks involved in memory and executive function. Differences in performance on this task were assessed in high school football players at baseline and midseason time points. Concussed individuals (n=7) committed a smaller percentage of inhibitory errors (26.2±18.5% baseline; 17.5±30.0% midseason) and had shorter latencies (321.2±199.9ms baseline; 264.8±134.4ms midseason) at the midseason time point. These preliminary findings, in contrast to expected results, could be due to a learning effect or due to lack of assessment at the time of injury. Due to the complexity of the MGS task, participants may have improved from their initial unfamiliarity with the task. Additionally, decreased performance may have been observed if the post-injury assessment had occurred in the acute or subacute phase following concussion rather than at a set time point later in the season. Further analysis is being completed which will allow us to compare differences between a concussed and non-concussed group..

Bass Connections, 11:30-12:30

Byung Cheol Lee

Tracing Consumer Food Decision In A Realistic Shopping Environment

Research Advisor: Scott Huettel, Psychology and Neuroscience

How do people visually search for items in a grocery store? What motivates people to search for, and choose to buy, healthier food items? I use mobile eye tracking glasses as they shop in a simulated grocery store environment. I hypothesize that a use of non-explicit priming may alter people's attention and choice towards or away from healthful foods. Participants (N = 56; 18 men; M_age = 25) were randomly assigned to either health-prime condition or taste-prime condition. Participants in the health-prime condition were primed with healthy eating behavior by being exposed to poster images on the wall of simulated grocery store such as images of people exercising. Participants in the taste-prime condition were primed with the goal of eating tasty foods by being exposed to such poster images as those with people eating ice creams. It was found that the poster images prime participants in a non-explicit way: 76% of participants in the health-prime condition reported that they were not aware of the purpose of poster images on the wall. After being exposed to prime images, participants then performed multiple shopping tasks. In particular, they were endowed with $10 and were asked to make choices about which items they would prefer from categories listed on a "shopping list" they were given. Upon completion of the task, participants were tested for their memory for attributes of food items they purchased, including name, price, and calories per serving. A case study on one of the participants reveals that people search for items in a sequential manner rather than exploring all available options in the store. Furthermore, first fixation duration was significantly longer for selected items than for unselected items, suggesting that eye measures might be able to predict choices (M_selected = 216.28ms; M_not_selected 159.84ms; p = .04).

Psychology GwD, 12:30-1:30

Laura Lewis

Memory of Social vs. Non-Social Content in Chimpanzees

Research Advisor: Brian Hare, Evolutionary Anthropology

The selective pressures that engendered intelligence remain debated. Most hypotheses propose that either social pressures or nonsocial pressures shaped the evolution of cognitive abilities in primates. The Social Intelligence Hypothesis states that challenges and complexities presented by group living most significantly shaped the evolution of intelligence in primates, while the Ecological Intelligence Hypothesis states that this evolution was guided by challenges and complexities in the nonsocial, ecological environment. Previous studies have used comparative methods to determine relationships between cognitive abilities and influences of social and nonsocial environments. In the present study, we examined whether chimpanzee long-term memory has been more significantly adapted to process social or nonsocial hierarchical information. The ability to remember hierarchical information is important in both social and nonsocial domains. Using touchscreens, chimpanzees were tested on their long-term memory of both social and nonsocial hierarchies. Chimpanzees successfully learned two social hierarchies and two nonsocial hierarchies, and after a six-month delay were tested on their memory of these hierarchies. Our results support the hypothesis that chimpanzees are specially adapted to remember nonsocial information, lending support to the Ecological Intelligence Hypothesis.

Biological Sciences, 12:00-1:00

Joy Li

Esophageal submucosal glands contain cells that exhibit progenitor characteristics in vitro

Research Advisor: Katherine Garman, Medicine

The luminal surface of the human esophagus is lined with stratified squamous epithelium interspersed with duct openings leading to buried esophageal submucosal glands (ESMGs). Research over the last 20 years has implicated ESMGs in diseases such as esophageal adenocarcinoma (EAC) and as well as healthy repair following damage. Despite this association, the cell or cells of origin in the ESMG that play a role in both disease and repair remains a matter of debate. This project uses a porcine 3D cell culture model to explore the role of ESMGs. We hypothesized that porcine ESMGs harbor cells that are capable of proliferation and differentiation and are distinct from the population known to reside in the basal region of the squamous epithelium. We isolated porcine ESMGs and overlaying squamous tissue for growth in a 3D culture model using growth factor reduced Matrigel overlaid with a minimal media containing no added growth factors. After 7 days in culture, minced ESMGs produced large (approximately 400μm in diameter) multicellular, hollow, outgrowths, solid cell filled "buds", and a monolayer of cells while similarly-processed overlying squamous tissue generated no growth in the same conditions. The minced ESMG culture can be passaged into Matrigel, and if supplemented with recombinant EGF, will form multicellular spheroids that can passaged repeatedly. This repeated self-renewal is a benchmark test of stemness. Further work will be carried out to characterize these proliferating cells and test their functional response to challenges that model disease risk factors.

Biological Sciences, 12:30-1:30

Hui Yi Grace Lim

How Do Cells Invade? Identifying Novel Regulators of Invasion

Research Advisor: David Sherwood, Biology

Specialized cells invade through tissues during development and disease progression. In the nematode Caenorhabditis elegans, invasive behavior occurs during larval development when a specialized uterine cell known as the anchor cell breaches the basement membrane underlying it. This process occurs in a precise, stereotyped manner, and can be easily studied using live-cell imaging of genetic mutants with observable defective invasion phenotypes. Given these advantages, anchor cell invasion in C. elegans has been closely studied as an in vivo model for understanding the regulatory mechanisms behind basement membrane transmigration. Although genes involved in invasion have previously been identified, gaps in the regulatory pathway continue to hinder our complete understanding of the mechanism behind anchor cell invasion. In this study, we identified novel regulators in C. elegans that could address some of the unknown mechanisms involved in anchor cell invasion. A protruding vulva mutant collection, whose phenotype is indicative of altered uterine-vulval connection, was screened for a block or delay in anchor cell invasion. Two anchor cell invasion-defective mutants were identified with phenotypes that were distinct from known genetic mutants, and their associated genes were mapped onto the C. elegans genome. These mutants were then characterized for defining features of basement membrane transmigration, which could allude to their regulatory function in anchor cell invasion. Future work will focus more specifically on demonstrating the role of these novel regulators within known pathways. These regulators can represent future targets for therapy and help elucidate basic mechanisms behind normal human development and cancer metastasis.

Biological Sciences, 12:00-1:00

Xin Tong Lim

Predicting Depressive Symptoms: Big Five, Self-Compassion, and Rumination

Research Advisor: Timothy Strauman, Psychology and Neuroscience

This study investigated the relationship between Big Five personality traits, rumination, self-compassion, stressors, and depressive symptoms. 289 undergraduate students were measured on the above variables at 3 time points: Wave A (pre-matriculation), Wave B (orientation), and Wave C (end of the academic year). A hierarchical regression analysis was conducted to test if Big Five, rumination, self-compassion, and stressors can predict variance in depressive symptoms at a later time (Wave C). Neuroticism, conscientiousness, extraversion, and stressors were significant predictors of variance in depressive symptoms at Wave C. The hypothesis that brooding would be a significant predictor while reflective rumination would not was also supported. Self-compassion at Wave C was a significant predictor, while self-compassion at Wave B was not. The final model accounted for 52.5% of the variance in depressive symptoms. Measuring these variables can allow us to identify those at risk for developing depressive symptoms and provide early intervention. While personality traits are more stable, responses to stress such as rumination and self-compassion can be changed.

Psychology GwD, 12:30-1:30

Helen Liu

Assessing mental health needs of pediatric oncology staff in Kuching, Malaysia

Research Advisor: Eve Puffer, Global Health

This study investigates the mental health needs and challenges of pediatric oncology staff at Sarawak General Hospital (SGH). Hospital staff often face poor mental health when exposed for lengthy times to distressing situations, such as patients passing away. However, there is not yet much research about their mental health in Malaysia. In this study, researchers found that some SGH pediatric oncology staff struggle with depression and/or anxiety. Identified stressors include lack of training, management issues, uneven workloads, job security, opportunities for promotion, and long hours. Staff who developed anxiety or depression were also more likely to develop the other. Effective stress-relief variables include musical activities, religious activities, time with family, self-improvement activities, and a diversity of social networks. To better understand what mental health resources staff would be open to, researchers also surveyed staff on various mental health resources. The results showed that staff feel positively or are open to regular individual therapy, support groups at work, mental health workshops, mental health information, and mental health consultations. Using this information, researchers formed a strategy to target stressors and encourage stress-relief activities, providing staff with information, mental health resources, and a plan for better working environments. Researchers also encourage a follow-up study in a year on this topic and further studies on mental health of hospital staff.

Social Sciences, 11:30-12:30

Margaret Locke

Identification of Novel Actin Cytoskeletal Regulators of Synapse Development

Research Advisor: Scott Soderling, Cell Biology

The formation of synaptic connections during the early postnatal period is a fundamental neurodevelopmental process. Dendritic filopodia are precursors to dendritic spines, the structure of excitatory synapses that receives neurotransmitter release. Though dendritic filopodia play a critical role in synaptogenesis, little is known about the molecular mechanisms involved in the formation and maturation of dendritic filopodia. To identify proteins which are critical for filopodia regulation, a novel fusion protein was expressed in neurons which is a combination of Wrp, a filopodia specific actin regulator, and BirA, an enzyme which promiscuously biotinylates nearby proteins. Biotin-labeled proteins were then isolated using a biochemical pull-down assay and identified through mass spectrometry. This system was tested in neurons and organotypic brain slice culture using the techniques from primary culture, lipofectamine and biolistic transfection, immunostaining, and confocal microscopy. Once optimization was completed, we developed an Adeno-associated virus which expressed Wrp-BirA, and infected mouse neurons in vivo through stereotactic injection. We then isolated filopodial synaptic proteins in vivo based on their targeted biotinylation. A list of fifteen candidates was identified out of 2500 associated proteins, and CRISPR knockdown and testing is underway to elucidate the mechanisms through which they act. The identification of previously unknown mechanisms involved in dendritic filopodia formation and synapse development may also reveal new insights into developmental brains disorders such as intellectual disability and Autism.

Biological Sciences, 11:30-12:30

John Lu

Schistosomiasis Prevalence, Mass Drug Administration Efficacy, and Risk Factors in Rural Tanzania

Research Advisor: David Toole, Global Health

Research-driven schistosomiasis mass drug administration campaign in four Tanzanian villages along Lake Victoria. Schistosomiasis is the deadliest neglected tropical disease, and it impacts primary school attendance, lowers growth proportions, and delays cognitive development. Previous unpublished research showed that the schistosomiasis prevalence among school-aged-children in one lakeside community was 95%. This program aimed to conduct research on schistosomiasis prevalence to guide the implementation of a mass drug administration (MDA) campaign against schistosomiasis. The first part of the program aimed (1) to quantify the burden of the schistosomiasis infection in four communities in Rorya District, Tanzania, (2) to identify risk factors for infection, and (3) to determine if prior treatment campaigns lowered prevalence. The second part of the program utilized this community-based research to scale an existing MDA. Program participants were recruited through mass community advertising. The project will be continued through a new partnership between SHED Foundation and Duke GlobeMed. By using CCA-antigen urine rapid tests (N=1600), schistosomiasis was found to be highly prevalent among both adults and children in the four tested communities, with prevalence ranging from 90% to 97% for adults and 85% to 90% for children. Major risk factors implicated in such high prevalence include youth, no prior treatment, and proximity to Lake Victoria. Comparing the number of uninfected people who were previously treated in a 2014 campaign (N=216) and the number of people not previously treated (N=216) showed that SHED Foundation's 2014 MDA led to a 57% increase in the percent of uninfected people (7% to 11%). As a result of these findings, an MDA was launched in the four communities in coordination with the SHED Foundation. In total, over 8,000 community members were given free praziqauntel during the program period.

Community Engaged Research, 12:00-1:0

Jason Luo

Diastereoselective, Site-Selective, and Enantiospecific Synthesis of 1,3-Amino Alcohols via Azaallyl Anion Ring-Opening of Epoxides

Research Advisor: Steven Malcolmson, Chemistry

Amino alcohols are common in natural as well as synthetic medicinal compounds, such as Cymbalta and Terramycin - an antidepressant and antibacterial. Current methods for synthesizing 1,3-amino alcohols require harsh conditions and very specific functionalities and auxiliaries. Additionally, stereoselectivity is difficult to achieve. We have developed a diastereoselective, site-selective, and enantiospecific method for synthesizing 1,3-amino alcohols from the ring-opening of epoxides via an azaallyl anion. This allows us to bypass harsh reagents, specific functionalities, and trouble with stereoselectivity.

Physical & Quantitave Sciences, 12:30-1:30

Bianca Lupan

Identification of FKBP8 as a MAVS regulator during RIG-I signaling

Research Advisor: Stacy Horner, Molecular Genetics & Microbiology

During RNA virus infection, viral RNA binds to the cytosolic receptor RIG-I to activate MAVS, a central innate immune adaptor, leading to the transcriptional induction of interferons (IFNs) and interferon-stimulated genes (ISG). This ISG induction is a crucial part of antiviral signaling and viral clearance. A proteomics screen recently published from our lab found that the molecular chaperone FKBP8 is present in the mitochondrial-associated membrane (MAM), a specialized subdomain of the ER, and that FKBP8 could be a potential MAVS-interacting protein. FKBP8 has been previously shown to regulate the localization of BcL2, a mediator of apoptosis, which localizes to the same subcellular membrane compartments as MAVS, specifically the ER and mitochondria. Thus, to determine whether FKBP8 directs the localization of MAVS as it does for BcL2, we performed confocal microscopy and found that FKBP8 co-localizes with MAVS. Co-immunoprecipitations also revealed that FKBP8 interacts with MAVS. siRNA-mediated knockdown of FKBP8 followed by confocal microscopy showed that FKBP8 does not regulate MAVS localization. However, siRNA-mediated knockdown of FKBP8 followed by Sendai virus infection showed decreased signaling to the IFN-beta promoter suggesting FKBP8 regulates IFN signaling and is important in the RIG-I pathway. To determine where FKBP8 acts on the RIG-I signaling pathway, we over-expressed several key innate immune proteins on the pathway and performed a dual luciferase signaling assay which revealed that FKBP8 acts between RIG-I and MAVS in the innate immune pathway. Taken together, this data has revealed a new MAVS-interacting protein that is important for RIG-I signaling during RNA virus infection.

Biological Sciences, 12:00-1:00

Vania Ma

Cesar Nicolas-Penson's "The Galindo Virgins" as Edenic Creation Myth and Foundational Fiction of Haitian-Dominican Bordering

Research Advisor: Richard Rosa, Romance Studies

The Haitian-Dominican border has been a significant object of study in several fields, including history and sociology. Less prevalent in this cross-disciplinary investigation is a literary exploration of the border and of the geospatial dimension of Dominican nationalism. I thus offer a departure point for such discourses concerning the literary intersection of nation, space, hospitality, and bordering through my reading of Dominican author César-Nicolás Pensón's short story "The Galindo Virgins" as a both an Edenic creation myth and a foundational allegory of the border. Synthesizing Doris Sommer's theory on foundational fictions, Henk von Houtum's interventions about the border, and Jacques Derrida's formulation of the guest-host dynamic, I focus on the motif of the door as both a physical boundary and as a vehicle of invitation and hospitality. I argue that for Pensón, the Dominican nation's pre-Fallen state is dependent upon a spatial configuration of closed doors (no hospitality) towards the Haitian. The nation's Fall thus occurs the moment the "Nation-Host" accidentally opens its door and extends hospitality to the Haitian arrivantes. This hospitality = Fall equation implies that to redeem itself, the Dominican nation must reverse its Fall by re-closing its doors and "uninviting"—or rescinding hospitality from—its unwelcome Haitian guests. As the border can be fashioned as a "national door" and instrument of national hospitality, such literary constructions of Haitian "unbelonging" that designate Haitians as unwelcome guests undeserving of hospitality in Dominican space are vital to understanding a key ideology of Haitian-Dominican bordering and spatialization.

Humanities, 12:30-1:30

John McDermott

Evidence for Volatile Modification of Compacting Crystal Assemblages

Research Advisor: Alan Boudrerau, Earth and Ocean Sciences

In the last few decades, there have been several leaps in our understanding of the petrology of layered igneous intrusions. Many of these focus on the Stillwater Complex in Montana. One particular area in which there is much experimentation is the impact of volatiles on crystallization sequences and volatile modification of original crystal assemblages over time. Previous experiments (Boudreau 1999, Meurer et al. 1997) demonstrate that certain minerals could have been affected by either volatile replacement of the fluxing effects of water trapped in the magma. This research focuses on how volatiles act in crystal assemblages. It is in 2 parts. First, the apparatus constructed by Dr. Boudreau is used to observe the physical behavior or trapped gasses in partially crystallized melts, using pressure and time lapse video to observe the vertical movement of a gas bubble or bubbles through slowly compacting crystal masses. Next, I will take these observations and apply them to the existing thin section rock samples of the layers of the Stillwater Complex, looking for evidence of volatile modification of the crystallization process.

Physical & Quantitave Sciences, 12:30-1:30

Thomas Meister

Dynamic regulation of COPII vesicle trafficking via O-GlcNAc modifications

Research Advisor: Michael Boyce, Biochemistry

The Coat Protein Complex II (COPII) vesicle trafficking pathway mediates the transport of cargo proteins from the ER to the Golgi. The pathway is initiated by a complex protein scaffold, which recruits cargo and promotes vesicle budding and scission. While the basic mechanism of coat formation is well-established, its dynamic regulation remains poorly understood despite its relevance in several congenital diseases. It has recently been discovered that multiple COPII coat proteins are decorated with the post-translational modification O-linked beta-N-acetylglucosamine (O-GlcNAc), though the function of these modifications remains unclear. Based on its role in other large protein complexes, I hypothesized that O-GlcNAc might regulate COPII vesicle trafficking through the mediation of protein-protein interactions during vesicle coat assembly. To test this hypothesis, I used a novel chemical tool, termed GlcNDAz, which covalently crosslinks any proteins that normally bind non-covalently through O-GlcNAc, allowing the interactions to be more easily studied. Using this method in a human cell line, I demonstrated that recombinant COPII coat proteins Sec23A, Sec24C, and Sec31A all participate in GlcNDAz-dependent crosslinking, though I have not yet identified their binding partners. I also identified a series of O-GlcNAc-modified residues on Sec31A using a protein purification and mass spectrometry technique. This knowledge can be used to construct non-glycosylatable Sec31A site mutants, in order to determine the significance of each site in GlcNDAz crosslinking and also in a series of functional assays. Using a similar set of non-glycosylatable Sec23A mutants, I found that two of the mutations eliminate GlcNDAz-dependent crosslinking, indicating that these sites may be important in O-GlcNAc-mediated protein-protein interactions. This mutagenesis approach, along with continued effort to identify GlcNDAz-mediated binding partners, will further elucidate the role of O-GlcNAc in COPII vesicle trafficking.

Biological Sciences, 12:00-1:00

Emilie Melvin

Sleep Quantification & Effects of Sleep on Cognition in Lemurs

Research Advisor: Charles Nunn, Evolutionary Anthropology

In-depth analysis of sleep and its effects on cognition in non-human primates can provide insight into human sleep and its effects on the body. We explored the behavioral and cognitive effects of sleep restriction in four captive species of lemur at the Duke Lemur Center. Our results suggest that diurnal species experience greater cognitive decline following a sleep restriction regimen than cathemeral species of lemurs. Lemurs exhibit a lower frequency of aggressive and self-directed behavior following sleep restriction. Species-specific results support the findings of the cognitive testing, indicating that sleep structure (cathemerality or diurnality) impacts degree of affectedness. Taking both the behavioral and cognitive results together, conclude that when sleep is disrupted, sleeping structure affects the degree of affectedness in lemur species. This project also explored the use of three technologies for quantifying sleep in the four lemur species. Actigraphy monitoring, infrared videography, and eulerian (processed and magnified) videography were collected simultaneously. Our findings confirm that there is strong agreement between actigraphy and infrared videography in classifying the sleep/wake state of a lemur across a 12-hour study period. Inter-observer agreement increases by 30-40% when eulerian-processed video is used compared to infrared video, the current videography method commonly used. We conclude that actigraphy monitoring and infrared videography both determine sleep/wake states reliably, and that eulerian videography has great potential to impact studies on primates and sleep by improving methods for sleep quantification of primates via videography.

Biological Sciences, 12:00-1:00

Jacob Miller

Genome-wide risk for schizophrenia is associated with altered prefrontal cortex activity and functional connectivity

Research Advisor: Ahmad Hariri, Psychology and Neuroscience

Recent genome-wide association studies (GWAS) implicate a large number of common risk alleles for schizophrenia, but the biological mechanisms through which this risk is conveyed are unclear. Establishing such a mechanistic understanding of genome-wide risk is critical for advancing related efforts to develop novel targets for intervention and prevention. Here, we use an imaging genetics strategy in young adults to map a schizophrenia risk profile score (RPS) derived from the Psychiatric Genomics Consortium onto inter-individual variability in prefrontal cortex activity and functional connectivity during the manipulation of information maintained in working memory. Analyses revealed that higher RPS was associated with relatively decreased activity in the dorsal anterior cingulate cortex (dACC) but increased functional connectivity between the dACC and left dorsolateral prefrontal cortex (dlPFC). This pattern suggests that increased genome-wide risk for schizophrenia may be associated with relatively diminished conflict monitoring as well as ineffective executive modulation of conflict monitoring when manipulating information maintained in working memory. Such dysfunction in prefrontal circuitry during executive control is a hallmark intermediate phenotype of schizophrenia and may represent a biological mechanism through which genome-wide common alleles confer risk for the disorder.

Biological Sciences, 12:30-1:30

Katrina Miller

Advancements in Tracking Detector Technologies

Research Advisor: Phillip Barbeau, Physics

Gas-based recoil tracking detectors are used in a variety of nuclear and particle physics experiments to identify incident particles based on distinct interaction signatures. Past research shows that this technology will substantially contribute to research concerning dark matter detection, neutrino studies, and more. This project attempts to improve upon present detector technologies by proving the utility of unconventional target materials in these detectors. The initial model, consisting of a single-wire chamber, is tested with several different gases and gas mixtures to determine the light-to-charge performance of each target material and its dependence on voltage and pressure. The development of a more sophisticated detector, incorporating a gas electron multiplier, is also outlined along with preliminary calibrations.

Physical & Quantitave Sciences, 12:30-1:30

Lauren Miranda

Disconnected Dyads: the distressed dynamics of the coach/athlete relationship in lesbian, gay, and bisexual intercollegiate athletes

Research Advisor: Karen Murphy, Psychology and Neuroscience

Lesbian, gay, and bisexual (LGB) athletes face a complex and heterosexist culture in athletics, maintained by stereotypes and harassment, that impacts them negatively: physically, mentally, and emotionally. Theories of social change suggest that their coaches can play an invaluable role in remedying this culture—starting with forging meaningful and supportive relationships with the athlete themselves. This study explored coach-athlete dynamics in various domains and in comparison to ideals as reported by a sample of LGB-identified, intercollegiate athletes using the Coach Athlete Relationship Questionnaire (CART-Q) and interview questions. It was hypothesized that the relationships between LGB-identified athletes and their coaches would be weakened and would show a significant disconnect between the athlete's reported ideal coaching relationship and their actual relationship. Results provide evidence to support these hypotheses, and show that LGB-identified athletes show weaker relationships with their coaches than other coach-athlete dyads. These athletes feel that they are missing various components of an ideal coach-athlete relationship as it pertains to trust, respect, and understanding of their identity. They suggest that this impacts their personal well-being, their performance as athletes, and their overall satisfaction on their team and in their sport. These findings imply that coaches need to take a more active role in creating an inclusive culture on their team through building more effective relationships and attempting to understand the different challenges that face their LGB-identified athletes.

Psychology GwD, 12:00-1:00

Briana Mittleman
Genetic Architecture of Variation in Sex Comb Tooth Number in Drosophila subobscura
Research Advisor: Mohamed Noor, Biology

In traits affected by sexual selection, differences between species may be large but variation within populations or species is often expected to be low. In contrast, some traits retain variation even within and among populations of the same species. Not much work has been done to study the genetic basis of this variation. Here, I study a sexually selected trait (sex combs) that has retained variation in the distal structure among strains of *Drosophila subobscura*. Sex combs are modified bristles on the front legs of male flies that aid in copulation by helping the fly attach to and spread the wings of the female. I test the hypotheses that a disproportionate amount of variation will map to the X chromosome and the trait will exhibit polygenic inheritance. I found that reciprocal F1 crosses express 58% of the phenotypic variation of the parent strains but have not found a region of the X chromosome accounting for this variation in F2 populations. I also found evidence for effects at 3 autosomes suggesting polygenic inheritance of the distal sex comb in D. subobscura. Overall, this study informs the literature on the genetic basis of within species variation a sexually selected trait.

Biological Sciences, 12:00-1:00

Christopher Monti

Gel Electrophoresis Methodology to Assess the Concentration of Collagen in Human, Gorilla, and Chimpanzee Heel Pads

Research Advisor: Angel Zeininger, Evolutionary Anthropology

Humans, chimpanzees, and gorillas use a specialized foot posture known as heel strike. At heel strike in humans, the heel and leg experience a large impact force that must be mitigated, in part, by the cushion-like heel pad. While the mechanics of heel strike are thought to differ across these three species, variation in the structural integrity of the heel pad across species is unknown. Differences in heel pad weight bearing between humans and nonhuman apes may result in collagen scaffolding variances—namely, the level of collagen—at different locations across the heel pad. However, collagen has an intricate, graded structure that can create challenges for analytical techniques. This project establishes a methodology for the use of gel electrophoresis as an analytical tool for the recovery of collagen. Research grade human placental collagen was used in phase-one of our research protocol to establish proof-of-principle. Collagen was dissolved in a pH 2.72 acetic acid buffer with rigorous vortexing. In trial one, the collagen was loaded onto a 4-15% gradient SDS polyacrylamide gel, heated in the presence of Coomassie Brilliant Blue stain for 30 seconds, and then allowed to de-stain overnight. We were not able to detect any collagen on the de-stained gel and hypothesized that the collagen was not able to enter the 4-15% gradient SDS polyacrylamide gel. In a second trial, collagen was run on a 7.5% acrylamide gel, stained for about 14 hours without heating, and then de-stained overnight. In trial two, collagen separated by molecular weight on the 7.5% acrylamide gel. consistent with previously published values. Results from trial two provide justification for the use of electrophoretic methodology to evaluate positional variation in collagen content of human, gorilla, and chimpanzee heel pads.

Biological Sciences, 11:30-12:30

Aditya Mukund
Ellipses for Continuous Flexibility in Protein Design
Research Advisor: Bruce Donald, Computer Science

Determining optimal amino acid sequences and conformations is a key problem in computational structure-based protein design. Design algorithms in CSPD software suites must permit modeling of protein flexibility, or they may fail to find optimal structures. While previous algorithms modeled amino acids as rigid structures in space, modeling continuous side-chain flexibility has proved useful for accurate design. Current methods of incorporating continuous amino acid flexibility use 9 degree square voxels over which amino acids are permitted to move and use lower bounds on protein energies to enumerate optimal structures and design peptides. Here we model amino acid flexibility by determining ellipsoidal volumes over which amino acids are allowed to move during the design process, and using these volumes to redesign a test set of proteins. Because movement along one degree of freedom affects the range of possible movement in another degree of freedom, ellipsoidal bounds on amino acid flexibility hold the potential for more accurate biophysical modeling and improved computational design.

Biological Sciences, 11:30-12:30

Cam-Ha Nguyen, Kathryn Henschel, Margaret Booz
Developing a Summer Literacy Program for Children in Durham's Transitional Housing
Research Advisor: Amy Anderson, Education

The Summer Literacy Program at Families Moving Forward is one of the deliverables of our Bass Connections team - Responding to the Educational and Psychological Needs of Children and Families in Durham's Transitional Housing. Our team works collaboratively with a community partner, Families Moving Forward, while team members study (1) quality practices to support educational needs of school-aged children at Families Moving Forward, and (2) the implications of trauma identification for children and families in Durham's transitional housing. From our findings about "trauma-informed cultures," self-concept, and the positive impacts of parental involvement in a child's schooling, we decided to create a summer reading program at Families Moving Forward. Summer literacy programs have been found to increase children's self-concept, which is a protective factor to trauma by improving overall well-being. We hope to apply the characteristics of successful after-school programs to our summer literacy program, which include individual attention, sufficient resources, support for students' study and social skills, and a home literacy environment. In developing the program, we are mindful to create a "trauma-informed culture" to empower students and parents to understand their rights and resources. Using books from Book Harvest and Families Moving Forward's library, the program aims to continue to engage children in academic material and avoid summer learning loss.

Bass Connections, 12:30-1:30

Leslie Niiro

How to Teach Traumatic History: A Case Study in Buenos Aires, Argentina

Research Advisor: David Malone, Education

How do societies teach about recent and traumatic history? From 1976 to 1983, state-sponsored terrorism reigned in Argentina. By the end of the dictatorship in 1983, the state had tortured, murdered, and disappeared more than 30,000 people in many clandestine torture centers in Argentina and abroad. Upon the completion of the transition to democracy, and after calls to action from many human rights organizations, some of these former clandestine torture centers were transformed into memory sites. These memory sites, painful reminders of the Argentine dictatorship, stand in protest against societal amnesia. Their message is clear. Never forget this history, so that it may never be repeated. Through an examination of three memory sites in Buenos Aires, I draw on critical pedagogy to analyze how Argentinians learn about the "Dirty War". Using Paulo Freire's idea of critical pedagogy, I ask how and why future generations learn about past atrocities. Because the basic principle of critical pedagogy is that education is a political act, the Argentine use of critical pedagogy demonstrates a political desire to promote certain citizenship ideals, namely, critical historical consciousness, human rights awareness, and the concept of people power. Argentinian memory sites accomplish this through promoting critical dialogue and questioning of the past. Drawing from interviews, participant observation, and analysis of educational materials from each site, I conclude that a critical reading and questioning of history, as done in Argentina, can serve as a model for other countries coping with difficult and traumatic pasts.

Social Sciences, 12:00-1:00

Malcolm Nowlin

Addressing the racial imbalances in Durham Public Schools

Research Advisor: Anna Gassman-Pines, Public Policy

The focus of my research project was to investigate the racial imbalances amongst the student populations of traditional public schools and charter schools in Durham. This project was in collaboration with Durham Congregations, Associations, and Neighborhoods (C.A.N.), a local community organizing non-profit. Through a series of interviews and the analysis of public school demographic records, I identified the racial makeup of both school systems, highlighted the schools with low populations of black and Hispanic students, and attempted to identify sources of the imbalances. The data reveals that charters have higher concentrations of white students than their traditional public school counterparts. The data pointed to the services omitted by some of the charter schools for this racial imbalance as the charter schools that did not provide transportation or meal programs to their students had lower black and Hispanic student populations.

Community Engaged Research, 12:30-1:30

Christine Nunez

Moderators of Habituation in a Laboratory Emotion Regulation Paradigm: The Role of Diagnostic, Trait, and State Anxiety

Research Advisor: Zachary Rosenthal, Psychology and Neuroscience

Difficulty calming down after a stressful event, or habituating, is a transdiagnostic problem associated with problematic coping behaviors such as alcohol abuse, interpersonal dysfunction, impulsivity, and recklessness. Therefore, it is important to clarify when these difficulties with habituation arise and to identify factors that predict individual differences in habituation time following a stressor. Prior work has investigated a number of factors that might impact habituation, with the most evidence pointing to a central role of anxiety in individual differences in habituation. To better understand moderators of habituation in a laboratory stressor task designed to induce emotional arousal, the current study investigates the differential impact of diagnostic, trait, and state anxiety on moderating habituation times. The current study uses data from a larger parent study evaluating a novel behavioral intervention for emotion regulation in a transdiagnostic sample of treatment-seeking adults (18-55 years old) with high emotion dysregulation (n = 167). Continuous monitoring of psychophysiological arousal (i.e., Galvanic Skin Response; GSR) was used to measure habituation, defined as the time in seconds between hearing an autobiographical stressor and returning to their personalized physiological baseline. Findings from this investigation indicate that age, anxiety disorder diagnosis, trait anxiety, body awareness, and caffeine consumption uniquely predict habituation time, over and above a range of demographic, diagnostic, trait, and state moderators. The results of this study suggest that the role of anxiety on habituation could have important clinical implications through better understanding of the factors which contribute to habituation and the development of more targeted interventions.

Psychology GwD, 11:30-12:30

Philipp Oberbeck

Policy Barriers to Successful Integration of Refugee Populations in Resettlement, Employment and Language Provision in Germany

Research Advisor: Alma Blount, Public Policy

The European Refugee Crisis has led to a historic turnaround in German immigration policy with more refugees eligible to be granted asylum than ever before. A formerly defensive immigration policy of 19,164 accepted immigrants in 2007 has been abandoned for a more open approach, with 800,000 refugees arriving in 2015 alone. My project dealt with identifying some of the policy inflexibilities that arise from this drastic change and recommending changes for better integration outcomes. I found non-dispersed refugee settlement, insufficient workplace integration, lack of federal funding for language and skills development and limited forums for exchange between citizens and policy makers to be key barriers to integration. My recommendations to best address these inflexibilities centered on easing of refugee work restrictions, increased funding for language and skills development and better voter inclusion in the design and implementation of future immigration policy.

Social Sciences, 12:00-1:00

Ruici Ong

Perceptions Matter: Smallholder Farmer Views on Climate Change

Research Advisor: Chantal Reid, Nicholas School of the Environment

Climate change will alter timing of organism life phases, including that of species cultivated for agriculture such as coffee, a cash crop grown in 60 countries by over 25 million people. Increased variability of rainy seasons in the tropics and excessively high temperatures also impact the life cycles of pest and pollinator species, further threatening agricultural productivity and food security of coffee farmers. While these farmers face considerable environmental and economic challenges, groups of small farmers have developed complex, biodiverse agriculture systems, risk-averse and avoid input-heavy modern cultivation methods. This research project investigated the views of smallholder farmers of conilón coffee (robusta, C. canephora) in Espírito Santo, SE brazil regarding their views on climate change, use of pesticides and alternative farm practices. Farmers perceived climate change occurring on a local level, based on coffee plant life phases and temperature and water requirements, however not all farmers who perceived local weather perturbations ascribed it to global processes. Farmers were also generally aware of pesticide risks but differed on their perception of effectiveness or accessibility of organic pesticides, though their actions were unique to individual circumstances. The process of building climate-resilient and sustainable farm systems should include smallholder farmer communities and take into account the farm system and specific life cycles of their crop.

Social Sciences, 11:30-12:30

Erica Ortiz

Neurobehavioral Effects of D1R and D2R Antagonists on TDCIPP Treated Zebrafish Larvae

Research Advisor: Edward Levin, Psychology and Neuroscience

The zebrafish model has elucidated to a strong basis for understanding the underlying mechanism of the dopaminergic nervous system in relation to environmental neurotoxicants. The acute effects of two dopamine antagonist, haloperidol and SCH23390, were assessed in zebrafish larvae that had been developmentally treated with TDCIPP. Since the phase-out of many pesticides, there has been widespread use of TDCIPP as an organophosphate flame retardant, but recently there has been more extensive research into this chemical to determine its carcinogenic abilities and potential for reproductive harm. METHODS: Zebrafish larvae were exposed to vehicle solution, consisting of 0.03% solution of DMSO, 3, or 6 μM of TDCIPP from 0 to 5 days post fertilization. At 6 days post fertilization, larvae were tested on a locomotor assay with an acclimation phase, and alternating light and dark phases to determine dose-dependent effects of either haloperidol and SCH23390 when acting on TDCIPP treated zebrafish larvae. RESULTS: There was a significant ($p<0.0321$) interaction between TDCIPP Dose x Haloperidol x Light Phase and also a significant ($p<0.0151$) interaction between TDCIPP Dose x SCH23390 x Light Phase. DISCUSSION: The purpose of this study was to determine whether there is a difference of the D1R and D2R antagonists, SCH23390 and haloperidol, respectively, acting on different doses of TDCIPP exposed zebrafish larvae. The series of experiments found a reduced locomotion response in the light and dark phases to acute administration of haloperidol and SCH23390 suggesting that inhibited dopamine response interacts with neurotoxins such as TDCIPP.

Psychology, 12:00-1:00

Sagar Patel
Astrocyte-Secreted Hevin is Required for Experience-Dependent Microglial Pruning of Excitatory Synapses in Visual Cortex
Research Advisor: Cagla Eroglu, Cell Biology

The fundamental unit of the central nervous system are synapses that bridge together neurons for communication. During development, neural circuits are refined through experience-dependent plasticity. During this process, glial cells orchestrate the elimination and maturation of synapses. Of these glial cells, microglia are the resident immune cells in the brain that play an active role during inflammation and cellular clearance. Recently, the dynamic motility and prevalence of microglia suggest that they may play an integral role in remodeling and plasticity of neural circuitry through a process known as synaptic pruning. However, the precise function of microglia at particular excitatory synapses, the molecular cues underlying microglia-mediated synaptic engulfment, and the consequence of visual experience on microglial behavior still remains unclear. A candidate mechanism through microglia-mediated pruning could interact with developing synapses in the visual cortex (V1) is via hevin, an extracellular protein highly expressed by astrocytes during sensory-experience development. With these emerging questions about microglia-driven pruning in the V1, we sought to understand the mechanism underlying the elimination of excitatory synapses in developing neural circuits during sensory-experience. In this study, we demonstrated that microglial behavior and morphology is controlled by visual input and secreted-hevin during a key part of V1 development. Furthermore, we identified that microglia preferentially engulf thalamocortical synapses during visual experience. In the absence of hevin, microglial pruning is impaired, exclusively affecting the phagocytosis of VGluT2-positive synapses. These exciting findings provide a role for microglia in the healthy, developing brain and a molecular mechanism by which microglia are signaled and activated in preparation for synaptic pruning.

Biological Sciences, 12:00-1:00

Carolyn Peterseim

Accessibility of Treatment in Cameroon for Malaria and Sickle Cell Disease

Research Advisor: Charmaine Royal, African and African American Studies

How does accessibility affect treatment for malaria and sickle cell disease (SCD) in the hospital and village clinic spaces in Cameroon? This study's methodology included semi-structured interviews with health care workers and participant observation. The indications to treat malaria are different between Yaoundé Central Hospital and the villages that ASCOVIME aids, due to differences in accessibility, epidemiology, and affordability of treatment. . Malaria patients are not hospitalized unless the case is severe or a pregnant female, and then the patients are placed in the hepato-gastroenterology ward or the maternity ward, respectively. A member of the family, the "garde malade," stays with patients who are hospitalized at all times. Accessibility to medication for simple versus complex malaria differs because of where the two manifestations of the disease are treated. In the villages, simple malaria was one of the most frequent diagnoses. In the villages, I only noted two instances of severe malaria out of the two campaigns for which I had statistics. The protocol for treatment is the same between the villages and the city with respect to what treatment should be given for each manifestation of the disease. Some are less expensive and more accessible than others. The villages have simple malaria treatments that may be available in the pharmacy and affordable to the patients. However, ASCOVIME distributes artemisinine-based drugs, quinine, paracetamol, multivitamins drugs to treat simple malaria. Patients with severe malaria were treated for simple malaria and referred to the nearest hospital. In the hospital, IV quinine is the cheapest and most often used. For two healthcare workers, artemisinine-based treatment is used for those who are allergic to quinine. Sickle cell disease is rarely seen or rarely recognized in the villages by healthcare workers because it can seem like anemia caused by other, more common diseases, like malaria.

Community Engaged Research, 11:30-12:30

Connor Phillips

The Experiential Connection?: Asymmetric Polarization and Political Experience

Research Advisor: Edmund Malesky, Political Science

The Democratic and Republican caucuses in the House of Representatives have been moving apart for the last several decades, a shift which has been observed to be more dramatic for the Republicans. One theory explains this asymmetry as the product of differences in legislative experience between the two caucuses: Republican voters, being anti-government, undervalue the benefits of previous service in public office, leading them to nominate candidates with less political experience who as a result are less likely to favor compromise and more likely to pursue their own ideological goals. However, an empirical analysis of these linkages, based on a mediation model comparing Congresses from the 1970s and three from the 2000s, finds no evidence for this theory. Republican Congressmen today are not significantly less experienced than in the 1970s, and less experienced representatives do not appear to be more extreme.

Social Sciences, 12:00-1:00

Roshni Prakash

Musculoskeletal effects and injury risk in collegiate Indian classical and ballet dancers

Research Advisor: Blythe Williams, Evolutionary Anthropology

Dancers of all forms often engage in aesthetic yet challenging movements. Their training, choreography, and performances require strength, stamina, flexibility, grace, passion, and emotion. Ballet and Bharatanatyam (an Indian classical dance form) dancers utilize two movements in each of their dance forms that are similar—a half-sitting pose and a full-sitting pose, both requiring external rotation of the legs and bending at the knee joints. The purpose of this study was to examine and compare the biomechanics of joint reaction forces and knee angles in both styles of dance for these particular poses. The study included nine female ballet dancers and seven female Bharatanatyam dancers. Hamstring and gastrocnemius flexibility were measured for each dancer. Knee angles, vertical peak forces, and moments were determined for dancers at the lowest point of their bending positions. Mann-Whitney U tests found significant differences in hamstring flexibility, right gastrocnemius flexibility, and knee angles for the full-sitting poses between ballet and Bharatanatyam dancers. No significant difference was found in the vertical peak forces as a ratio to total body weight and moments between the two styles of dance. Further research can be done to more directly assess a difference in injury risk between the ballet and Bharatanatyam dancers.

Biological Sciences, 11:30-12:30

Roshni Prakash, Paige Scarbrough, Giselle Graham, Xin Tong Lim
Voices Together: Music Therapy and Autism in Elementary Schools (2015-2016)
Research Advisor: Carol Ripple, Bass Connections Education and Human Development

Autism spectrum disorder (ASD) affects 1 in 68 children and its prevalence has been steadily increasing over the years. Studies have shown that music can not only increase the activation in the language processing areas of the brain in individuals with autism, but can also increase their connectivity pathways. The field of music therapy for ASD is just emerging, and systematic research is necessary to advance the field. The current study assesses the efficacy of a form of music therapy, Voices Together, in improving the social, emotional, and communicative skills of children with ASD. Data was collected on 64 students across 9 ASD elementary school classrooms in a school system in North Carolina. Probes were designed to measure change in communication skills of these students as a result of their Voices Together music therapy sessions. These probes were administered at 6 times points, and student responses were coded on multiple dimensions such as verbal and non-verbal communication, awareness of self and others, and attention. As expected, preliminary results showed no significant difference between two of the pre-treatment total probe scores, Time 1 and Time 4. Moving forward, the next set of planned analyses will examine if there is a change in the total probe score after weekly music therapy sessions, at Time 5 and Time 6. Additionally, the total probe scores will be compared to other student and teacher measures. Quantifying the effects of music therapy will help improve the accessibility and visibility of music therapy programs, like Voices Together.

Community Engaged Research, 11:30-12:30

Ana Restrepo

Does everyone do it? The general tendency to underestimate capacities in self-control forecasting

Research Advisor: Rick Hoyle, Psychology and Neuroscience

The different strategies used by individuals with high trait self-control that differentiate them from those with low self-control are poorly understood. One possibility may be that they engage in more forecasting of their success or failure when faced with future self-control demands, enabling them to better plan how they will behave. This study sought to understand how trait self-control affects whether people routinely think about their upcoming self-control challenges, whether they predict their behavior, and the accuracy of their predictions. Two surveys captured the degree to which participants (N = 168) recruited on Amazon Mechanical Turk spontaneously anticipated upcoming self-control challenges and examined how accurate they were in predicting their self-control successes and failures over Thanksgiving. Most participants did not spontaneously forecast their self-control behavior, though when asked to do so, participants were generally accurate in predicting their self-control successes and failures, though they tended to underestimate their ability to control their behavior. Surprisingly, trait self-control did not play a role in increasing participants' tendency to forecast, nor was it consistently related to accuracy, though it was significantly correlated to their self-reported attempts and success at controlling their behavior. The current study suggested that, in general, people tend to be accurate in their predictions of their behavior though individuals higher in trait self-control do not have a greater tendency to forecast their self-control behavior. Further research should be done to further elucidate this issue.

Psychology GwD, 12:30-1:30

Lauren Rivkin

Affective state of children with autism influences frontal brain activity while viewing of social stimuli

Research Advisor: Geraldine Dawson, Duke Center for Autism and Brain Development

Asymmetries in frontal brain activity have been linked to different emotional states, with positive affect linked to increased left relative to right frontal activation and negative affect linked to increased right relative to left frontal activation. Research has show that infants with autism spectrum disorder (ASD) display differences in frontal brain activity while watching videos of social versus nonsocial stimuli. Such brain activation patterns that are characteristic of children with ASD could serve as an indicator of risk for ASD or as an outcome measure based on electrophysiological responses in clinical trials. The current study examined frontal EEG alpha power asymmetries in 2-6 year old children with ASD while they watched videos of social, engaging nonsocial, and neutral nonsocial stimuli. Results revealed that during the social condition, there was a marginally significant correlation between the degree of child negative affect and increases in right relative to left frontal alpha activity. During the two nonsocial conditions, analyses revealed no significant correlations between degree of negative affect and patterns of frontal alpha asymmetry. These results suggest that the child's affective state, specifically the presence of negative affect, may be an important variable when measuring frontal alpha EEG asymmetry during dynamic videos displaying social content. This finding should be considered in future studies examining EEG biomarkers as an indicator for early risk of autism or an outcome measure during clinical treatment trials.

Psychology, 12:30-1:30

Michael Rogers

The secret behind "silent" nucleotide changes: Novel tools to uncover cell and tissue-specific differences in codon bias

Research Advisor: Don Fox, Pharmacology & Cancer Biology

The genetic code is a fundamental component of biology, yet recent studies suggest one aspect of this code has been too often ignored. This aspect involves codons: triplet nucleotides that specify each amino acid. Multiple codons can specify the same amino acid, and synonymous nucleotide changes that alter which codon specifies the same amino acid are called "silent." However, codon usage has been found to have a striking impact on protein production. This impact is the result of codon bias, the phenomenon in which each species exhibits biased usage of certain synonymous codons over others. While nearly all previous research has studied codon bias at the broad genomic and organismal levels, almost no one has investigated how codon usage influences the development and function of different cell and tissue types in eukaryotes. To explore this idea, I developed experimental tools to assess codon bias via codon-altered fluorophores expressed throughout development and in all tissues of *Drosophila* flies. Interestingly, I discovered that specific cell types of the testes and ovaries deviate from the fluorophore protein level expected from the *Drosophila* codon bias. This suggests regulation of codon-dependent protein levels differs between specific cells and tissues. Future study of cell and tissue-specific variations in codon bias using this *Drosophila* model will help to determine whether codon bias plays a regulatory role in protein production. Furthermore, codon bias has recently been shown to influence progression of diseases such as cancer, and my novel tools will contribute to efforts to combat disease.

Biological Sciences, 12:30-1:30

Indrani Saha

Perceptual Disruption and Action: a multidisciplinary analysis of Carlos Cruz-Diez's Chromosaturation

Research Advisor: Mark Olson, Art, Art History, Visual Studies

Ocularcentrism informs dominant art historical methodologies. However, contemporary art requires a different type of analysis -- one that addresses the whole body in space and moves beyond the primacy of vision. A case study of Carlos Cruz-Diez's light-based installation, Chromosaturation, demonstrates the need for an embodied approach to contemporary art analysis. The experience of immersive art places participants in a domain where they encounter both loss and reconstitution of the body. In Cruz-Diez's work, light creates an environment, but it is our actions that provide the context. With a thorough understanding of visual neurobiology, Cruz-Diez disrupts vision's spatial orientation within three monochromatic light chambers. Crowd-sourced video data collected from the installation reveals an interesting trend: with vision inhibited, participants seek to employ other sensory modalities to find their bearings. They attempt to feel "grounded" within each chromatic chamber, often using other bodies to situate themselves in the disorienting space. The treatment of the senses and the body of the participant becomes integral to examining the installation, but is often ignored. It is for this reason that Chromosaturation and other sensorial works warrant examination through a combination of neuroscientific, phenomenological, and anthropological lenses. How each discipline treats the concept of embodiment serves as a site of convergence. The work of Merleau-Ponty and McLuhan, in particular, provide a theoretical framework to support a sensory modality-based approach. Immersive environments demand a methodology that addresses not only information from the visual faculty, but ultimately, the multi-sensorial body as a whole.

Humanities, 11:30-12:30

Natasha Sakraney

The Semantics of Cognitive Neuroscience: Mapping Structure and Evolution

Research Advisor: Greg Appelbaum, Psychology and Neuroscience

As cognitive neuroscience research continues to proliferate, it generates new knowledge about the linking between brain and behavior. The primary outputs of such research are peer-reviewed articles that express results of individual experimental studies. In the current project, we apply network analysis techniques to the text of thousands of articles that report findings from fMRI studies of human cognition in order to create, visualize, and quantify the interrelations between anatomical and psychological terms that constitute the foundation of the discipline of cognitive neuroscience. Two-year sliding window networks between 2004 and 2010 reveal a distinct trend of clustering occurring in the networks, which can be seen in the statistically calculated Newman Groups of highly interconnected terms. Stability analysis of the shared terms in these Newman groups from the beginning to the end of the timeline of the corpus reveals that subdisciplines within cognitive neuroscience are evolving; some communities of terms remain stable over time while others combine together, split into distinct groups, or fade away altogether. This meta-analysis therefore quantitatively demonstrates how the field of cognitive neuroscience is changing and can identify longitudinal trends and gaps to be filled, while also suggesting profitable directions for future research.

Psychology, 12:30-1:30

Paige Scarbrough

How infants learn about food: Discrimination and associative learning of food-related emotions

Research Advisor: Makeba Wilbourn, Psychology and Neuroscience

Infants will put almost anything into their mouths, suggesting that they have many things to learn about the properties and consequences of eating. Understanding what and how infants are learning about food is important because it may have consequences in later childhood and adulthood. It is likely that infants begin learning about food by referencing others' expressions of food-related emotions (e.g., disgust and happy), as they similarly learn about objects through others' emotions in a phenomenon known as social referencing. However, studies have yet to assess how and if infants are able to use others' displays of food-related emotions to learn about food. The current study seeks to investigate if 14-month-old infants possess fundamental skills that may help them in their early understanding of these emotions. In Experiment 1, a visual habituation task was used in order to determine if infants could discriminate between a disgust and a happy facial expression. In Experiment 2, a "switch" paradigm was used to assess 14-month-olds' ability to learn an associative link between facial and vocal expressions of disgust and happy. Results from Experiment 1 indicated that 14-month-olds could discriminate between disgust and happy facial expressions. Results from Experiment 2 suggested that 14-month-olds were also capable of forming an associative link between facial and verbal expressions of happy and disgust. Results are discussed in the context of emotion understanding and associative learning.

Psychology GwD, 11:30-12:30

Clarissa Schilstra

Who helps and how? Examining the relationship between social support and the quality of life of adolescents with chronic illness

Research Advisor: Robert Thompson, Psychology and Neuroscience

Introduction. The purpose of this study was to understand whether 4 forms of social support – nondirective emotional, nondirective instrumental, directive emotional, and directive instrumental – provided by parents and friends differentially affect the physical, social emotional, and school quality of life (QoL) of adolescents with chronic illness. Methods. The study sample included 170 adolescent summer camp participants from Dr. Gary Maslow's The Development of Character for Youth with Chronic Illness Study. The participants completed a web-based questionnaire that included a measure of: quality of life, the PedsQL™, and a measure of social support, the Social Support for Adolescents Scale, which was completed once in response to support received from parents and once in response to support received from friends. Multiple regression analysis was used to evaluate the relationship between social support and physical, social, emotional, and school QoL, while controlling for age, race, gender, and physical disability. Results. The only significant finding was a positive relationship between nondirective emotional support from parents and emotional QoL, when controlling for age, race, gender, and physical disability. Conclusions. The finding that nondirective emotional support from parents has a positive relationship with emotional QoL implies that future research should examine the relationship between social support and psychological adjustment indicators, like depression. This also indicates that results of the PedsQL™ should be evaluated via the emotional, social, and school QoL scale scores, rather than the psychosocial or overall scores. Finally, future studies should consider whether a within-illness approach rather than an across-illness approach might lead to clearer findings.

Psychology GwD, 11:30-12:30

Michael Shih

Arginase 1 in Myeloid Cells Mediates Allergic Contact Hypersensitivity in Mice and is Therapeutically Targeted by Dexamethasone to Suppress Pathological Skin Inflammation

Research Advisor: Amanda MacLeod, and Immunology

Allergic contact dermatitis (ACD) is an inflammatory disease and the major cause of occupational cutaneous disorders. Contact hypersensitivity (CHS) is an established immunological model of human ACD, in which innate and adaptive immune are responsible for exaggerated irregular inflammatory responses.. Recent studies on CHS and ACD have shown that macrophages induce, suppress, and regulate adaptive immune responses. However, the immunological mechanism by which macrophages modulate the inflammatory response exhibited in CHS and ACD is not well described. M1 macrophages mainly express inducible nitric oxide synthase (iNOS) generating NO. In contrast, M2 macrophages mainly express arginase 1 to generate polyamines, which are associated with tissue repair and cell growth promotion. Arginase and iNOS directly compete with one another for the same substrate, L-arginine, but generate distinct end products; imbalance of this system is an underlying cause for dysregulated inflammation in several diseases, including the ACD-related disease atopic dermatitis. Our laboratory has shown that conditional knock outs of Arg1, the gene encoding arginase 1, in macrophages exaggerates immune response in the murine CHS model. Mechanistically, this could be linked to increased expression of Nos2, the gene encoding iNOS. Dexamethasone (DEX) targets macrophages. We found that murine CHS models with knocked out Nos2 had reduced disease, murine CHS models with knocked out Arg1 had increased disease, and DEX suppressed inflammation in CHS through the use of arginase 1 in macrophages. The competition between arginase and iNOS for L-arginine functioned as an immunological regulator of over-inflammation in ACD and CHS, and DEX suppressed over-inflammation by regulating the competition between arginase and iNOS for L-arginine.

Biological Sciences, 12:00-1:00

Michael Shih

Catalytically Inducing a Site-Selective Asymmetric Cyclopropanation Reaction

Research Advisor: Jennifer Roizen, Chemistry

Methods of site-selective asymmetric cyclopropanation of polyolefin substrates are unprecedented in current literature, though access to these processes will unlock late-stage functionalization of many biologically active small molecules. A few chiral porphyrin complexes of cobalt (II) induce high enantiomeric excess in intermolecular cyclopropanation reactions, but are unable to facilitate chelate-directed, site-selective cyclopropanation reactions. It is hypothesized that the novel tridentate carbazole bisoxazoline cobalt complex may perform cyclopropanation reactions with enantioselectivity comparable to its chiral porphyrin analogs, while also being able to induce site-selectivity by coordinating both a carbene and a polyolefin substrate at two adjacent points to facilitate cyclopropanation reactions. This tridentate carbazole bisoxazoline cobalt complex will be synthesized, isolated, and tested as a catalyst for cyclopropanation reactions. By investigating the effects of the ligand/metal complex, methods to induce enantioselectivity and site-selectivity in these cyclopropanation reactions will be identified, thus providing a new way to access desired biologically active small molecules. A couple forms of the desired complex have already been synthesized, and some of the corresponding racemic cyclopropanation assay developments have been completed.

Physical & Quantitave Sciences, 11:30-12:30

Avery Silverman

Graphene Sample Preparation Methods Improvement and Analysis

Research Advisor: Gleb Finkelstein, Material Science

New strides in the material classification of graphene have yielded great potentials for the utilization of the material in thermal, electrical, and physical devices for further testing and application.A challenging task in the fabricated of such devices is producing consistent, clean, high quality graphene able to be mounted on substrates for easy transfer and testing. The final quality of a graphene/substrate sample has large impacts on further lithography and evaporation processing methods, as well as electrical properties testing. To classify fabrication steps, both chemical and preparatory steps were tested, including but not limited to washing, annealing, substrate cleaning, and etching (durations and intensities). By narrowing down the importance of each process in the preparation of graphene samples, and the exact durations which produced the highest quality results, better samples were ultimately produced and verified via Raman spectroscopy. Additionally, samples were tested by attempting to produce a viable test device utilizing SEM lithography in combination with evaporation and wire bonding for final electrical testing. Overall, the devices themselves yielded mixed results as far as operational activity, but demonstrated a vast improvement in the utilization of sample-making techniques to produce quality graphene layers and controllable designs.

Physical & Quantitave Sciences, 12:00-1:00

Anisha Singh

Characterizing the insulin response of cultured human myotubes

Research Advisor: George Truskey, Biomedical Engineering

Skeletal muscle is an important source of both basal and insulin-mediated glucose uptake. 75% of postprandial glucose absorption occurs in skeletal muscle. Altered insulin signaling has been implicated in several disease states, including diabetes. Therefore, the insulin response of a tissue engineered skeletal muscle construct must recapitulate the native tissue response in order for the construct to be meaningful. To this end, I have characterized both the basal glucose uptake and the insulin dose response of human myotubes differentiated in 2D. These experiments are significant for direct, matched comparison with regards to cell types, growth conditions, and glucose uptake assay to the insulin response of the Truskey lab 3D engineered human skeletal muscle bundles. As a result, these experiments can help validate that the 3D construct has similar basal and insulin-mediated glucose uptake as in vivo skeletal muscle.

Biological Sciences, 11:30-12:30

Kyle Smith

Water choices and disease: how lemurs avoid exposure to parasites

Research Advisor: Charlie Nunn, Evolutionary Anthropology

A variety of animals, including humans, possess behavioral adaptations that allow them to avoid exposure to parasites, which in turn helps them avoid the costs of infection. Previous research has found evidence of these behaviors in lemurs, which prefer to drink clean water instead of water that has been contaminated with feces. However, the previous research did not explore the relative importance of olfaction or vision in choosing water, and it did not examine whether this preference can be strengthened to compensate for a compromised immune system. I conducted two experiments with captive lemurs to answer these questions. In the first experiment, I presented lemurs with a choice between clean and seemingly contaminated water, but with only vision or only olfaction available at a time to distinguish the two options. The results indicate the importance of olfaction in allowing lemurs to detect parasites, but a comparison with other research indicates that sensory information is integrated between vision and olfaction. In the second experiment, I tested whether restricting lemurs' sleep affected their ability to differentiate between clean and dirty water. Because sleep restriction has negative consequences for both cognitive functioning and the immune system, it could either impair lemurs' ability to distinguish the two water sources, or it could make them more sensitive in order to compensate for the increased risk of disease. The second experiment did not find evidence that sleep restriction has an effect on lemurs' preference for clean water.

Biological Sciences, 12:00-1:00

Sriramkumar Sridharan

Effects of Heavy Marijuana Use on Brain Activation during Stroop Task in Individuals Living with HIV

Research Advisor: Christina Meade, Global Health

Marijuana use is disproportionately prevalent among persons living with HIV/AIDS. The neurocognitive effects of both marijuana and HIV/AIDS have been well documented independently, but not much research has been conducted on the intersection of the two conditions. A handful of studies have reported that the regular effects of marijuana– deficits in decision-making, behavioral inhibition, memory, and executive functioning – are exacerbated in marijuana users living with HIV/AIDS. In order to further explore the neurocognitive effects associated with heavy marijuana use in the context of HIV/AIDS, a sample of HIV-positive marijuana users (n=18) and non-drug users (n=15) completed the fMRI Counting Stroop, behavioral Color/Word Stroop task, and a neuropsychological test battery. An analysis over the entire participant sample revealed significantly greater brain activation in the orbitofrontal cortex, anterior cingulate cortex, occipital fusiform cortex, and superior parietal cortex during incongruent trials compared to neutral trials in the Counting Stroop task. However, there were no significant discrepancies in activation between marijuana and non-drug user groups. A comparison between non-drug users, early marijuana users, and late marijuana users of mean percent signal change extracted from task-activated clusters revealed no significant variation. Further correlation of mean percent signal to Color-Word Stroop Interference t-score elucidated no relationship between neural activation and Color-Word Stroop performance. Finally, comparison of signal change to neuropsychological assessment domain t-scores showed correlations to attention and learning domains, but not the expected executive control domain.

Biological Sciences, 12:00-1:00

Vivek Sriram

Computational Analysis of Bacterial Growth Rates in the Human Microbiome

Research Advisor: Lawrence David, Genomic and Computational Biology

As humans, we host an entourage of microscopic inhabitants, part of an overall "microbiome," within our bodies that is as necessary as it is natural. Various environmental factors can heavily influence the composition of these organisms, and imbalances in the distribution of our internal microbiomes can disrupt the healthy state of the human body. Unfortunately, we currently lack effective quantitative methods that can identify specific microbial contributions to overall human health. The considerable diversity of the human microbiome has complicated efforts to evaluate the growth of individual bacterial populations, thus hindering attempts to determine how bacterial composition can influence our health. I have developed a computational pipeline that determines the growth rates for a multitude of gut microbiota across different conditions. I used Python and the R "grofit" package to analyze three key variables intrinsically linked to bacterial growth: alpha, c, and lambda, which represent the carrying capacity of the population, the population's doubling rate per hour, and the lag period for growth, respectively. Growth curves were fit to optical densities of various bacterial populations over time to examine the proliferation of different types of bacteria. I specifically demonstrated how factors such as temperature and anaerobic surroundings would affect the viability of bacterial populations. Ultimately, my analyses indicate a wide variety in the types of growth exhibited by bacteria, revealing the ideal temperatures and oxygen levels for numerous different bacterial species. My project also indicates significant potential in using microfluidics as a method of growing and experimenting with bacteria.

Biological Sciences, 12:00-1:00

Alexandra Stonehill

Effects of prenatal testosterone and maternal social status on immune health in meerkats (Suricata suricattae

Research Advisor: Christine Drea, Evolutionary Anthropology

A testosterone (T)-mediated tradeoff between reproductive success and immunocompetence has been regularly investigated in males of many species, but this tradeoff is under-appreciated in females or their offspring. In some species, females are hormonally masculinized and increase T during gestation. Given the potential immunosuppressive properties of T, rank-related differences in T can influence female parasitism. Moreover, if maternal T reaches the developing fetus, offspring may 'inherit,' an androgen-mediated immunohandicap. Here, we explore the effects of maternal social status and gestational T concentrations on offspring health, as determined by gastrointestinal parasite burdens, in the female-dominant, cooperatively breeding meerkat (Suricata suricatta). The meerkat is an ideal model for our question because dominant females routinely experience greater T concentrations than do subordinate females; thus, depending on maternal social status, offspring may experience different prenatal endocrine environments. From 2012-2015, we measured innate immune responses in a wild population of meerkats in South Africa's Kalahari Desert. Our subjects were 89 wild meerkats from 22 social groups. We collected fecal samples from offspring derived from dominant and subordinate 'control' dams (DC and SC, respectively), and from dominant dams 'treated' with an androgen-receptor blocker (DT). As predicted, we found a significant association between maternal status and parasitism in juvenile offspring: DC offspring harbored greater parasite burdens than did DT offspring. We suggest that this relationship is T-mediated, that maternal T can influence fetal development in meerkats in a manner that has a permanent, organizational effect on offspring immune health.

Biological Sciences, 12:00-1:00

Shobana Subramanian

Investigating the role of PPAR-gamma in TOMM40-APOE-APOC1 expression regulation

Research Advisor: Ornit Chiba-Falek, Neurology

Peroxisome proliferator-activated receptor-gamma (PPAR-gamma), a ligand-activated nuclear transcription factor, is involved in lipid and carbohydrate metabolism and mitochondrial biogenesis. Here, we investigated the involvement of PPAR-gamma in the expression of a cluster of genes that has been implicated in late-onset Alzheimer's disease (LOAD). This gene map locus, 19q13.32, contains the genes translocase of outer mitochondrial membrane 40 (TOMM40), apolipoprotein E (APOE), and apolipoprotein C1 (APOC1). Bioinformatic analyses have revealed several potential PPAR-gamma binding sites throughout this chromosomal region. We hypothesized that PPAR-gamma participates in the transcriptional regulation of genes in this region. To test this hypothesis, we tested the effect of PPAR-gamma agonists and antagonists on TOMM40-APOE-APOC1 expression by treating a transformed human cell-line of liver origin (HepG2) with the PPAR-gamma agonists rosiglitazone and pioglitazone and the PPAR-gamma antagonist GW9662 and measuring the messenger RNA (mRNA) levels of TOMM40, APOE, and APOC1, comparing them to those of untreated control cells. We also used the short hairpin RNA (shRNA) method to knock down PPAR-gamma expression in HepG2 cells and measured the TOMM40, APOE, and APOC1 mRNA levels relative to untransfected cells. We found that rosiglitazone and pioglitazone treatment resulted in decreased TOMM40, APOE, and APOC1 expression in HepG2 cells, while GW9662 treatment resulted in increased TOMM40, APOE, and APOC1 expression. Correspondingly, PPAR-gamma knockdown also resulted in increased TOMM40, APOE, and APOC1 expression. Collectively, our results suggest that PPAR-gamma acts as an inhibitor of the 19q13.32 region.

Biological Sciences, 12:30-1:30

Danielle Sumner

Social Responsibility of the Global Health Researcher: Ethics Training Workshops

Research Advisor: Kearsley Stewart, Global Health

For 20 years, the National Institutes of Health (NIH) and Office of Research Integrity (ORI) have developed best practices for Research Ethics (RE), Research Integrity (RI), and Responsible Conduct of Research (RCR) training. Since 2009, RE and RCR training is mandatory for universities receiving NIH funding. However, there is broad agreement that RE, RI, and RCR need to include locally relevant, culturally competent content. Locally responsive RCR training is particularly relevant following the success of the Medical Education Partnership Initiative (MEPI) program in Africa. Duke Global Health Institute (DGHI) has partnered with Kilimanjaro Christian Medical University College (KCMUCo) in Tanzania to produce a five-part series of RCR training videos. To create locally relevant content, we surveyed RCR knowledge, attitudes and perceptions of KCMUCo faculty, researchers, administrative staff and students. We also conducted in-depth interviews with community advisory board (CAB) members, local leaders and research participants. Finally, we held focus group discussions with CABs and local community members. We analysed transcripts for key themes to develop into story lines. Using an enhanced web connection between Duke and KCMUCo, students and faculty collaborated to write and finalize scripts. A team of Duke students joined members of the KCMUCo medical student organization, "Communication Skills Club," in Tanzania for filming. Each module is approximately five minutes long, in Kiswahili with English subtitles. KCMUCo staff screened the modules for IRB members, administrators, and students. DVDs and facilitator guides will be distributed to East African research administrators and educators with plans to roll-out a training program for KCMUCo post-graduate and Duke MSc-GH students over the next year.

Psychology, 11:30-12:30

Philippa Tanford

Fungal endophytes in moss: host or site specific?

Research Advisor: Jonathan Shaw, Biology

All plants have fungi (fungal endophytes) within their tissues that can be important in plant functioning and have applications in agriculture, medicine, and technology. Endophyte communities vary along a broad array of variables (e.g. latitude, season, host species), but what underpins an endophyte's host/geographic specificity is not entirely understood. To explore the influence of host species and geographic location on the variation in endophyte communities, I sampled the moss species Atrichum angustatum and Bryoandersonia illecebra where they grow in interwoven "mats" in three forest sites in Durham County, North Carolina. Plant fragments were placed into three different fungus culture media (malt extract agar, modified Melin-Norkrans medium, and a moss-based medium). Isolates were Sanger sequenced (and identified via a BLAST search. All isolated fungi were members of the phylum Ascomycota (predominantly of class Sordariomycetes and order/family Xylariales/Xylariaceae) with the exception of one Basidiomycete (isolated from Atrichum) and one Zygomycete (from Bryoandersonia). None of the examined variables (host plant species, sampling site, culture medium) showed significant variation in their endophyte diversity at the level of order/family, but analysis at lower taxonomic levels revealed the vast majority of species isolated were unique to their host plant, collection site, and culture medium. One species of Hypoxylon was common to all sites and media, and species of Xylaria and Nemania were also common to multiple hosts, sites and culture media (all Xylariaceae). Species accumulation curves did not level, indicative of incomplete sampling. This study represents the first direct characterization of the endophyte communities of these moss species.

Biological Sciences, 11:30-12:30

Kelly Tomins

Effects of Tobacco Smoke on the Sperm Methylome Using a Zebrafish Vertebrate Model

Research Advisor: Susan Murphy, Pathology

Prenatal smoke exposure is a well documented risk factor for many health problems in children, including neurodevelopmental disorders. Epigenetic DNA modifications may be responsible for these effects, and several human studies have shown that in utero exposure to maternal smoking can alter methylation patterns of the DNA in the offspring. Despite studies that demonstrate that paternal smoking increases the risk of infertility and negatively affects sperm motility, count, and morphology, there is limited data regarding the molecular mechanisms of these effects. This study aims to identify epigenetic changes in sperm in response to tobacco smoke exposure using a zebrafish vertebrate model. In this study, male fish were divided into four different exposure groups: a pure water control, .1 % DMSO control, .01% tobacco smoke extract, and .1% tobacco smoke extract. DNA was extracted from the sperm of mature zebrafish after a two week exposure period. Reduced Representation Bisulfite Sequencing (RRBS), a relatively cheap way to obtain genome wide analysis of methylation, was utilized to quantify methylation changes. DNA samples were digested with the Msp1 restriction enzyme to enrich CpG sites, ligated with adaptors, treated with bisulfite, PCR amplified, and subsequently sequenced on the Illumina HiSeq platform. Preliminary analysis indicates that tobacco smoke exposure significantly alters methylation in zebrafish sperm. Comparison of the DMSO control group and the highest exposure group identified 145 differentially methylated CpG sites with methylation changes of 40% or more. This study is the first documented use of RRBS in zebrafish sperm, and provided novel information about the use of zebrafish as a model of epigenetic changes in response to tobacco smoke.

Biological Sciences, 12:00-1:00

Taylor Trentadue

Investigating musculoskeletal health and limb biomechanics in Mandena, Madagascar: A quantitative approach to understanding normal and pathological gait patterns

Research Advisor: Daniel Schmitt, Evolutionary Anthropology

Musculoskeletal health is vital for successful participation in occupational and daily activities and is thus an important area of study clinically and in global health. A variety of factors impact skeletal form and health, yet little is known about worldwide variation in limb function. This research tests the hypotheses that lower extremity joint pathologies are more prevalent in this Malagasy population than a randomly sampled Western population and that Fourier analysis of the force curves can detect joint pathology. Musculoskeletal health surveys were distributed to 95 Malagasy individuals (55 females and 40 males). 46.55% of women and 50% of men self-reported current lower extremity pain. Vertical ground reaction forces (VGRFs) were collected using a bi-axial force platform. Participants walked barefoot at self-selected speeds. All steps (n=681) were qualitatively categorized into five types. Based on classifications, 53.78% of the Malagasy steps demonstrated VGRFs characteristic of pathological gait. Differences between shape type and pain were found in the right knee (p=0.00103) and left knee (p=0.00049). Statistically significant differences in pain exist at the right hip (p=0.00058), right knee (p=0.00126), left hip (p=0.00022), and left knee (p=4.047E-05) in normal versus pathological steps. 20 females and 20 males from the sample were randomly selected for biomechanical analysis. Statistically significant differences by type were found in cosine coefficients a3 (p=6.16E-06) and a4 (p= 0.000643) and sine coefficients b5 (p=2.64E-05) and b7 (p=0.000212). Fourier analysis revealed unexpectedly high pathology prevalence in this population, and the technique offers a novel tool for analyzing joint health globally.

Biological Sciences, 12:00-1:00

Noah Triplett

Addressing the Gaps in Mental Health Care for Spanish-Speaking Individuals in Durham, N.C.

Research Advisor: Eve Puffer, Psychology and Neuroscience

As the number of Latino immigrants in the US has continued to grow, there has been a corresponding rise in the number of Spanish-speaking individuals presenting for mental health services in Durham County, NC. The rise in individuals seeking mental health care has called attention to the psychological well-being of children and adolescents in immigrant communities and has sparked several needs assessments to better understand the specific barriers to seeking care and mental health problems of this community. The goal of this project was to provide a comprehensive view of mental health among Latino children and adolescents living in Durham, discuss potential opportunities for providing care, and review existing Durham resources. This review further examines the potential negative impact of acculturation on youth mental health and outlines documented barriers to obtaining mental health care for Latinos specifically within Durham County. Review results suggested the stressors associated with acculturation and discrimination place Latinos at a greater risk for developing mental health problems. Additionally, the review indicated the lack of bilingual mental health care providers, misconceptions regarding immigration status and seeking care, and lack of health insurance as major barriers to interfacing with the mental health care system. Potential intervention strategies for increasing access to care might include task shifting, telecounseling, and community-based health promotion programs. These strategies might easily be adapted to work within the Latino community's robust religious organizations or existing Latino mental health center, El Futuro.

Psychology, 12:30-1:30

Grace Wang

Biochemical characterization of Plasmodium falciparum prolyl tRNA synthetase

Research Advisor: Emily Derbyshire, Chemistry

Malaria is an infectious disease that plagues massive populations in numerous regions of the world. Currently, the fight against malaria is severely halted by the lack of effective vaccines and the fast rate of resistance developed by the Plasmodium parasite. Aminoacyl tRNA synthetases(aaRS), also known as tRNA ligases, are a class of enzymes that attach the tRNA with its corresponding amino acids during the translation process. In recent years, the prolyl-tRNA synthetase in Plasmodium has been identified and validated as the target of halofuginone—a potent antimalarial derivative of Febrifugine. Through the inhibition of PfPRS activity, halofuginone has been shown to significantly decrease parasite load in both liver and blood stage malaria. The current project aims to offer advanced biochemical characterization of Plasmodium falciparum prolyl-tRNA synthetase to elucidate its biochemical role in the eukaryotic cell, and to provide a more thorough understanding of the protein's halofuginone-binding mechanism through activity assays and mutant protein studies. Further insight into PfProRS's merit as a pioneering drug target will shed light on new therapeutics both to treat malaria and circumvent parasitic resistance.

Physical & Quantitave Sciences, 12:00-1:00

Henry Washington

"No Hiding Place:" Running as Complexly Vexed and Historicized Relay in James Baldwin's If Beale Street Could Talk"

Research Advisor: Wahneema Lubiano, African and African American Studies

This paper considers the literal moments of "running" in texts of African-American literature as a literary thematic that coheres contemporary, normative and non-normative black masculinity performances. This close reading of 'running' is apart of a larger interest in the saliency of the 'roots and routes' of African-American history to the black masculinity formations in 20th century African-American literature. The 'roots'—the displacement of continental Africans in the Transatlantic Slave Trade, their enslavement, and the subsequent racial trauma inflicted on those persons and their descendants for generations to come has had profound impacts on the production and perpetuation of modern black male subjectivity. The paper also considers geography and the black theological tradition as contextualizing narratives, or 'roots' of my study of black masculinity in literature. If Beale Street Could Talk, the text about which this excerpt is written, takes up as a central project the 'routes'—which I conceptualize as the kind of relay to which black males in America are subjected, induced by the historical hardship imposed upon black identity in post-Civil War America. If Beale Street Could Talk achieves a great deal of foregrounding work on the complex questions of relay in black male subjectivity while simultaneously surveying the contextualizing historical and sociological circumstances that characterize the black experience in America in the 20th century. Such work serves to remind readers that for centuries, to be a black man and to desire freedom in America was to be a fugitive constantly "on the run."

Humanities, 12:00-1:00

Lauren Waskowicz

Investigating species selectivity of inhibitors between Human and Plasmodium heat shock protein 90

Research Advisor: Emily Derbyshire, Chemistry

Heat shock protein 90 (Hsp90) is a highly conserved molecular chaperone protein involved in maintaining protein homeostasis. The Plasmodium parasite, the causal agent of malaria, relies on Hsp90 for survival and growth, making it a viable target for antimalarial drug development. Recent studies in the Derbyshire lab have shown that many Hsp90 inhibitors have selective affinity for the human Hsp90 (HsHsp90) over the Plasmodium Hsp90 (PfHsp90). Identifying species selective inhibitors is crucial for therapeutic development; however, achieving selective affinity for one species over the other is challenging as both the human host and parasite express Hsp90 with 69% sequence similarity. Within the ATP binding pocket of the protein targeted by Hsp90 inhibitors, three residues differ between the species: Ala38, Arg98, and Ile173 in PfHsp90 are replaced with Ser52, Lys112, and Val186 in HsHsp90.). In this work, site-directed mutagenesis was used to generate PfHsp90 mutants to investigate the importance of these nonconserved residues for selectivity. Using target-based binding assays with the mutant proteins to evaluate the selective affinity of Hsp90 inhibitors, we were able to show steric hindrance may play a role in selectivity for a class of aminobenzamide Hsp90 inhibitors. Overall, our findings suggest that structural factors other than the three nonconserved ATP binding site residues may be critical in species selective affinity.

Biological Sciences, 12:30-1:30

Jason Xu

Synthesis of a Diphenylfuran-Based Small Molecule Library to Target the MALAT1 Triple Helix

Research Advisor: Amanda Hargrove, Chemistry

Long noncoding RNAs (lncRNAs) are a newly discovered class of functional, non-protein-coding transcripts that have unique roles in important cellular processes and have inspired novel approaches in disease therapy. An example is Metastasis-associated-lung-adenocarcinoma-transcript-1 (MALAT1), whose accumulation leads to an increase in oncogenic processes. A recently discovered triple helix on its 3' end has been found to have a pivotal role in MALAT1 accumulation and nuclear retention. To target this unique structure and understand its role in cancer processes, we envisioned using small molecules as an ideal tool. Diphenylfurans, for example, have been demonstrated to have nuclear permeability, RNA affinity, triple helix-binding ability, as well as biological activity. Due to these favorable properties, a library of small molecule probes based on a diphenylfuran core is currently being synthesized and will be evaluated for binding to the MALAT1 triple helix.

Physical & Quantitave Sciences, 11:30-12:30

Karen Xu

Investigating the Role of Vinculin Tension in Cell Spreading and Polarization

Research Advisor: Brenton Hoffman, Biomedical Engineering

Cell adhesion and responsiveness to mechanical cues plays a critical role in tissue strength, and misregulation of this process has been linked to mechanically sensitive diseases such as atherosclerosis and cancer. Focal adhesions are a highly specialized structure that link the cytoskeleton and extracellular matrix, and allow cells to probe the mechanical properties of their extracellular environment. The specific role of the focal adhesion protein vinculin in cell adhesion is examined by placing a fluorescence-based tension sensor into vinculin and quantifying the signal that is released when this protein is under varying amounts of force within different regions of the cell. Primarily, the changes in vinculin tension were examined in mouse embryonic fibroblasts over time as cells freely spread. Intriguingly, tension peaked early in the cell spreading process before large actin structures had fully developed. To further examine the role of actin structures in cell adhesion processes, the actin regulatory proteins RhoA and Rac1 were activated in spreading cells. Preliminary results show both RhoA-mediated stress fibers and Rac1 mediated branched actin networks significantly load vinculin. We are currently examining how focal adhesion and cell morphology affect vinculin loading by confining cells to pre-determined shapes. Overall, a greater understanding of vinculin's role in cell adhesion and movement is vital to eventually control cell responses to mechanical stimuli as might be desirable in tissue engineering efforts or abnormally regulated in disease states.

Biological Sciences, 12:30-1:30

Aiwei Yan

Investigating a mechanism of modulation of visual cortical circuits by goal-directed attention.

Research Advisor: Lindsey Glickfeld, Neurobiology

Goal-directed attention is a cognitive process by which the brain flexibly processes sensory input according to behavioral context. Previous studies in primates show that attention improves behavioral performance and perceptual sensitivity, as well as modulates activity in primary sensory areas. However, it is not known how specific functional properties of neural circuits are modulated by goal-directed attention. To address this question, we train mice on a goal-directed attention task and monitor neural activity in the visual system. We have developed a new, context-dependent behavior in which head-fixed mice are cued to switch, on a trial-by-trial basis, between detecting a visual stimulus change or an auditory stimulus change. To test whether the mouse is indeed using the cue to switch attention between the visual and auditory trials, we used rare, invalidly cued trials, where the mouse is presented with a stimulus change that is opposite of what they would expect from the cue. During invalidly cued trials, we found that the mice are less likely to detect the stimulus than on validly cued trials, suggesting that we have successfully established a context-dependent attention paradigm. Furthermore, mice are even less likely to detect the invalidly cued change on long trials, suggesting that the mice are able to remember the cue for the length of the trial (up to 4s) and that the effect of attention strengthens over time. In concurrent imaging experiments, we can investigate how neurons in V1 are modulated depending on task goals.

Biological Sciences, 12:30-1:30

Daniel Ye

Neural Substrates of Choice & Impulsivity Associated with Long-Term Cocaine Dependence and HIV

Research Advisor: Christina Meade, Psychiatry, Behavioral Sciences

Drug addiction is a brain disease that often results from increased secretion or accumulation of dopamine, resulting in overactivation of the reward pathway, and is associated with the loss of cognitive control and risk-seeking behaviors. The chronic use of cocaine, a serotonin-norepinephrine-dopamine reuptake inhibitor, in particular is associated with deficits in working memory, response inhibition, and impulsive decision-making. Human immunodeficiency virus (HIV) is a retrovirus that, among its more commonly-recognized symptoms, causes pathological changes in the brain that have been associated with neurocognitive impairment, including possible deficits in decision-making. This study examined the effects of HIV and cocaine dependence, separately and in concert, on neural activation during decision-making by using fMRI and a delay-discounting task with varying 'choice difficulty' levels. We found that while the main effects of cocaine dependence were insignificant across the board, HIV+ participants demonstrated hyperactivation in numerous brain regions associated with executive control when making both easy and hard decisions. Interestingly, a significant interaction effect between cocaine dependence and HIV status was observed: in participants that were both HIV+ and cocaine-dependent, neural activation was significantly smaller.

Psychology, 12:00-1:00

James Yu

The Skin Microbiome and Soap Use: A study of a rural population in Madagascar.

Research Advisor: Charles Nunn, Evolutionary Anthropology

The skin microbiome is a growing field of interest and research has focused on factors that may impact the bacterial composition of the skin. However, the effects of antibacterial soap use have not been thoroughly documented in scientific literature. I hypothesize that soap use will lower the richness and diversity of the skin microbiome and would also alter the bacterial community of the skin. I conducted an experiment that introduced soap to an indigenous Malagasy population that had limited access to antibacterial soap. I had an experimental group of 10 male adults that used soap for a period of time and a control group of 10 male adults that did not use soap. I found that soap use did not significantly impact bacterial richness or diversity. However, I did find that amount of soap used was a significant predictor of change in beta diversity ($b=0.0011\pm0.0005$, p-value=0.0208). My results indicate that other factors such as the environment, diet, and genetics may overpower the effects of soap use on richness and diversity, but soap use may still significantly impact the microbial composition of the skin microbiome.

Bass Connections, 12:30-1:30

Sangwon Yun

Investigating the Therapeutic Efficacy of Fibrinogen-Coated Albumin Nanospheres as a Treatment for Thrombocytopenia

Research Advisor: Anthony Sung, Cellular Therapy & Hematologic Malignancies

Thrombocytopenia is a hematological condition involving low platelet counts. It is a common medical problem of patients with various blood diseases or cancers receiving radiation or chemotherapy and may lead to fatal bleeding. Currently, this is mitigated by administering platelet transfusions. However, platelets carry serious risks of transfusion reactions, as well as viral and bacterial infections. These are especially problematic as thrombocytopenic patients are often also immunocompromised from radiation and chemotherapy. Furthermore, recruiting platelet donors can be difficult, causing supply problems, and platelet transfusions are often cost prohibitive. As such, exploring synthetic alternatives is imperative. Here, we investigate the therapeutic efficacy of an alternative treatment, fibrinogen-coated nanospheres (FCN). Prior research on synthetic platelet substitutes has shown improvements in bleeding times in animal models; however, no previous product has demonstrated the ability to prevent fatal hemorrhage. Fibrinogen is a protein that is involved in clot formation and also binds to platelets. As such, in the setting of thrombocytopenia, FCN may augment limited numbers of platelets, binding to them, contributing to clot formation and reducing bleeding. We use a C57BL/6 murine model in which we induce thrombocytopenia by administering radiation and multiple injections of platelet-depleting antibody. Preliminary studies found that mice receiving FCN had significantly higher survival relative to various control groups. Autopsies revealed that untreated mice likely died as a result of significant intracranial and gastrointestinal bleeding. We hope to elucidate the mechanism through which FCN prevents bleeding. We hypothesize that FCN aggregates platelets and thus induces hemostasis.

Biological Sciences, 12:30-1:30

Ashling Zhang

Exploring the directing effect of iminopyridine-oxazaline-based cobalt complexes on C-H amination

Research Advisor: Jennifer Roizen, Chemistry

Nitrogen-containing molecules play diverse roles in pharmaceutical, biological, and therapeutic applications. The ability to selectively install nitrogen and nitrogen-containing functionality at one of many C–H bonds in a small molecule would have profound effects on the synthesis of a variety of bioactive molecules. This process, termed C–H amination, would allow for a facile synthesis process that can bypass costly, multi-step functional group manipulations. For example, C–H bond amination could be used for a one-step synthesis of pharmaceutical analogues of naturally existing molecules. Existing methods of C–H amination result in preferential amination at the most electronically-rich C–H bond in the substrate; yet, no method of directing amination to specific C–H bonds outside of these preferred reaction sites has been reported in the chemical literature. This project endeavors to induce directed amination of C–H bonds by using a cobalt(II) catalyst with cis-vacant coordination sites in amination processes to override the inherent electronic and steric bias of the substrate molecule. Iminopyridine-oxazoline-based cobalt complexes have two available cis-coordination sites that show promise for directed cobalt(II) catalyzed C–H amination. We are in the process of synthesizing and exploring the reactivity of (IPO)CoCl2 complexes that could potentially implement a chelate directing effect in C–H bond amination.

Physical & Quantitave Sciences, 12:00-1:00

Yingying Zhang

Identifying Enhancer Regions in the Baboon Genome using ChIP-seq

Research Advisor: Jenny Tung, Evolutionary Anthropology

Changes in gene regulation are thought to make important contributions to primate phenotypic variation, both within and between species. Some changes occur in enhancers: short regulatory elements that activate transcription by interacting with promoters via protein intermediates. The goal of my project is to use ChIP-seq (chromatin immunoprecipitation, followed by high-throughput sequencing) to isolate and map enhancers marked by H3K4me1, a histone chemical modification, in the baboon genome. As there is no baboon enhancer annotation available, this project will extend previous studies on how gene regulation has contributed to primate evolution. It will also help interpret data on age, diet, and social environmental influences on gene regulation in baboons, which are the focal study system in my lab. To first optimize the ChIP-seq protocol, I used rhesus macaque peripheral blood mononuclear cells (PBMCs). The resulting data exhibited only weak enrichment of putative H3K4me1 marks relative to background noise, probably due to an ineffective antibody. I am now testing H3K4me1 ChIP using human PBMCs across serial concentrations of two different antibodies. Additionally, I am developing positive control qPCR assays to verify the protocol's effectiveness in isolating enhancer-specific regions of the baboon genome, prior to sequencing. Annotating enhancers will determine whether known environmental effects on differential methylation fall within likely enhancers.

Biological Sciences, 11:30-12:30

Emma Zhao

iBALT, a tertiary lymphoid tissue, is a potential mediator of silica-induced autoimmunity

Research Advisor: Mary Foster, Medicine (Nephrology)

Autoimmune diseases afflict 3-5% of people in the United States, but little is known about how they develop. Autoimmunity is thought to have both a genetic and environmental component. Occupational exposure to silica, for example, is strongly associated with the development of multiple autoimmune diseases. We hypothesize that environmental exposures may induce autoimmunity through formation of inducible bronchus-associated lymphoid tissue (iBALT). iBALT is a tertiary lymphoid structure that forms upon infection and inflammation of tissue, a common effect of silica exposure. To help answer this question, I stained the lung tissue of mice previously exposed to aspirated silica for B and T cells, which are indicative of iBALT. I then quantified and compared results between mice of several genetically distinct strains to assess the effect of genetic background on immune responses. Results supported the hypothesis that silica exposure induces iBALT formation as compared with controls. However, continued lung analysis on additional mice is needed to determine whether iBALT quantity differs between mouse lines. Correlation of results with autoantibody data from these mice will determine whether iBALT is a likely mediator of silica-induced autoimmunity. This research will shed light on a possible mechanism for environmentally triggered autoimmunity, and the role of genetic background in influencing such a process.

Biological Sciences, 11:30-12:30

Roger Zou

Deformable Graph Model for Tracking Epithelial Cell Sheets in Fluorescence Microscopy

Research Advisor: Carlo Tomasi, Computer Science

We propose a novel method for tracking cells that are connected through a visible network of membrane junctions. Tissues of this form are common in epithelial cell sheets and resemble planar graphs where each face corresponds to a cell. We leverage this structure and develop a method to track the entire tissue as a deformable graph. This coupled model in which vertices inform the optimal placement of edges and vice versa captures global relationships between tissue components and leads to accurate and robust cell tracking. We compare the performance of our method with that of four reference tracking algorithms on four data sets that present unique tracking challenges. Our method exhibits consistently superior performance in tracking all cells accurately over all image frames, and is robust over a wide range of image intensity and cell shape profiles. This may be an important tool for characterizing tissues of this type especially in the field of developmental biology where automated cell analysis can help elucidate the mechanisms behind controlled cell-shape changes.

Biological Sciences, 12:00-1:00