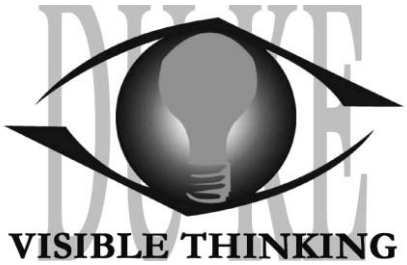

CIEMAS Atrium
Thursday, April 12, 2017
11:00 a.m.-2:00 p.m.

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

Karen Murphy, Director
Brittany Kelly, Staff Assistant
undergraduateresearch.duke.edu

Acknowledgments

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

Funding Provided by Trinity College of Arts & Sciences

Undergraduate Research Support

at Duke University

Duke undergraduates have received support from the following College and University programs in AY 2016-2017:

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Undergraduate Research Support at Duke University
(cont'd)

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Duke BioCore Scholars
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Duke Skin Disease Research Fellowships
Evolutionary Anthropology Molly Glander Awards
Marine Lab Rachel Carson Research Fellows
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NSF-PRUV - Department of Mathematics
Physics - High Energy Physics Program
Physics Department Summer Fellows Program
Pratt Fellows Program
Summer Neuroscience Program
Summer Undergraduate Research in Pharmacology
Research Internships in Toxicology & Environmental Health

Psychology – Graduation with Distinction Candidates

Student Name	*Faculty Mentor*	*Title*	*Time*
Sophie Alman	Gavan Fitzsimons	Can Reminders of Brands Make People Happier than Reminders of Romantic Partners? Perceived Control and Self-esteem as Mediators of Brand/Partner Comparisons	12:30 - 1:30
Lindsey Bass	Elizabeth Marsh	Recognizing Errors in Fiction: Does Reduced Transportation Promote Detection?	11:30 - 12:30
Anna-Katalina Bock	Robert Thompson	The Coca-Cola Concept: Can Marketing Orientation Mitigate Materialism's Adverse Aftermath?	11:00 - 12:00
Julia Carp	Gary Bennett	A qualitative study of Women, Infants, and Children providers' perceptions of managing obesity in pregnancy	11:00 - 12:00
Meghan Clifford	Steven Asher	Beyond Behavior: An Examination of the Association between Aggression and Friendship Quality	11:00 - 12:00
Cortney Dable	Francis Keefe	Validation: A New Way to Help Friends Better Deal with Pain?	12:30 - 1:30
Leighton Durham	Laura Richman	Nasty Women: The influence of the 2016 presidential election on women's response to indirect sexism	11:30 - 12:30
Jackson Grady	Steven Churchill	To the Sticking Point: The Comparing the Effect of Tip Cross-Sectional Area versus Perimeter on Projectile Penetration Depth and Identifying Potential Lithic Armatures.	12:30 - 1:30
Mikella Green	Noga Zerubavel	The Effects of Mindfulness-Based Cognitive Therapy: A Quality Improvement Project	11:30 - 12:30
Arielle Kahn	Christina Grimes	Reducing the Achievement Gap: Why Are Self-Affirmation Interventions Effective?	11:00 - 12:00
Elizabeth Kim	Dan Ariely	Broad Bracketing Induces Utilitarian Consumer Decisions	12:30-1:30
Bianca Martin	Christina Meade	A shift from recreational to medicinal? Comparing motives of marijuana use and accompanying psychiatric and physical symptoms across HIV-status	11:30 - 12:30
Mirai Matsuura	Nancy Zucker	Remembering and Reinforcing: The relationship between autobiographical memory and food reward response	11:30 - 12:30
Gaurie Mittal	Nancy Zucker	Pathologically Picky Eating in Children and Sensory Sensitivty	11:30 - 12:30
TuanDat Nguyen	James Blumenthal	The Relationship between Religiosity and Psychosocial Factors in Lung Transplant Candidates	11:00 - 12:00
Sakura Takahashi	Rick Hoyle	Explaining Your Lateness: Time Estimation, But Not Inhibition, May Affect Time Management Ability	11:30 - 12:30
Noah Triplett	Eve Puffer	The Influence of Race and Ethnicity in Psychiatric Emergency Services	11:00 - 12:00
Lingrui Zhou	Gavan Fitzsimons	Fruit or Chocolate? How Choices for Friends affect Subsequent Choices for Self	11:00 - 12:00

Psychology & Behavioral Sciences

Jennifer Acosta	Mark Leary	First in the Family: Exploring Social and Psychological Variables Across Generational Status in College Students	11:00 - 12:00
Briana Acosta	Sara LeGrand	"¿Quiero que mis hijos vivan lo que yo estoy viviendo?" / "Do I want my kids to suffer the same violence that I am suffering now?": Perceived Effects of Intimate Partner Violence (IPV) on Parenting among Immigrant Latinas	11:00 - 12:00
Ehizokha Ihionkhan	Christina Meade	Does HIV/HCV co-infection correlate with more neurocognitive deficits than HIV monoinfection in a stimulant using population?	12:30 - 1:30
Akash Patel	Kevin Labar	Differences in Startle Blink Response to Conditioned Spatial Frequency Filtered Faces	11:00 - 12:00
Biological Sciences			
Kirsten Bonawitz	Ornit Chiba-Falek	Changes in the Expression of Late-Onset Alzheimer's Disease Risk Genes throughout Pathological Progression within Single Neurons	12:30 - 1:30
James Bradford	Emily Derbyshire	Investigating the Species Selective Inhibition of Plasmodium Heat Shock Protein 90	12:30 - 1:30
Elizabeth Anne Brown	Christine Drea	Changes in gut microbiome (GMB) structure and host behavior: depletion and supplementation of GMB in the ring-tailed lemur (Lemur catta) through antibiotics and fecal transfaunation	11:00 - 12:00
Debbie Burdinski	Michael Kastan	Glucose deprivation causes enhanced cytotoxicity via increased oxidative stress in ATM-null cells with mitochondrial dysfunction	11:30 - 12:30
Alex Chang	Nicholas Katsanis	Mutation in RLIM Leads to Disease Phenotypes in Zebrafish Models	12:30 - 1:30
Lilly Chiou	Daniele Armaleo	Massively parallel genetic engineering using CRISPR-Cas9 technology: the simultaneous modification of 150 rRNA genes in yeast as a means to investigate desiccation resistance in lichens	12:30 - 1:30
Hellen Chiou	Daniel Keihart	Investigation of the molecular mechanisms required for cell sheet morphogenesis using a forward genetic screen in Drosophila dorsal closure	11:30 - 12:30
Isabelle Clark	Anne Yoder	Patterns of Intestinal Nematode Infection in the Diurnal Lemurs of Ranomafana National Park, Madagascar	12:30 - 1:30
Mark Cullen	Roxanne Larsen	Look Out! A Study of Vision in Human Running	11:00 - 12:00
Quinlan Cullen	Emily Derbyshire	Characterization of aquaporin-3 in liver-stage Plasmodium infection	12:30 - 1:30
Rebecca Culver	Amanda Hargrove	Design, Synthesis, and Evaluation of an Oxazolidinone-Based, RNA-Targeted Small Molecule Library	12:30 - 1:30
Mudit Dutta	Gerard Blobe	The role of βIGH3 in the TGF-β signaling pathway in the breast cancer tumor microenvironment	12:30 - 1:30
Sarah Gorvetzian	Christine Drea	Environmental factors, not phylogeny, drive the gut microbiome across 7 captive Eulemur species	12:30 - 1:30

Madison Harman	Erika Deinert	Adverse Effects of Climate Change Induced Salinity Increases on Freshwater Biomphalaria Snails Could Lead to Reduced Schistosomiasis Infections in Humans	11:00 - 12:00
Anthony Hung	L. Ryan Baugh	Identification of genetic loci involved in starvation tolerance through next-generation sequencing	11:00 - 12:00
James Hwang	Michel Bagnat	CRISPR/Cas9-mediated mutagenesis of tram1 in zebrafish	12:30 - 1:30
Carolyn Im	Bernard Mathey-Prevot	Developing and Validating a Fluorescent Protein Reporter for the E2F1 Protein	11:00 - 12:00
Morgan Irons	Justin Wright	The Development of Pre-Treatments for the Growth and Survival of Crops Under Martian Regolith Conditions	12:30 - 1:30
James W. Johnson	David Sherwood	Muscle contraction alters hemicentin dynamics at the B-LINK: a newly identified basement membrane adhesion system that connects tissues	11:30 - 12:30
Diane Karloff	Amanda Hargrove	Amidation of an Oxazolidinone-Based Scaffold for the Synthesis of an RNA-Biased Screening Library	11:30 - 12:30
Nadia Kirmani	Ashutosh Chilkoti	Genetically Engineered Zwitterionic Polypeptides for Drug Delivery	12:30 - 1:30
Gina Kovalik	Gentzon Hall	Interleukin-15 Receptor-a Contributes to Podocyte Anti-apoptotic Signaling Through Activation of the PI-3K/AKT and JAK/STAT3 Pathways	12:30 - 1:30
Daniel Levine	Bernie Fischer	Lymphocyte Activation and Bone Turnover in HIV-infected Young Adults	12:30 - 1:30
Mae Lewis	Davoud Mozhdehi	Constructing a Biohybrid Material through Protein Engineering	11:00 - 12:00
Becky Li	Charles Nunn	The effect of helminths on atherosclerosis progression on a mouse model of a post-industrial population	12:30 - 1:30
Jana Lu	Eric Spana	Identification of key residues in a human scaffold protein that are phosphorylated by a kinase effector from *Legionella pneumophila*	11:00-12:00
Jordan Lucore	Leslie Digby	Unveiling the Differences of Female Dominance Expression and Co-occurring Factors: Lemur catta and Eulemur Species	12:30 - 1:30
Sweet Hope Mapatano	Dwight Koeberl	Male Hormone may be important in the efficacy of Pompe Gene Therapy	11:30 - 12:30
Malcolm McDonald	Jorg Grandl	Investigation of Piezo1 Inactivation Kinetics with Mutants and pH	12:30 - 1:30
Christopher Monti	Richard Brennan	Development of a Protocol for Analysis of Collagen in a Cadaveric Human Heel Pad	11:00 - 12:00
Chad Munger	Diego Bohorquez	The Enteroendocrine-Neuron Synapse	11:00 - 12:00
Kevin Murgas	Eda Yildirim	Using CRISPR/dCas9 gene targeting to study the role of XIST noncoding RNA in maintenance of X-chromosome inactivation	12:30 - 1:30
Meghana Rao	Jenny Tung	Investigating the relationship between diet, social rank, and gut microbial diversity in captive cynomolgus macaques	12:30 - 1:30

Linda Ren	Bryan Cullen	A lentiviral vector bearing a reverse intron demonstrates superior expression of both proteins and microRNAs	11:00 - 12:00
Yuming Shi	Eda Yildirim	Examining the role of Nuclear Pore Complex in X chromosome dosage compensation	11:30 - 12:30
Rachel Skelton	Ashutosh Chilkoti	Design and Characterization of Proapoptotic Nanoparticles for Targeted Cancer Therapy	11:00 - 12:00
Shobana Subramanian	Ornit Chiba-Falek	The effects of the transcription factor PPARÎ³ on late onset Alzheimer's disease-implicated genetic risk factors and downstream cellular phenotypes	12:30 - 1:30
Yujiao Sun	Tso-Pang Yao	Functional relationship between OPTN, TBK1 and p62 proteins and their implication in amyotyophic lateral sclerosis (ALS) pathogenesis	11:30 - 12:30
Thomas Wang	David Sherwood	Identification of Novel Genes Regulating Cell-Invasive Behavior	11:30 - 12:30
Henry Warder	Ken Gall	3D Printed Lower Limb Prosthetic Device	12:30 - 1:30
Angela Wei	Dan Kiehart	Determining the Genetic Basis of Dorsal Closure in Drosophila	12:30 - 1:30
Anchi Wu	Lawrence David	Evaluation of Horizontal Gene Transfer in the Evolutionary History of Beta-galactosidase	12:30 - 1:30
Karen Xu	Brenton Hoffman	The Role of Integrin Activation in Vinculin Loading and Actin Morphology	12:30 - 1:30
Madison Zamora	Ornit Chiba-Falek	Using iPSC-derived neural precursor cells to functionally evaluate the role of SNCA triplication in the context of synucleinopathies	11:00 - 12:00
Yingying Zhang	Jenny Tung	A genomic analysis of immune response-induced changes in chromatin accessibility in baboons	12:30 - 1:30

Bass Connections

Daniel Oconnell	Jason Luck	Age Related Differences on a Smooth Pursuit Task in High School and Youth Football Participants â€“ Implications for Baseline Concussion Assessments	11:00 - 12:00
Katie Becker	Elizabeth Ananat	That's Not FAIR: Fact-Checking Trump's $113 Billion Undocumented Immigration Sticker Price	11:00 - 12:00
Madeleine Bernstein	Jason Luck	Efficacy of "Thresholding Method" in Identifying On-Field Impacts with DASHR Device	11:00 - 12:00
Kathy Dai	Ornit Chiba-Falek	Genomic Instability in Alzheimer's Disease: TOMM40 Poly-T Variations	11:30 - 12:30
John D'Angelo	Jason Luck	Baseline Drift Removal with an Electrooculography Headset	12:30 - 1:30

Community Engaged Research

Riley Reardon	Martha Ann Keels	Improving the Oral Health Literacy in the Cangrejal Valley	11:30 - 12:30

Humanities

Roy Auh	Kimberly Lamm	The Polyphonic Poetics of Watchmen by Alan Moore and Dave Gibbons and its Ontological Implications	11:00 - 12:00
Elizabeth Barahona	Sarah Deutsch	The History of Latinx Students at Duke University	11:30 - 12:30
Ben Brissette	Elvira Vilches	What can we learn about learning by looking at textbooks? The case of literacy in Early Modern Spain	11:00 - 12:00
Ethan Czerniechi	Brenda Baletti	Capitalism's Enduring Paradox: The Falling Rate of Profit and Crisis	12:30 - 1:30
Attyat Mayans	Eileen Chow	Evaluating changing attitudes towards education in the People's Republic of China: Western disruption and the rise of the study abroad movement	12:30 - 1:30
Patricia Pinckombe	Mark Neal	Post-Mortem Racism: A Politics of Double Death	11:30 - 12:30
Indrani Saha	Mark Olson	Being Within: Disruption and Disorientation in Carlos Cruz-Diez's Chromosaturation	11:00 - 12:00

Physical & Quantitative Sciences

Rechel Geiger	Emily Derbyshire	Characterizing binding interactions between atypical protein kinase 9 and enolase in Plasmodium	12:30 - 1:30
Matias Horst	Katherine Franz	Chelating Polymers to Investigate Coordination Complex Mechanochemistry	11:30 - 12:30
Craig Madrak	Glenn Edwards	Nonlinear Tissue Dynamics: Oscillations Switching to Ingression	12:30 - 1:30
Kathleen Marsh	Jie Liu	Long-term toxicity and uptake of silver nanomaterials to agriculturally relevant plant species	12:30 - 1:30
Brandon Ngo	Michael Therien	Photo-Induced Electron Transfer Reactions in Well-Defined Nanoscale Objects that Feature Electronically Homogeneous Single Walled Carbon Nanotubes Wrapped by Redox Active Polymers	11:00 - 12:00
Bilva Sanaba	Amanda Hargrove	A Chemoinformatic Approach Towards the Synthesis of an Oxazolidinone-Based, RNA-Targeted Small Molecule Library	11:00 - 12:00
Vaibhav Tadepalli	Benjamin Wiley	A Novel Method of Double Network Hydrogel Manufacturing using 3-D Printing and its Potential use as a Synthetic Meniscus	12:30 - 1:30
Grace Wang	Emily Derbyshire	Chemical biological approaches toward malaria drug discovery	12:30 - 1:30
Kelley White	Katherine Franz	Characterization of cyclen-based molecules capable of redox tuning and transmetallation	12:30 - 1:30
Jason Xu	Amanda Hargrove	Synthesis of a Meta-Substituted Diphenylfuran-Based Small Molecule Library to Target the MALAT1 Triple Helix	11:00 - 12:00

Social Sciences

Cam-Ha Nguyen	David Malone	Scaling up Alternative Education in Vietnam (SAEV)	11:30 - 12:30
Meghana Vagwala	Walter Sinnott-Armstrong	A Moral Ecology of Student Smart Drug Use	12:30 - 1:30

Jennifer Acosta

First in the Family: Exploring Social and Psychological Variables Across Generational Status in College Students

Research Advisor: Mark Leary, Psychology and Neuroscience

The purpose of this study was to (a) test whether first-generation students report lower fit and belonging than students who have at least one parent who completed college, (b) examine whether first-generation students have lower GPAs compared to other students, and (c) examine whether perceived discrimination plays a greater role in the reactions of first-generation students than those of other students. Participants (n = 117) were divided into three groups: first-generation (FG), partial first-generation (PFG; only one parent had a college education), and non-first generation (NFG). Results indicated that perceptions of fit and value decreased across all three groups from the beginning of the first year to the end of the second year, and from the beginning to the end of the second year. Furthermore, at the end of the first semester, FG students' GPAs were significantly lower than GPAs of both PFG students and NFG students. Perceptions of everyday discrimination were also more strongly negatively correlated with feelings of belonging (r = -.73) and perceptions of fit and value (r = -.68) for FG than NFG students (rs = -.07 for both belonging and fit, ps < .05). Thus, although FG students reported greater challenges than NFG students with respect to perceived discrimination and grades, they did not feel that they belonged or fit less well than students whose parents went to college. However, FG students' sense of belonging and fit were more strongly associated with perceived discrimination than the belonging or fit of PFG and NFG students.

Sophie Alman

Can Reminders of Brands Make People Happier than Reminders of Romantic Partners? Perceived Control and Self-esteem as Mediators of Brand/Partner Comparisons

Research Advisor: Gavan Fitzsimons, other department...

Perceived control, the degree to which a person feels in control over his or her environment, has been widely studied. However, research into the correlation between this phenomenon and a person's reactions to external agents has been somewhat limited. This paper examines the relationship between levels of perceived control, and the self-esteem and happiness received from reminders of a person's favorite brands compared to reminders of their romantic partners. Specifically, we hypothesize that individuals with high perceived control are made happier by reminders of their favorite brands than reminders of their romantic partners, whereas individuals with low perceived control are made happier by reminders of their partners than reminders of their brands. We also propose that this interaction may be mediated by self-esteem. We find that when people feel in control, reminders of their favorite brands make them happier than reminders of their partners. Furthermore, we find evidence that those who are not in control and are reminded of their partners have higher self-esteem than their counterparts reminded of their brands and those who feel in control. Low control individuals reminded of their partners and high control individuals reminded of their brands also had greater self-esteem than those with high control reminded of their partners. The implication of these results may inform marketing strategies as well as help us understand happiness in relationships.

Behavioral Sciences 12:30 - 1:30

Meghan Clifford
Beyond Behavior: An Examination of the Association between Aggression and Friendship Quality
Research Advisor: Steven Asher, Psychology and Neuroscience

The present study (n = 226 college students, 55% women) examined associations between friendship quality, everyday aggressive behavior, normative beliefs about the legitimacy of aggression, and the interpretations, goals, and strategies involved in responding to transgressions within a friendship. Friendship quality was assessed by examining levels of positive friendship features, negative friendship features, and conflict. Interpretations, goals, and strategies were assessed as responses to vignettes depicting hypothetical friendship transgressions. Participants responded online to measures of each of the four major constructs. Results indicated that, when responding to transgressions within a friendship, forming aggressive goals mediated the association between making hostile interpretations of a friend's intent and endorsing aggressive strategies. These aggressive strategies were found to be associated with poorer friendship quality, including higher levels of negative friendship features and conflict and lower levels of positive friendship features. Additionally, everyday aggressive behavior was also associated poorer friendship quality: higher levels of negative friendship features and conflict and lower levels of positive friendship features. Third, normative beliefs endorsing the legitimacy of aggression were associated with higher levels of negative friendship features and conflict, but were not associated with levels of positive friendship features. Overall, results suggest that aggression is associated with poorer friendship quality, and that the association between aggression and negative friendship features is particularly strong.

Behavioral Sciences 11:00 - 12:00

Cortney Dable
Validation: A New Way to Help Friends Better Deal with Pain?
Research Advisor: Francis Keefe, Psychology and Neuroscience

Pain validation is one method that has been studied as a way in which one can interact with a friend or family member in pain. Past studies focusing on pain validation have yielded contrasting results on its influence on affect and pain behaviors. In this study, 94 undergraduate students at Duke University completed an online questionnaire survey to assess how pain validation is related to positive affect, negative affect, pain intensity, and pain disability. It was hypothesized is that an undergraduate's pain intensity and pain disability would be minimized if a close friend validated his pain. Further, it was predicted that perceived pain validation would be positively correlated with positive affect and negatively correlated with negative affect. This study had no significant results for correlations between perceived pain validation and positive affect, perceived pain validation and negative affect, perceived pain validation and pain intensity, and perceived pain validation and pain disability.

Behavioral Sciences 12:30 - 1:30

Leighton Durham
Nasty Women: The influence of the 2016 presidential election on women's response to indirect sexism
Research Advisor: Laura Richman, Psychology and Neuroscience

This research examines the relationships between the 2016 election, indirect salient sexism and outcomes surrounding women's self-perceptions, attitudes and psychological well-being. Specifically, this study employed a 2 by 2 factorial design with between-subject factors of salient indirect sexism (salient indirect sexism manipulation or control) and the election (before or after) and investigated whether exposure to salient indirect sexism and/or the 2016 election influenced women's levels of perceived pervasiveness of sexism in the U.S., collective self-esteem, future orientation, optimism, self-efficacy, self-compassion, and state hope. Separate pre-election (n = 205) and post-election (n = 202) samples of female students at Duke University were collected during the month before and the month after Election Day. The manipulation took the form of an article prime, and outcome variables were assessed using an electronic questionnaire. No significant condition effects were found for any of the outcomes. Results indicate a trending increase in state hope for Republicans and a trending decrease in state hope for Democrats after the election, but just within the control condition. Additionally, results indicate a trending decrease in self-compassion for Republicans exposed to salient indirect sexism after the election and a trending increase in self-compassion for Independents/others after the election in the control condition. Finally, results indicate that the election was related to a significant increase in future orientation for Republicans and a significant decrease in future orientation for Democrats.

Jackson Grady

To the Sticking Point: The Comparing the Effect of Tip Cross-Sectional Area versus Perimeter on Projectile Penetration Depth and Identifying Potential Lithic Armatures.

Research Advisor: Steven Churchill, Evolutionary Anthropology

Killing prey from a distance using mechanically powered projectile weapons is a behavior unique to Homo sapiens. The archeological remnants of these weapons are mostly limited to their lithic points, as their organic components have decomposed. In order to distinguish these points from stones fashioned for other purposes and more accurately determine the advent of this advanced technology, researchers have primarily utilized a measurement known as tip cross-sectional area (TCSA). This metric was thought to be the most ballistically significant one available for this purpose based on studies of high velocity projectiles. Sisk and Shea (2011) hypothesized that tip cross-sectional perimeter (TCSP) is a more useful ballistic measurement when identifying low velocity projectiles such as arrows and darts. To test this idea, we designed and printed six arrowheads divided into pairs with either the same TCSA but different TCSP, or the same TCSP but different TCSA. Our results support the Sisk and Shea hypothesis that TCSP is a better predictor of a point's penetration than TCSA. We also found that surface area, which is highly correlated to TCSP, may be the most useful ballistic measurement for low velocity projectiles. Utilizing TCSP and surface area, rather than TCSA, may allow archeologists and anthropologists to more accurately categorize points found in archeological sites prior to 40ka, a watershed moment in the development of modern human behaviors and population growth. If projectile weapons are identified prior to 40ka, their development may have served as a catalyst in the early cognitive evolution of man.

Behavioral Sciences 12:30 - 1:30

Ehizokha Ihionkhan

Does HIV/HCV co-infection correlate with more neurocognitive deficits than HIV monoinfection in a stimulant using population?

Research Advisor: Christina Meade, other department...

Human Immunodeficiency Virus (HIV) is known to be associated with neurocognitive deficits in the memory and motor coordination domains, and recent research suggests that Hepatitis C (HCV) is also associated with similar neurocognitive deficits. However, it remains disputed if these effects are enhanced in HIV/HCV coinfected subjects. We hypothesize that the HIV/HCV coinfected sample will perform worse on a neuropsychological battery test than their HIV monoinfected or healthy subject counterparts. We separated subjects according to their various HIV and HCV statuses and had all subjects perform a neuropsychological battery test. The scores of all subjects were compared with their counterparts using Statistical Package for the Social Sciences (SPSS). Our results suggest that there was no statistically significant relationship between HIV/HCV coinfection and HIV monoinfection in regards to performance on neuropsychological evaluations. It is still possible that HIV/HCV coinfection does in fact have an additive effect in regards to neurocognitive deficits, but that this effect is not large enough to detect via a one-tailed test. These findings are inconclusive and do not suggest that HIV/HCV coinfection is correlated with more neurocognitive deficits than HIV monoinfected subjects.

Behavioral Sciences 12:30 - 1:30

Elizabeth Kim
Broad Bracketing Induces Utilitarian Consumer Decisions
Research Advisor: Dan Ariely, other department...

In this digital age, over 2 billion people are making increasingly important financial and health decisions on digital interfaces of computers and mobile devices. Yet we know people fail to have enough self-control to resist temptations time and time again. How can we help people make better decisions in a digital environment? We hypothesize that using broad bracketing to present decisions will increase utilitarian decision making by decreasing the licensing effect. In 2 experiments, we used the context of choosing videos to watch, which we presented in two conditions: a broad or narrow bracket. The broad bracket shows all 7 days on one page whereas the narrow bracket shows each day separately on 7 different pages. Participants chose whether they would choose to watch a hedonic or utilitarian video on each day. In Experiment 1, each day was labelled generically (ie. Day 1, Day 2…etc). Participants in the broad bracketing group chose more utilitarian choices than did those in the narrow bracketing group. To increase relevance, Experiment 2 showed the days of the week instead (ie. Monday-Sunday). Participants in the broad bracketing group chose more utilitarian choices; however this effect was only seen during the weekdays. There was no effect of broad bracketing on the weekends. This result indicates that people naturally separate the division of weekdays and weekends into two brackets, which significantly affects their decision making. Broad bracketing can help people make better long-term decisions; however, this effect can be limited by "natural" brackets derived from society.

Behavioral Sciences 12:30 - 1:30

Bianca Martin

A shift from recreational to medicinal? Comparing motives of marijuana use and accompanying psychiatric and physical symptoms across HIV-status

Research Advisor: Christina Meade, Psychology and Neuroscience

The prevalence of marijuana use in HIV-infected populations has been shown to be up to three times greater than general population estimates, and has been associated with an increase in depression and anxiety. However, it remains unknown whether there are differences in the motivations behind initial and continued use of marijuana between HIV+ and HIV- populations. This study compared patterns of marijuana use, psychiatric and medical symptoms, and self-reported motives for cannabis initiation and continued use in a 4-group comparison of participants (N = 111) stratified by HIV and marijuana use: HIV+ marijuana users (n = 28); HIV+ non-drug users (n = 18); HIV- marijuana users (n = 43); and HIV- non-drug users (control) (n = 22). Cannabis use, psychiatric diagnoses, and medical symptoms were assessed by clinical interviews. Motives of marijuana use were measured using an adapted version of the Marijuana Motives Measure, which assesses motives in 6 domains: social, coping, enjoyment, conformity, expansion, and medical. The sample was mostly male (73%), Black or African-American (67.6%), and heterosexual (66.7%), with a mean age of 36.24 years. Most participants reported initiating use for recreational reasons, but an increased proportion of participants reported continuing use for medical reasons, perhaps suggesting marijuana use shifts from predominantly recreational to both recreational and medicinal. HIV+ marijuana users were also more likely to have current diagnoses of MDD and PTSD (p=.049; p=.000). Understanding patterns of marijuana use over time and their correlations with medical symptoms is imperative to improve quality of life for HIV+ individuals.

Akash Patel

Differences in Startle Blink Response to Conditioned Spatial Frequency Filtered Faces

Research Advisor: Kevin Labar, Psychology and Neuroscience

Previous work has demonstrated that fear-relevant stimuli are processed quicker than other sensory information. Neural imaging and direct recording studies have suggested that this bias for fearful stimuli is driven by the preferential processing of coarse visual information conveyed by low spatial frequency (LSF) stimuli over detailed visual information conveyed by high spatial frequency stimuli (HSF). However, cognitive processes and behavioral outputs generated within the amygdala have not been tested for this bias. To address if behavior is impacted by this preferential processing of LSF information, we collected fear potentiated startle (FPS) responses, Galvanic Skin Responses (GSR), and unconditioned stimuli (US) expectancy ratings during a two day conditioning paradigm in humans. Participants were conditioned to both a fearful LSF and a fearful HSF face using a mild aversive electrical stimulus. If LSF information is indeed preferentially processed, then LSF stimuli compared to HSF stimuli should reveal stronger fear conditioning. However, according to both FPS data and US expectancy ratings, conditioning did not occur. Possible explanations for failure to condition include: difficulty distinguishing between two LSF stimuli, high electrode impedance values during EMG data collection, and the inherent unpleasantness of the FPS diluting the fear-inducing effects of the electrical stimulus. Future directions involve using only one HSF and one LSF stimuli, conducting a between subjects experiment, and measuring fear by other means, such as pupil dilation.

Sakura Takahashi

Explaining Your Lateness: Time Estimation, But Not Inhibition, May Affect Time Management Ability

Research Advisor: Rick Hoyle, Psychology and Neuroscience

Despite the negative consequences of lateness for success in school and at the workplace, little is known about why people are late, and some chronically late. This pilot study aims to test an experimental paradigm that could provide insight into the relative importance of time estimation ability and inhibitory ability in time management, using a modified version of Waldum and McDaniel's (2016) paradigm. In this paradigm, participants complete an initial task and estimate its duration. They then complete an unrelated distraction task and another version of the initial task within a given time frame. Background songs are used to cause participants to over- or underestimate the duration of the initial task (Waldum & Sahakyan, 2013). Additionally, a manipulation of inhibitory challenge that must be overcome to move on from the distraction task in the second phase of the experiment was added to the original paradigm. Trait inhibitory ability was measured by self-report. Participants who were led to underestimate initial task duration took longer to complete the second phase. However, there was no evidence to suggest that trait inhibitory ability or the inhibitory challenge posed by the second phase of the experiment affected completion times. These results suggest that estimating the duration of events correctly is an important factor in time management. Further directions for the development of this pilot study are discussed.

Noah Triplett

The Influence of Race and Ethnicity in Psychiatric Emergency Services

Research Advisor: Eve Puffer, Psychology and Neuroscience

The present study examined the distribution of psychiatric diagnoses across black, white, and Hispanic or Latino children and adolescents that presented for psychiatric emergency care at the Duke University Hospital Emergency Department. In concordance with existing literature, it was hypothesized that the distribution of diagnoses would differ significantly among Hispanic or Latino patients and their non-Hispanic or Latino counterparts. Emergency department records from 442 pediatric patients were analyzed. Two sample t-tests were completed to test for significant differences in the proportion of each sample diagnosed with a pre-defined category of mental or behavioral illness. Significant differences were found between ethnic groups in the proportion of patients diagnosed with behavioral and emotional disorders, anxiety disorders, and substance use disorders. The findings of this research suggest differential experiences of mental illness and treatment by ethnic minority children and adolescents. These findings may be built upon with further directed research into the cause of the disparities.

Behavioral Sciences 11:00 - 12:00

Lingrui Zhou

Fruit or Chocolate? How Choices for Friends affect Subsequent Choices for Self

Research Advisor: Gavan Fitzsimons, Psychology and Neuroscience

Consumers often make consumption decisions for others intermingled with decisions for the self. However, not much research has been done on how choices for others affect subsequent choices for the self. Do decisions made for someone else's consumption impact subsequent decisions for our own consumption in terms of working towards our goals? We theorize that in the presence of our own personal goal, making a personal goal-(in)consistent choice for someone else liberates (reinforces) us to be more likely to make a subsequent choice for ourselves that is inconsistent (consistent) with our personal goal. We believe perceived goal progress to be the mediator, such that making a goal-consistent choice for an other gives a false sense of perceived goal progress, while making a goal-inconsistent choice for other gives a false sense of perceived goal regress. We also identify Inclusion of Other in Self (IOS) and competitiveness of the relationship as boundary conditions.

Behavioral Sciences 11:00 - 12:00

Briana Acosta

"¿Quiero que mis hijos vivan lo que yo estoy viviendo?" / "Do I want my kids to suffer the same violence that I am suffering now?": Perceived Effects of Intimate Partner Violence (IPV) on Parenting among Immigrant Latinas

Research Advisor: Sara LeGrand, Global Health

Located at the intersection of global health and medical anthropology, this research study qualitatively investigates immigrant Latina mothers' perceptions about how intimate partner violence (IPV) has affected their parenting experiences, with particular attention to psychosocial health effects. This ethnography constitutes a senior thesis research project conducted through the Duke Global Health Institute (DGHI). Six main themes characterize the findings. Firstly, IPV was found to trigger mothers' protective instinct, while hindering their ability to realize that instinct by adequately protecting their children from harm. Secondly, IPV reduced the social support available for women's parenting. Thirdly, IPV disrupted the unity/closeness of mother-child relationships. Fourthly, IPV contributed to mothers' depression, anxiety, low self-esteem, and feelings of low self-efficacy. Fifthly, IPV inspired mothers to take explicit steps to positively shape their children's approach to issues related to IPV, relationships, and respect. Finally, IPV provoked some mothers to treat their children worse or have a worse attitude toward them. Furthermore, the relationship between IPV and the aforementioned effects was found to be profoundly influenced by the mothers' structural vulnerabilities based on gender, race, class, ethnicity, and national origin. Thus, the creation of a program informed by this study's findings aimed at helping mothers in recovery from IPV build strong relationships with their children, achieve health, and begin to overcome structural violence is recommended. This study represents a step toward the ultimate goal of ending the intergenerational cycle of IPV among all people, for the elimination of IPV depends on its prevention among each new generation.

Behavioral Sciences,Social Sciences,Humanities,Other 11:00 - 12:00

Kirsten Bonawitz

Changes in the Expression of Late-Onset Alzheimer's Disease Risk Genes throughout Pathological Progression within Single Neurons

Research Advisor: Ornit Chiba-Falek, other department...

Over 20 susceptibility loci for late-onset Alzheimer's disease (LOAD) have been identified in large-scale genome-wide association studies (GWAS). However, much is unknown about the contribution of these genes to the pathogenesis and etiology of Alzheimer's disease (AD). The goal of this study is thus to characterize alterations in LOAD-risk gene expression profiles over the course of disease progression, specifically within neurons. To achieve this objective, we combined immunohistochemistry with laser capture microdissection (LCM) to collect single neurons from normal, mild-cognitive impairment (MCI), mild AD, and severe AD frozen human temporal cortex samples. We then extracted RNA and determined mRNA levels utilizing the NanoString nCounter Single Cell gene expression assay. Our results confirm that for many LOAD-risk genes, mRNA levels indeed vary throughout disease progression, and changes often begin to occur between the normal and MCI stages. Two significant genes that showed notable expression trends are amyloid precursor protein (APP), which encodes the precursor molecule to beta amyloid, and apolipoprotein E (APOE). APP mRNA levels were found to decrease throughout disease progression, while APOE mRNA levels were found to decrease between the normal and MCI stages and then increase through progression to severe AD. This endeavor diverges from past studies by examining a single cell type (neurons) as opposed to whole brain tissue, allowing us to gain accuracy and specificity in identifying target genes. Moreover, these results implicate the expression regulation of critical genes in playing a part in the early stages of disease, suggesting a role in causing LOAD.

Biological Sciences 12:30 - 1:30

James Bradford

Investigating the Species Selective Inhibition of Plasmodium Heat Shock Protein 90

Research Advisor: Emily Derbyshire, Chemistry

Malaria remains a significant global health burden responsible for 214 million new infections and 438,000 deaths in 2015. The Plasmodium parasites responsible for this disease have a complex biology which includes a liver and blood infection stage of the host. A protein implicated in both of these infections is the heat shock protein 90 (Hsp90), a chaperone protein that properly folds newly synthesized proteins vital for growth and development. It has been suggested from previous studies that Plasmodium Hsp90 (PfHsp90) is critical for liver stage pathogenesis, as inhibition of PfHsp90 reduced parasite survival. This project investigated inhibition of Hsp90 to examine the species selectivity of chemical probes between PfHsp90 and human protein (HsHsp90). Using molecular cloning, truncated protein constructs containing the N-terminal domain, the site containing an ATP binding pocket targeted by competitive inhibitors, were generated by PCR. The full length wild-type and N-terminal Hsp90 proteins of each species were expressed and purified for evaluation in target based binding assays. The binding affinity for Hsp90 inhibitors was evaluated for each protein construct to examine effects of the N-terminal domain on species selectivity of the compounds. This work successfully cloned the N-terminal constructs for each species, and proteins were expressed to greater than 95% purity. Evaluation of these proteins with known Hsp90 inhibitors revealed no significant shift in binding of the wild-type HsHsp90 and the N-terminal domain, while the truncated PfHsp90 protein appeared to have decreased binding relative to the full-length wild-type.

Elizabeth Anne Brown

Changes in gut microbiome (GMB) structure and host behavior: depletion and supplementation of GMB in the ring-tailed lemur (Lemur catta) through antibiotics and fecal transfaunation

Research Advisor: Christine Drea, Evolutionary Anthropology

The community of commensal microorganisms that live within an animal's digestive tract, collectively known as the gut microbiome (GMB), is emerging as a key mediator of host health and function. Recent studies have revealed the existence of a gut-brain axis, a bidirectional pathway allows the GMB and central nervous system to relay signals using neurotrophic factors, hormones, and other physiological mechanisms. Thus, alterations to the gut microbiome structure may have a profound impact on the CNS function and host behavior. A multitude of studies conducted on traditional rodent models suggest that the GMB may modulate anxiety and stress reactivity; however, studies with primates are essential to ensure that conclusions about the short- and long-term impacts of gut microbiome alteration are translatable to human health. To investigate the links between microbiome structure and host behavior, we studied the effect of a 7-day course of the broad-spectrum antibiotic amoxicillin and subsequent fecal transfaunation on the behavior of a non-human primate, Lemur catta. By examining gut microbiome depletion (via antibiotics) and supplementation (via fecal transfaunation), we aim to address the anxiogenic and anxiolytic potential of the gut microbiome. The results of this study carry important implications for the pervasive use of antibiotics in medical, agricultural, and industrial fields and inform the feasibility of using probiotics to treat stress and anxiety.

Biological Sciences 11:00 - 12:00

Debbie Burdinski

Glucose deprivation causes enhanced cytotoxicity via increased oxidative stress in ATM-null cells with mitochondrial dysfunction

Research Advisor: Dr. Michael Kastan, Pharmacology & Cancer Biology

Ataxia-Telangiectasia is a disease caused by loss-of-function mutations of the ATM (ataxia telangiectasia mutated) gene, and manifests itself in cerebellar neurodegeneration, oculocutaneous telangiectasia, insulin resistance, immunodeficiency and extreme cancer predisposition. Previously, loss of ATM's contribution to DNA damage signaling and cell cycle control was thought to be responsible for the disease phenotypes. However, the recent observation that glucose deprivation is especially cytotoxic to ATM-null cells suggested that ATM plays a significant role in cellular metabolism, which could be a novel link to better understand this disease. Since oxidative stress was known to be elevated in ATM-null cells, this project sought to determine whether oxidative stress was causal to glucose-deprivation toxicity and whether it originated from the mitochondria. Glucose deprivation was found to increase parameters indicative of oxidative stress (glutathione and peroxiredoxin-3 oxidation) in ATM-null cells. This was reversed by 2-deoxy-D-glucose (2DG) and diethylenetriaminepentaacetic acid (DTPA) treatment, which had been previously shown to rescue these cells under glucose deprivation. These data suggested oxidative stress was causal to glucose-deprivation toxicity in ATM-null cells. ATM-null cells showed extensive evidence of mitochondrial dysfunction, including increased mitochondrial mass, DNA content, superoxide production, and membrane potential. Thus, we speculate that the mitochondria are the origin of oxidative stress. 2DG and DTPA did not affect parameters of mitochondrial dysfunction, suggesting that they mitigated oxidative stress directly, as opposed to mitigating its upstream causes. Current efforts of this project focus on elucidating the upstream cause of oxidative stress susceptibility in ATM-null cells.

Biological Sciences 11:30 - 12:30

Alex Chang
Mutation in RLIM Leads to Disease Phenotypes in Zebrafish Models
Research Advisor: Nicholas Katsanis, Cell Biology

Five families of European descent reported children that displayed a combination of phenotypesâ€”microcephaly, facial dysmorphism, short stature, and micrognathiaâ€”that did not match any known diseases. Sequencing the DNA of the five children revealed that the children shared a mutation of RLIM, a gene located on the X-chromosome that encodes a protein involved in protein degradation pathways. The experiment aimed to determine whether a mutation of the RLIM orthologue in zebrafish models would result in similar phenotypes in the zebrafish. Two morpholinos that target the RLIM transcript in zebrafish were designed and injected in zebrafish embryos. CRISPR/CAS9-mediated mutagenesis was also used to generate a mutation in the RLIM gene. The zebrafish embryos were subsequently stained with Alcian Blue and imaged under a light microscope where measurements of body length, jaw structure, and head size were taken. The results showed that zebrafish with a silenced RLIM gene had a statistically significant difference in jaw angle and head size. Rescue of the phenotype for embryos injected with morpholinos was also observed when wild-type RNA was co-injected with the morpholino. The results indicate that mutations to the RLIM gene seem to be vital to the observance of the diseased phenotypes in the children. Future experiments that provide functional insight regarding the RLIM gene will be crucial in confirming the role of RLIM in disease manifestation.

Lilly Chiou

Massively parallel genetic engineering using CRISPR-Cas9 technology: the simultaneous modification of 150 rRNA genes in yeast as a means to investigate desiccation resistance in lichens

Research Advisor: Daniele Armaleo, Biology

Lichens are slow-growing and desiccation-resistant symbioses between specialized fungi and unicellular algae. Uniquely among ascomycetes, lichen fungi have numerous rDNA introns of unknown functions. We hypothesize that these introns contribute to the lichen's slow growth and desiccation resistance by affecting rRNA processing and ribosomal biogenesis. We used the yeast Saccharomyces cerevisiae, which lacks rDNA introns, to model the functions of the lichen introns. The CRISPR-Cas9 technique was used to insert a 57-base pair lichen rDNA intron, which resembles type II spliceosomal mRNA introns, in the yeast rDNA at a site where an intron exists in the lichen rDNA. Yeast was co-transformed with an intron-containing PCR fragment and with a plasmid encoding caspase and the guide RNA sequence designed to recognize the rDNA target site. Many of the transformants had the intron inserted in all rDNA copies, as verified by PCR and sequencing. These transformants indicate that yeast could effectively splice out the intron during rRNA processing, otherwise it could not have survived. The intron-bearing yeast grows more slowly than wild type and a first test indicated a greater resistance to desiccation. However, data from successive experiments were inconclusive and we are still in the process of refining the desiccation assay technique. To our knowledge, this is also the first experiment where CRISPR was successfully used to modify hundreds of rRNA genes, a result that opens up a novel avenue to approach ribosomal biology.

Biological Sciences 12:30 - 1:30

Hellen Chiou

Investigation of the molecular mechanisms required for cell sheet morphogenesis using a forward genetic screen in Drosophila dorsal closure

Research Advisor: Daniel Kiehart, Cell Biology

Cell sheet morphogenesis is one of the fundamental aspects of animal development biology that involves coordinated cell shape changes and movements to form specialized tissues. Here we use live confocal microscopy imaging of the dorsal closure stage of D. melanogaster embryogenesis as an effective model system. Dorsal closure serves as a valuable model for understanding both developmental processes such as heart morphogenesis, neural tube formation, and palate formation, and homeostatic processes such as wound healing.

Through a forward genetic screen to systematically delete a series of large chromosomal segments, called deficiencies (Dfs), we identified four parent deficiencies, that when removed, cause severe defects in dorsal closure. Subsequent crosses with overlapping sub-deficiencies to test for expression of the parent deficiency phenotype narrowed down the regions of interest containing potential genes that may affect dorsal closure. Df(2L)03 contains 24 genes, with special interest in smoothened for its role in epithelial tube morphogenesis. Df(2L)27 contains 19 potential genes. Df(2L) 56 contains 3 separate regions of interest containing 5 genes, 16 genes, and 18 genes. Df(2L)69 was narrowed down to a small region of interest containing 3 genes, with special interest in spalt-major for its role in spiracle and muscle organ morphogenesis and spalt-related for its role in wing vein morphogenesis. This research will contribute to the generation of a more complete parts list for the genes involved in dorsal closure as well as increase our overall understanding of the mechanisms of cell sheet morphogenesis and its implications in wound healing and tissue repair.

Biological Sciences 11:30 - 12:30

Isabelle Clark

Patterns of Intestinal Nematode Infection in the Diurnal Lemurs of Ranomafana National Park, Madagascar

Research Advisor: Anne Yoder, Biology

Intestinal parasites, including nematodes, can be detrimental to the long-term health and fitness of wild populations. Lemurs in Madagascar present a unique model for studying parasitism due to their diversity, sociality, and sympatry, but their intestinal parasites are relatively unstudied. To investigate patterns of nematode infection across a community of lemurs, we opportunistically collected 116 fecal samples across 7 sympatric diurnal lemur species in Ranomafana National Park, Madagascar. We performed preliminary morphology-based identifications of nematodes at the order or family level using fecal flotation and microscopy. Of these samples, we extracted genomic DNA from the feces of sifakas (Propithecus edwardsi, n=19) as well as bamboo lemurs (Hapalemur aureus, n=1; Hapalemur griseus, n=2; Prolemur simus, n=4). The ITS+ rDNA region was amplified with polymerase chain reaction (PCR) using primers targeting the nematode order Strongylida and sequenced with Sanger sequencing. Along with publicly available data from the NCBI nucleotide sequence database, we performed phylogenetic analyses using distance-based methods. We determined that the sifakas were infected with a species likely in family Trichostrongylidae, while the bamboo lemurs were infected with species that likely belong to genus Oesophagostomum. Within the latter clade, the sequences from P. simus clustered apart from those of the two Hapalemur species, suggesting there may be unrecognized nematode species diversity. In light of increasing habitat degradation and anthropogenic disturbance in Madagascar, it is important that we incorporate molecular methods to further our understanding of patterns of potentially parasitic nematode infection across threatened lemur populations.

Mark Cullen
Look Out! A Study of Vision in Human Running
Research Advisor: Roxanne Larsen, Evolutionary Anthropology

Gaze-tracking technology has advanced our understanding of visual attention during locomotion in humans, but methods for tracking gaze during rapid dynamic behaviors have been limited. Our goal was to develop an appropriate method for analyzing gaze while the study subject was in motion. To validate our methodology, we used a telemetric gaze-tracker for a male and female participant completing a 20 meter run along a standardized sidewalk with a single curb as an obstacle. Six trials were chosen for analysis of gaze fixation on the curb. We developed models of error (MoEs) for automated analysis of the gaze-tracking and validated our MoEs against 7 independent raters. The data demonstrated as values for MoE increased, so did the frequency of fixations scored at the curb. Overall, we found a gaze tracker is an effective means of capturing how individuals observe their environment while running outdoors and navigating obstacles. Furthermore, we validated our methodology for use in larger trials.

Quinlan Cullen

Characterization of aquaporin-3 in liver-stage Plasmodium infection

Research Advisor: Emily Derbyshire, Chemistry

The liver stage of Plasmodium infection has largely gone uninvestigated, but is an excellent target for developing drug therapies and vaccines, as malaria-associated pathology does not occur until the subsequent blood stage of infection. Within a hepatocyte, each sporozoite matures into upwards of 106 merozoites that are released to infect erythrocytes. Through global transcriptional analysis, the Derbyshire lab has shown liver-stage Plasmodium infection to induce expression of the protein aquaporin-3 (AQP3), an integral membrane protein that allows transmembrane osmosis and transport of glycerol. Characterization by immunostaining shows AQP3 to localize to the parasitophorous vacuole surrounding the parasite within the host cell. Knockdown of host AQP3 significantly reduces P. berghei parasite load during the liver stage, indicating that this protein is essential to the parasite's continued survival and development. Currently, we are developing mutant knockouts using CRISPR/Cas9 genome editing and identifying knockout lines for further evaluation. We are also working to tag host AQP3 with a fluorescent mCherry marker to allow us to track expression and localization of AQP3 after Plasmodium infection in vivo.

Biological Sciences 12:30 - 1:30

Rebecca Culver
Design, Synthesis, and Evaluation of an Oxazolidinone-Based, RNA-Targeted Small Molecule Library
Research Advisor: Amanda Hargrove, Chemistry

RNA has proven to be an important therapeutic target in a variety of diseases, including viral and bacterial infections, neurodegenerative diseases, and cancer. Despite its importance, there are no FDA-approved drugs that target RNA outside of the ribosome. Currently, a major challenge in targeting RNA is the protein-targeted nature of many screening libraries, which has led to low hit-rates and the repeated identification of non-specific nucleic acid binders. My project focuses on improving the identification of RNA-binding ligands through the molecular shape-driven design, synthesis, and screening of an RNA-privileged oxazolidinone library. In this approach, bioactive RNA-binding ligands and FDA-approved drugs are compared using principal moment of inertia (PMI) calculations. PMI calculations depict the molecular shape of the small molecules, leading to their classification as rod-, disk-, or sphere-like. From these analyses, we identified statistically significant differences in the rod-like character of bioactive RNA-binding ligands. Using these findings as guiding principles, I designed two synthetic routes to generate oxazolidinones for diversification, yielding three unique scaffolds and four fully characterized small molecules. Two of the synthesized small molecules were tested against a library of 16 RNA secondary structures in a tagged, fluorescence-based assay. We found that the ligands bound preferentially to bulge motifs larger than three nucleotides. Therefore, my preliminary work suggests that molecular shape-based guiding principles may be utilized to design an RNA-targeted library with specific binding to RNA secondary structures.

Biological Sciences 12:30 - 1:30

Kathy Dai

Genomic Instability in Alzheimer's Disease: TOMM40 Poly-T Variations

Research Advisor: Ornit Chiba-Falek, other department...

Late-Onset Alzheimer's Disease (LOAD) accounts for roughly 99% of Alzheimer's cases and is the most common cause of dementia. Other than age, an individual's genetic background is the greatest risk factor for LOAD. The genetic basis for LOAD involves a complex interaction of multiple genes. A highly polymorphic, deoxythymidine-homopolymer ("poly-T") in intron 6 of the TOMM40 gene called rs10524523 ("523") has been associated with the age-of-onset of AD. The number of 523 T-residues varies highly across individuals, ranging from "Short" (S, $T \leq 19$), to "Long" (L, $20 \leq T \leq 29$), to "Very Long" (VL, $T \geq 30$). VL poly-T length has been associated with earlier LOAD onset, while S poly-T length has been associated with later onset. In addition, VL was associated with lower cognitive performance in healthy elderly patients than S. My project in the Chiba-Falek Lab aimed to further characterize the TOMM40 gene and investigate its role in LOAD. Specifically, we were interested in 1) the regulatory effect of 523 poly-T variant on gene expression and splicing, and 2) the stability of the poly-T genomic region. We used fragment analysis to detect a novel alternative TOMM40 splice variant and to explore the prevalence of this splice variant across pathologies and brain regions. We collected and genotyped aliquots of neurons collected from different brain regions of a single LOAD subject, as well as embryonic stem cells at different division cycles, to test for somatic variation in the TOMM40 poly-T region.

Biological Sciences 11:30 - 12:30

John D'Angelo
Baseline Drift Removal with an Electrooculography Headset
Research Advisor: Jason Luck, Biomedical Engineering

Eye-tracking systems like the Eyelink 1000 (SR Research) have been employed to assist in diagnosing mTBI, but Electrooculography (EOG) systems have recently been investigated as a cheaper, portable alternative to evaluate eye gaze.Â An EOG headset using dry electrodes was investigated for its ability to produce signal deflections related to the subject's eye gaze angle. The ability to remove baseline drift inherent to the EOG device was also examined.Â The subject was positioned in the Eyelink 1000 while wearing the EOG headset and instructed to follow a prosaccade routine presented on the screen by the Eyelink 1000 system while both systems simultaneously recorded eye movement. MATLAB was used to low-pass filter (fc=55 Hz) the EOG signal by 40 dB in the stop-band. All EOG data was scaled by 4000 degrees/V for calibration. The Eyelink system defined the baseline points; piecewise and continuous 3rd order polynomial curves were fit to these baseline points. The piecewise and continuous curves were subtracted from their corresponding regions of EOG signal and all EOG signal, respectively.Â The piecewise correction more accurately captured the baseline values as it matched the Eyelink's baseline with 0.60 degrees Â± 0.10 degrees of error compared to the continuous method's error of 2.40 degrees Â± 2.20 degrees. Future work will focus on automating drift-removal so that the eye-gaze angle can be determined without using the Eyelink to define baseline points. However, this system shows promise as it provides a signal that directly relates to eye gaze angle changes after drift-removal.

Sarah Gorvetzian

Environmental factors, not phylogeny, drive the gut microbiome across 7 captive Eulemur species

Research Advisor: Christine Drea, Evolutionary Anthropology

The gut microbiome (GMB) has become an important area of research given its potentially significant influence on host health. Until recently, however, scientists have had a relatively limited understanding of what influences GMB composition. Mounting evidence indicates that important factors may include host evolutionary history, diet, habitat, age, and sex, but it is unclear the degree to which each factor is acting. Thus, to determine if phylogenetic relationships or environmental factors have a larger effect on GMB composition and diversity, I compared the GMB of seven species of Eulemur housed at the Duke Lemur Center in similar conditions and being fed similar diets. I found that under these captive conditions, there is almost no relationship between evolutionary divergence times and GMB similarity. Instead, it appears that housing condition and subsequently diet (in terms of access to forested enclosures) has a larger impact on the GMB of these lemurs. Furthermore, social groups hosted more similar GMBs to each other than to conspecifics in different groups. Thus in Eulemur, it seems that the environment has a greater influence on the GMB than does host evolutionary history. If true, perhaps the environment created by captivity masks species differences that could be present in wild Eulemur. Finally, geriatric Eulemur hosted GMBs that were compositionally distinct from adults and infants, a finding which could be useful for future husbandry practices. As Eulemur are nontraditional primate models, studies of their GMBs may have implications for the health of captive animals, lemur conservation, and for human healthcare.

Madison Harman

Adverse Effects of Climate Change Induced Salinity Increases on Freshwater Biomphalaria Snails Could Lead to Reduced Schistosomiasis Infections in Humans

Research Advisor: Erika Deinert, Biology

The genus Biomphalaria contains 34 species of freshwater snails, 18 of which are confirmed hosts for Schistosoma mansoni, a blood trematode that causes Schistosomiasis infection in humans. This is a comparative study that examined two species of these snails, one currently unidentified, Biomphalaria spp. from the Palo Verde National Park in Costa Rica, and another, B. havanensis, which has invaded the coast of South Carolina in the United States. These snails live in coastal freshwater habitats, and will likely be affected by increasing salinity in coming years as climate change causes sea level rise and therefore coastal inundation with seawater. This study tested the effects of 0ppt, 2ppt, and 4ppt salinity concentrations on the foraging behavior, reproduction, and egg survival of these snails. In both species, increased salinity was found to decrease the number of snails who foraged and the amount that they consumed. Fecundity was only tested for B. havanensis, and it followed a similar trend. Fewer egg masses and fewer fertilized eggs were laid in the 2ppt treatment than the control. No egg masses were laid in the 4ppt treatment and eggs reared in 4ppt did not hatch. Although neither of these species has yet been shown to carry S. mansoni, these results can likely be extrapolated to other members of the genus. Therefore, this study predicts that climate change will lead to reduced survivorship and population sizes of Biomphalaria snails in coastal habitats, and thus to decreased rates of Schistosomiasis infection in these areas.

Biological Sciences 11:00 - 12:00

Anthony Hung
Identification of genetic loci involved in starvation tolerance through next-generation sequencing
Research Advisor: L. Ryan Baugh, Biology

Starvation is relevant in the wild, where the ability to thrive in both lack and abundance of food is crucial. Although much has been uncovered about the biological effects of nutrient deprivation, the details of the genetic basis of starvation response remain largely unknown. Furthermore, alleles involved in resistance to nutrient stress in humans may also influence the risk for developing diabetes and other metabolic disorders. We sought to elucidate the genetic nature of starvation tolerance in wild isolates of the Caenorhabditis elegans model organism and to identify genetic loci and polymorphisms involved in conveying starvation tolerance. Using a next-generation sequencing approach to population genetics, restriction site associated DNA sequencing (RADSeq), we measured the relative frequencies of each of 97 wild isolate strains in samples taken from a starved pooled population of animals and subsequently recovered on food. The strains were ranked based on the trend of their relative frequencies over the course of the experiment, revealing a few especially starvation-tolerant strains. A genome-wide association study (GWAS) performed between genetic variation amongst the wild isolate strains and the frequency trend phenotype yielded two association peaks on chromosomes I and III spanning 19 kilobases and 600 kilobases respectively. Analysis of the cumulative marginal epistatic interactions for starvation tolerance for each variant within the strains yielded six variants distributed across 3 chromosomes with potential epistatic interactions. Further investigation of starvation tolerant strains identified through the pooled population experiment showed a potential relationship between starvation tolerance and reproductive capacity but not longevity.

James Hwang
CRISPR/Cas9-mediated mutagenesis of tram1 in zebrafish
Research Advisor: Michel Bagnat, Cell Biology

Congenital scoliosis, which occurs in about 1 in 10,000 live births, leads to deformities of the vertebral column. Although both environmental and genetic factors are believed to cause congenital scoliosis, little is known about the specific genetic alleles of the disease. Our lab conducted a genetic screen to identify recessive mutations that cause scoliosis in zebrafish and to gain a deeper understanding of the genes that regulate notochord biogenesis. This screen showed that defects in the notochord of early embryos can cause spinal malformations in adulthood, since the notochord acts as a scaffold for spine morphogenesis. From this genetic screen, our lab identified a mutation in a kinase-encoding gene called spaetzle as a regulator of notochord development in early embryos, which leads to severe scoliosis in the juvenile and adult stages. The goal of my project is to investigate the function of one possible target of spaetzle, tram1, during vertebral growth. Using a CRISPR/Cas9 approach, I synthesized guide RNAs (sgRNAs) to induce targeted genomic lesions in this gene to inhibit its function. PCR-based genotyping using gel electrophoresis and DNA sequencing confirmed the successful induction of insertions and deletions at the target site.

Biological Sciences 12:30 - 1:30

Carolyn Im

Developing and Validating a Fluorescent Protein Reporter for the E2F1 Protein

Research Advisor: Bernard Mathey-Prevot, Pharmacology & Cancer Biology

Levels of the E2F1 protein, a downstream effector of the E2F/Rb pathway, dynamically change during the cell cycle via a combination of transcriptional, translational and posttranslational mechanisms. To capture this complex regulation and understand how dynamics of activation of the Rb/E2F pathway correlate with quiescence and proliferation, we designed an E2F1 protein reporter with four requirements in mind: (1) it includes endogenous elements of transcriptional regulation; (2) it captures the regulation by miRNAs interacting with its 3' UTR; (3) it results in a signal that can be monitored in real time in single cells; (4) it includes all of the E2F1 sequence, save for a small region responsible for binding DNA. Two constructs, either lacking or including the 3'UTR of E2F1, were designed. For both, we replaced the leucine zipper of E2F1 (a.a 152-173) with the sequence of Venus, a fluorescent protein, resulting in a fusion protein (687 a.a) unable to bind DNA, but otherwise predicted to be subjected to known post-translational modifications associated with E2F1. The constructs were introduced into a rat fibroblast line (REF52), and single cell clones were derived. We show that both reporter constructs express a fluorescent fusion protein of the correct size, albeit at different levels, depending on the presence or absence of the 3' UTR. Furthermore, they faithfully recapitulate the endogenous expression of the E2F1 protein, under both physiological and stress conditions. Lastly, we obtain real time fluorescent trajectories in single cells, suggesting the reporters can be used as tools to predict cell fates.

Biological Sciences 11:00 - 12:00

Morgan Irons

The Development of Pre-Treatments for the Growth and Survival of Crops Under Martian Regolith Conditions

Research Advisor: Justin Wright, Biology

Historically, closed ecological systems (CESs) developed for habitation modules for space exploration have been biologically and ecologically infeasible, experiencing degradation or requiring the system to be opened prematurely for the safety of the inhabiting human crew. To solve the ecological flaws of past systems, CES development should be studied in the context of ecosystems undergoing biological and ecological succession. Here, twelve different combinations of regolith pre-treatments, including microorganism inoculations with biosolids, plant combinations, litter presence, and initial soil saturation conditions, were applied across twelve, one gallon pots of sterilized Mars regolith simulant. Ten replicates were done, with an additional twelve pots as an Earth-based soil control. The pots were given 50 mL/day of water for the first half of the experiment and then switched to 50 mL of water every other day for the second half. The experiment went from 06/22/2016 to 12/20/2016. Preliminary analysis of the results reveal an increase in biomass production variability for pots with initially dry conditions, while pots with initially wet conditions revealed less variability. The pots treated with microbial inoculations had CO2% values above the normal atmospheric value, while pots without microbial inoculums remained near the atmospheric value. Pots with microbes produced higher amounts of biomass and had lower C:N values than pots without microbes. My next steps include running further analysis on the results to provide insight into the viability of pre-treatment use in developing closed ecological systems.

Biological Sciences 12:30 - 1:30

James W. Johnson

Muscle contraction alters hemicentin dynamics at the B-LINK: a newly identified basement membrane adhesion system that connects tissues

Research Advisor: David Sherwood, Biology

Basement membranes (BMs) are thin, dense sheets of extracellular matrix found covering most tissues in multicellular organisms. Adjacent BMs can become linked to form BM-BM adhesion complexes that attach tissues together. Studying BM-BM adhesion complexes can lead to a better understanding of conditions like Alport syndrome, a human pathology characterized by a loss of kidney function due to a failed BM-BM linkage. I investigated how the Basement Membrane Linkage complex (B-LINK), a BM-BM adhesion complex found at the uterine-hypodermal juncture in C. elegans, responds to biomechanical force. To do this, I determined the necessity of multiple BM proteins to B-LINK structural integrity by performing gene knockdown with RNA interference (RNAi) and scoring for B-LINK mediated vulval rupture. Additionally, I used fluorescence recovery after photobleaching (FRAP) to measure the rate of the protein recruitment response of hemicentin, one of the major B-LINK components, when muscle contraction was either permitted or restricted. Type IV collagen, a common BM component, was identified as an important factor in BM adhesion due to high vulval rupture percentages when it was knocked down at the L1 (80.5%) and L4 (20.0%) larval stages. The FRAP experiments revealed that muscle contraction in animals significantly increases the hemicentin turnover rate (76.7%) when compared to immobilized worms (24.3%) over the same 15-minute time course. These results provide a better understanding of which BM components are essential to B-LINK function and development and how muscle contraction influences B-LINK dynamics.

Biological Sciences 11:30 - 12:30

Diane Karloff

Amidation of an Oxazolidinone-Based Scaffold for the Synthesis of an RNA-Biased Screening Library

Research Advisor: Amanda Hargrove, Chemistry

RNA has been shown to play a critical regulatory role in both normal cellular functions and human disease states. Small molecule chemicals probesâ€"which have already demonstrated utility as RNA translation inhibitors and splicing modulatorsâ€"are invaluable tools to investigate RNA. Yet current commercially available screening libraries have limited capacity to identify ligands that bind with high affinity and specificity to an RNA of interest. Therefore, the development of small molecule screening libraries based on physicochemical guiding principles is hypothesized to expedite progress in RNA-targeted therapeutics. The Hargrove lab proposes to synthesize an oxazolidinone-based small molecule library inspired by the structural features of known, bioactive RNA-binding ligands. A cheminformatic analysis revealed that these molecules possess high nitrogen content and low fractions of sp3-hybridized carbon relative to FDA-approved drugs. Amidation of a designed oxazolidinone scaffold would not only add a nitrogen atom but also reduce sp3 hybridization, making amidation useful for library diversification. To date, two synthetic amidation schemes have been pursued. The successful silver-assisted Kornblum oxidation of a chloromethyl oxazolidinone resulted in an aldehyde, which was oxidized to a carboxylic acid; however, the reaction required N(3) protection. As an alternative, current work is focused on the generation of a cyano-substituted oxazolidinone and its subsequent hydrolysis. Once amidation has been achieved, a library of small molecules will be synthesized that reflects the structural properties identified. The library will then be screened for selectivity against a diverse set of RNAs to validate the proposed physicochemical guiding principles and further facilitate RNA targeting.

Biological Sciences 11:30 - 12:30

Nadia Kirmani
Genetically Engineered Zwitterionic Polypeptides for Drug Delivery
Research Advisor: Ashutosh Chilkoti, Biomedical Engineering

Prognosis and survival rates of cancer patients can be improved by controlling primary tumors at their local sites. However, it is difficult to target a primary tumor with high doses of chemotherapeutics due to systemic toxicity. Moreover, traditionally used chemotherapeutics are limited in their efficacy as a result of their small size and hydrophobicity which lead to rapid clearance and poor bioavailability. One way to address these issues is to design effective drug carriers that can increase the bioavailability of chemotherapeutic drugs, their accumulation at the tumor site, and consequently, their therapeutic potential. The overall aim of this project is to design recombinant zwitterionic polypeptides (ZIPPs) and to characterize their potential as drug carriers to solid tumors. Zwitterionic polypeptides have the consensus sequence VPX1X2G, where X1 and X2 are a pair of oppositely charged residues. These novel constructs are hydrophilic such that they will create a hydration layer around themselves and sterically shield drug cargo from degradation in vivo, thus prolonging the overall circulation and efficacy of the conjugated therapeutics. ZIPPs are a promising class of biopolymers due to their biodegradability, biocompatibility, and ease of synthesis, as they can be easily expressed and purified inÂ Escherichia coli by adding kosmotropic salts to trigger phase transition (a method referred to as Inverse Transition Cycling). A ZIPP mini-library was designed by genetic engineering using Recursive Directional Ligation with all possible ion pairs K, R, D, and E. The constructs VPKEG, VPREG, VPKDG, and VPRDG were then expressed and purified using Inverse Transition Cycling. The pharmacokinetics of these ZIPPs were studied in mice, and the sequence VPKEG was found to have the longest circulation time. Overall, ZIPPs have the potential to increase the bioavailability of therapeutics by more than two-fold compared to a well-studied uncharged elastin like polypeptide.

Gina Kovalik

Interleukin-15 Receptor-a Contributes to Podocyte Anti-apoptotic Signaling Through Activation of the PI-3K/AKT and JAK/STAT3 Pathways

Research Advisor: Gentzon Hall, other department...

We recently identified a rare heterozygous missense variant (K47R) in the Interleukin-15 Receptor-a (IL-15Ra) as a contributor to autosomal dominant FSGS in an African American kindred. The K47R variant occurs within the high-affinity “sushi”ligand binding domain of IL-15Ra and exerts a loss-of-function effect on the receptor, which impairs podocyte anti-apoptotic signaling. To further characterize the role of IL-15Ra in podocyte anti-apoptotic signaling, we examined the effects of IL-15Ra overexpression and gene knockdown (KD) on its two known downstream effector pathways, PI-3K/AKT and JAK/STAT. We used immunoblotting and immunofluorescence imaging to evaluate PI3K/AKT and JAK/STAT signaling in IL-15Ra knockdown, IL-15RaWT -overexpressing, and IL-15RaK47R-overexpressing podocytes. In response to IL-15 stimulation, podocytes overexpressing IL-15RaK47R exhibited reduced AKT and STAT3 activation relative to IL-15RaWT -overexpressing podocytes. Nuclear localization of activated STAT3 was also reduced in IL-15RaK47R -overexpressing podocytes stimulated with IL-15. In IL-15Ra KD podocytes, AKT and STAT3 activation were decreased with concomitant reductions in BAD phosphorylation at the AKT target site Ser136 and STAT3-mediated Bcl-2 and Bcl-xL expression. Cleaved Caspase 3 was also upregulated in IL-15Ra KD podocytes consistent with the initiation of apoptosis. We conclude that IL-15Ra is a key component of the podocyte anti-apoptotic signaling repertoire and the PI-3K/AKT and JAK/STAT3 pathways are important mediators of IL-15/IL-15Ra-induced anti-apoptotic signaling.

Biological Sciences 12:30 - 1:30

Daniel Levine

Lymphocyte Activation and Bone Turnover in HIV-infected Young Adults

Research Advisor: Bernie Fischer, other department...

Rationale: HIV and antiretroviral (ARV) treatment drugs such as Tenofovir (TDF) adversely impacts bone metabolism resulting in osteopenia. We hypothesize that plasma biomarkers of bone metabolism and HIV-associated inflammation can identify deleterious effects of HIV and TDF prior to bone mineral density (BMD) changes.

Methods: Young HIV-infected adults (n=23, median age 21 years (range 18-24), 87% male) enrolled in a prospective study in which blood samples were obtained prior to, and 48 and 152 weeks post ARV. All subjects had optimal viral suppression on ARV and TDF was discontinued at 48 weeks but subjects remained on ARV. Biomarkers of BMD, lymphocyte, and macrophage actions were assayed using 13 plex Luminex assay, ELISAs or multi-parameter flow cytometry. A Pearson's correlation was used to detect associations between biomarkers. Ten HIV uninfected youth served as healthy controls (HC).

Results: Table 1, lists significant correlations. Prior to ARV, TNF-α± positively correlated with OPG and PTH but as TNF-A± declined with treatment this correlation resolved. At week 152 TNF-A± correlated with OC. Levels of sCD14, sCD27, and sCD163 did not change with ARV. sCD27 correlated with RankL at entry and Alk Phos correlated with sCD14 at weeks 48 and 152. OPG correlated with sCD14 levels at end of study. Vit D was increased relative to HC at week 48 and correlated sCD163.

Conclusion: HIV-associated Inflammation, (high TNFA±, sCD27, sCD14, and sCD163) results in abnormal biomarkers of bone metabolism. Viral replication perturbs PTH and Rank L but with viral suppression, ongoing macrophage activation impacts bone metabolism.

Table 1: Lymphocyte and macrophage activation biomarker correlations with bone metabolism markers over time.

HIV week 0 (Entry)	HIV week 48	HIV week 152
TNF-A±	OPG (0.67), PTH (0.77)	OC (0.57)
sCD14	AlkPhos (0.72)	AlkPhos (0.78), OPG (0.53)
sCD163	Vit. D (0.60)	Vit. D (0.68)
sCD27	RankL (0.54)	

Pearson rho in parentheses. Abbreviations: TNF- α, Tumor necrosis factor-alpha; OC, Osteocalcin; OPG, Osteoprotegerin; PTH, Parathyroid hormone; RankL, Receptor activator of nuclear factor kappa-B ligand; AlkPhos, Alkaline Phosphatase.

Mae Lewis

Constructing a Biohybrid Material through Protein Engineering

Research Advisor: Davoud Mozhdehi, Biomedical Engineering

Developing new biomaterials is an active area of research with many potential applications to improve human health. Protein based biomaterials represent a major component of new biomaterials as they provide non-toxic, biodegradable, and tunable alternatives. While the precision, control over sequence, and length of the final product of recombinant expression is unmatched by synthetic methods, the composition of recombinant proteins is limited to the twenty naturally occurring amino acids. To increase the chemical diversity of proteins, we tapped into the rich repertoire of post-translational modifications (PTM) to reprogram a naturally occurring lipidation. We used a previously developed methodology in our lab to express a library of Myristoyl modified Resilin Like Polypeptides (MRLP). MRLPs contain three components and were created by a genetically encoded expression modification step. The first component is myristic acid to be incorporated at the N-terminus of polypeptides. The second component is a peptide sequence that creates a peptide amphiphile (PA), and is used to direct the self-assembly. The third is a polypeptide called RLP that is fused to the C-terminus, and is used to confer temperature-responsiveness to MRLPs. MRLPs exhibits an upper critical solution temperature (UCST) phase transition, which causes them to form an insoluble coacervate below a critical temperature and reversible transition to dissolve in solution above the critical temperature. We are currently investigating the effect of temperature on protein self-assembly to further understand the aggregation properties of this new class of hybrid materials.

Becky Li

The effect of helminths on atherosclerosis progression on a mouse model of a post-industrial population

Research Advisor: Charles Nunn, Evolutionary Anthropology

In post-industrial society, the incidence of atherosclerosis, a hyper-inflammatory related condition, is on the rise. At the same time, symbiotic helminths, known to have co-evolved with humans and modulate immune function, have been all but eliminated from the human biome. It has been hypothesized that helminth-mediated attenuation of hyper-inflammatory responses in individuals living in post-industrial society can alter the progression of atherosclerosis. To test this idea using a laboratory animal model, LDL receptor-deficient (LDLR) mice, which are known to develop atherosclerotic lesions in response to a Western (high fat, sugar) diet, were fed an atherosclerosis-inducing diet with (n = 16) and without (n = 15) twice-per week exposure to Hymenolepis dimunita cysticercoid (HDC), a helminth that is currently being used as a non-regulated supplement by many individuals treating inflammatory disease. After 15 weeks of treatment, mice were sacrificed and plaque lesion quality and quantity was assessed by quantitative histological analysis using a Masson's trichrome stain. The presence of HDCs was associated with an approximately two-fold increase of tissue remodeling, as measured by both the total remodeled lesion area and percentage of remodeled lesion area (p= 0.0379 and p=0.0025, respectively). Changes in the amount of foam cell lesion area was not statistically significant (p=0.2131). The remodeled lesion consisted of less foam cells and more collagenâ€"known to contribute to plaque stability. The results suggest that in a post-industrial population demonstrated by a mouse model, multiple evolutionary mismatches, such as inflammatory diet and biota alteration, can interact to amplify pathology.

Biological Sciences 12:30 - 1:30

Jana Lu

Identification of key residues in a human scaffold protein that are phosphorylated by a kinase effector from Legionella pneumophila

Research Advisor: Eric Spana, Biology

The Gram-negative intracellular pathogen Legionella pneumophila causes a severe form of pneumonia known as Legionnaires' disease by infecting human alveolar macrophages upon inhalation of contaminated aerosols. L. pneumophila uses a Dot/Icm protein secretion system to translocate effector proteins into its host in order to avoid fusion with the host lysosome and replicate in the Legionella-containing vacuole (LCV). Through in vitro human protein microarrays, our laboratory discovered that Jpm1, a kinase effector of L. pneumophila, phosphorylates human protein C2orf6 (Chromosome 2 open reading frame 6). C2orf6 is a phosphorylation dependent scaffold protein involved in regulating cell proliferation, differentiation, and apoptosis. Previous studies have shown that four threonine residues of C2orf6 can be post-translational modified via phosphorylation. We hypothesized that Jpm1 might also target these residues. We used the Stratagene Quickchange PCR and crossover PCR to construct plasmids encoding C2orf6 variants with alanine substitutions in individual or all four threonine residues respectively and performed GST-tagged purification to obtain GST-tagged C2orf6 variants from E. coli. Protein phosphorylation was tested through a non-radioactive in vitro ATPgS kinase assay and detected by immunoblotting. Overall, we concluded that three out of four residues of C2orf6 are phosphorylated by Jpm1. The target residues identified in vitro will need to be further validated in vivo in human infected cells and the mechanism by which C2orf6 phosphorylation affects downstream signaling in infected cells will need to be determined.

Biological Sciences 11:00-12:00

Jordan Lucore

Unveiling the Differences of Female Dominance Expression and Co-occurring Factors: Lemur catta and Eulemur Species

Research Advisor: Leslie Digby, Evolutionary Anthropology

Female social dominance (FSD) is a contentious and relatively uncommon social structure among mammals with obscure evolutionary mechanisms. In female dominance, females maintain access to high priority resources such as food and water by exhibiting consistent agonistic superiority over males in all contexts. This form of FSD is exemplified in Lemuriformes (e.g lemurs and sifaka). The prevalence of FSD in the majority of lemur species allows for the investigation of the expression of FSD across species. (Norscia & Palagi, 2015; Wright, 1999). This study examines and quantifies the differences in the expression of FSD across Lemur catta and four species of Eulemur. We conclude Eulemur species rely on female aggression to maintain female feeding priority while L. catta use male deference as a maintenance mechanism for female feeding priority. Additionally, evidence of agonistic superiority in Eulemur species outside of a feeding context is not supported by this study. Therefore, Eulemur species may not express complete FSD in contrast to L. catta. In all, understanding the differences in social dominance between species can illuminate the evolutionary mechanisms driving the appearance and maintenance of this unique and rare social system.

Biological Sciences 12:30 - 1:30

Sweet Hope Mapatano
Male Hormone may be important in the efficacy of Pompe Gene Therapy
Research Advisor: Dwight Koeberl, Biology

Recombinant adeno-associated viral vector (AAV) is a vector used in the treatment of genetic diseases such as Hemophilia and Pompe. Previous studies have shown a higher efficacy of the vector in males compared to females. This gender disparity has been suggested to be due to an androgen specific pathway. An evaluation of the influence of testosterone on the transduction of liver specific rAAV in female alpha-glucosidase (GAA) knockout mice suggested that liver specific rAAV vector alongside testosterone increases the activity of the GAA enzyme in female mice and decreases the accumulation of glycogen in the heart and liver. Results also indicate an increase in muscle strength with the administration of AAV + testosterone in female mice. These results suggest that androgens likely play a significant role in rAAV gene transfer in Pompe and are likely to have significant implications in increasing the efficacy of rAAV gene therapy for female patients suffering with genetic disorders in the future.

Biological Sciences 11:30 - 12:30

Malcolm McDonald

Investigation of Piezo1 Inactivation Kinetics with Mutants and pH

Research Advisor: Jorg Grandl, Neurobiology

Piezo1 and Piezo2 are mechanosensitive, nonselective cation channels found in mammals (Coste 2010). Piezo1 has been found to have a critical role in red blood cell volume regulation and vascular development (Bae 2013, Ranade 2014 a). Piezo2 has been found to have a role in touch, proprioception, and respiration (Ranade 2014 b, Woo 2015, Nonomura 2017). The major functional difference between the two is inactivation kinetics with slower inactivation for Piezo1. The Piezo1 channel itself characteristically has a rapidly activating inward current of positive ions that quickly inactivates and decays when provided with a mechanical stimulus. The ion channel also shows differential responses to repetitive stimulations of different frequencies. Repetitive stimulations that would activate Piezo1 are part of normal physiology including touching a vibrating object, feeling the surface of an object, the heart beating, the lungs expanding, etc. The channel response to different frequencies creates a tuning curve of current inflow. The frequency-tuning curve appears to be highly dependent on the inactivation state of the channel. Inactivation from a rapid succession of pulses at higher frequencies should give little time to recover between pulses and channels thus have lower probabilities of being open later in the stimulus. Inactivation-deficient mutants and pH modulations would be one way to potentially alter this curve because they have both demonstrated slowed inactivation (Albuisson 2013, Bae 2015). These experiments use the mutants RH2456H, M2225R, R1358P, E2496ELE, and acidic pH to attempt to modulation the frequency curve to better determine inactivation's role in frequency stimulation

Christopher Monti

Development of a Protocol for Analysis of Collagen in a Cadaveric Human Heel Pad

Research Advisor: Richard Brennan, Biochemistry

Humans walk with a characteristic foot posture, called a heel strike, in which the middle of the heel contacts the ground before the rest of the foot. During walking, the human heel can endure impact forces nearly three times body weight. To mitigate these forces, humans have a cushion (heel pad) that consists of pockets of fat separated by septa that act like a spring during heel strike. It is probable that the scaffolding material that underlies the load-bearing structures in the heel pad includes collagen since it is the most abundant structural protein in the human body. Admittedly, collagen is often difficult to study given several of its properties such as its large size and complex structure. The present study proposes a methodology for extracting and analyzing collagen from a cadaveric human heel pad and comparing it to a standard solution of pure collagen. A preferred methodology was found to include dissecting the heel pad into small, approximately square sections, extracting the collagen from the whole cell in radioimmunoprecipitation assay (RIPA) buffer, performing sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE), Coomassie Brilliant Blue staining to visualize extracted proteins, and collagen-specific western blotting. Bands were detected at a similar molecular weight as a pure collagen control solution, purchased from Sigma-Aldrich, and collagen was detected using collagen-specific polyclonal antibodies, thereby suggesting successful isolation of collagen. The methodology produced in this research may contribute to further studies investigating the current theory of the structure-function variations observed in primate locomotion and the evolutionary theory of locomotor patterns in these species. The protocol developed from this study may also prove useful in the study of plantar foot wounds leading to ulcerations that often accompany diabetes mellitus.

Biological Sciences 11:00 - 12:00

Chad Munger
The Enteroendocrine-Neuron Synapse
Research Advisor: Dr. Diego Bohórquez, Neurobiology

Enteroendocrine cells (EECs) are intestinal epithelial cells that respond to luminal stimuli. Historically, the cells were believed to communicate with sensory neurons using secreted hormones. However, the Bohórquez Lab has been investigating whether the EECs can communicate with neurons via a synaptic connection. The team has found evidence for a synaptic connection between EECs and efferent neurons using monosynaptic rabies neurotracing. The aim of the project I am working on is to provide additional evidence for a synaptic connection between EECs and efferent neurons using Mammalian GFP Reconstitution Across Synaptic Partners (mGRASP). mGRASP uses two plasmids, pre-GRASP and post-GRASP. Pre-GRASP extends the non-fluorescent protein GFP11 out of the transfected cell using neurexin-1ß, a pre-synaptic protein. Post-GRASP extends GFP1-10, another non-fluorescent protein, using neuroligin-1, a post-synaptic protein. Neurexin-1ß and neuroligin-1 normally bind together in synaptic clefts. However, using mGRASP, the non-fluorescent proteins at the end of neurexin- 1ß and neuroligin-1 combine to reconstitute GFP. Therefore, a GFP signal between a pre-GRASP transfected cell and a post-GRASP transfected cell provides evidence of a synaptic connection between the two cells. The goal of the project is to find this GFP signal in co-cultured organoids transduced with one of the plasmids and neurons with the other plasmid.

Biological Sciences 11:00 - 12:00

Kevin Murgas

Using CRISPR/dCas9 gene targeting to study the role of XIST noncoding RNA in maintenance of X-chromosome inactivation

Research Advisor: Eda Yildirim, Cell Biology

XIST is a long noncoding RNA that is key in the initiation of X-chromosome inactivation (XCI) in female placental mammals. XIST RNA loss, X-linked gene upregulation and X aneuploidies have been implicated in several cancers, yet causality has not been established. Yildirim lab recently showed that conditional deletion of Xist in mouse blood cells leads to aggressive female-specific blood cancers. Importantly, Xist mutant blood cells show upregulation of X-linked genes. This mouse model strongly suggests that Xist impacts XCI maintenance and acts as a suppressor of blood cancer in mice. Here, I establish CRISPR/dCas9-KRAB based gene-targeting tools to determine a functional role for XIST in maintenance of mouse and human XCI during hematopoiesis. I hypothesize that XIST deletion results in chromatin instability on the X chromosome leading to alterations in X-linked gene transcription and cell differentiation. First, I utilize female human leukemia cell lines and determine XIST expression before and after differentiation of cells into myeloid or erythroid lineages. Using K562 cells, I screen human XIST gRNAs and successfully establish K562 cell lines that show 85-95% knockdown in XIST expression. Second, I focus on identifying gRNAs to target mouse X-linked genes Kif4 and Hdac8 that are upregulated in Xist-mutant blood cells. Knockdown of key X-linked genes in Xist mutants should rescue Xist-dependent hematopoietic defects. I determine 2-3 gRNAs that result in ~65% knockdown in Hdac8 and Kif4 transcription. These gRNAs serve as novel tools to study the role of XIST in XCI maintenance and its relation to hematopoiesis and cancer.

Biological Sciences 12:30 - 1:30

Daniel OConnell

Age Related Differences on a Smooth Pursuit Task in High School and Youth Football Participants - Implications for Baseline Concussion Assessments

Research Advisor: Jason Luck, Biomedical Engineering

Smooth pursuit eye movement (SPEM) assessments may offer an objective tool to assist in diagnosing mTBI and further our understanding of the mechanisms of brain injury associated with a concussion and potentially sub concussive exposure. SPEM provide insight into delays in motion processing and short-term memory deficits. Literature suggests that SPEM develop through six years of age, and some aspects of attention such as focus and visual attention continue to develop in older children, leading us to examine how SPEM changes with age. This pilot study seeks to examine a SPEM metric in high school (HS) and youth football athletes to determine whether the baseline metric changes with age (5 to 17 years). The results may influence frequency of baseline testing.

Participants were males recruited from HS and youth football (n = 77; 5-17 YRS). SPEM was collected during a baseline session. Positional gain (PG) - a ratio of the maximum distance the eye travels to the peak travel of the stimulus - was calculated and compared by age. The pilot data shows PG minimally varies among HS athletes in this pilot cohort ($p=0.76$). However, limited data among the youth cohort limits our insight into the younger ages. Oculomotor testing may provide an objective mTBI tool, but baseline metrics obtained at different ages may vary due to developmental considerations. Normative datasets are an alternative to individual baseline data, and further understanding of age related differences will assist in the potential development of these datasets.

Biological Sciences 11:00 - 12:00

Joost Op 't Eynde

Biological Sciences 11:00 - 12:00

Meghana Rao

Investigating the relationship between diet, social rank, and gut microbial diversity in captive cynomolgus macaques

Research Advisor: Jenny Tung, Evolutionary Anthropology

There is a well-researched positive correlation between social status and health in human societies. Given that the gut microbiome is affected by diet and stress exposure, both of which can vary depending on social environmental conditions, studying gut microbial diversity is relevant to the mechanisms underlying health disparities. To study the relationship between gut microbiota and socially induced stress, we utilized an established captive nonhuman primate study system with female, adult cynomolgus macaques (M. fascicularis) in which social rank and diet can both be manipulated to determine their independent and joint effects on health. Fecal samples were collected at two timepoints after administration of two different diets. Diet was found to be a significant predictor of microbial community composition overall and within each timepoint. Diet also significantly moderated the effect of social rank and BMI on microbial stability between the two timepoints. A consistent signature of social rank was also seen within each timepoint. With respect to microbial richness and diversity, no BMI or social rank signature was observed, however, richness tended to change between the two timepoints in a diet-dependent manner. Together, our results confirm the central role of diet in shaping the global structure of the gut microbiota at the genus level and indicate that diet effects emerge over both short-term and longer-term time scales. They also point to novel co-acting and interacting effects of social status on the diet-microbiome relationship.

Biological Sciences 12:30 - 1:30

Linda Ren

A lentiviral vector bearing a reverse intron demonstrates superior expression of both proteins and microRNAs

Research Advisor: Bryan Cullen, Molecular Genetics & Microbiology

While lentiviral expression vectors are widely used in many facets of molecular biology, they suffer from the disadvantage that introns inserted into the vector genome are rapidly lost by splicing in packaging cell lines. The presence of an intron, if achievable, has the potential to facilitate the expression of transgene cDNAs, as splicing has been extensively shown to facilitate mRNA biogenesis and function. Moreover, if a stable intron could be introduced into a lentiviral vector, it would have the potential to greatly facilitate the expression of miRNAs, and especially miRNA clusters, as is the introduction of pri-miRNA stems into the exonic region of a lentiviral vector can strongly inhibit both the vector titer and the expression of miRNA-linked indicator genes due to cleavage of the vector genome by Drosha. Here, we describe a novel lentiviral vector design in which transgenes and/or miRNAs are expressed using an antisense-orientation inducible promoter driving an expression cassette bearing a functional intron. We demonstrated that this lentiviral vector, called pTREX, is able to express higher levels of both transgenes and pri-miRNA clusters when compared to a closely similar conventional lentiviral vector.

Biological Sciences 11:00 - 12:00

Yuming Shi

Examining the role of Nuclear Pore Complex in X chromosome dosage compensation

Research Advisor: Eda Yildirim, Cell Biology

Nucleoporin153 (Nup153) is a component of the Nuclear Pore Complex (NPC), a multi-protein channel that mediates nucleocytoplasmic transport of proteins and mRNAs. Evidence from multiple labs demonstrate that several nucleoporins (Nups) impact chromosome organization and transcription. Nup153 is among the subset of Nups that associate with DNA and has been linked to regulation of transcription. However, the underlying mechanisms of Nup-mediated gene expression are still not well understood. By examining Nup153-genome interactions in a female mammalian cell line, Yildirim lab recently show that Nup153 interacts with the active X chromosome (Xa) and transcriptionally active regions of the genome. In female mammals, one of the two X chromosomes is transcriptionally silenced through a dosage compensation mechanism called X chromosome inactivation (XCI). Here, I focus on Nup153 function in XCI maintenance by utilizing Nup153 knockdown (KD) female fibroblast cell lines. First, I investigate XCI defects by examining differential expression of Xist and X-linked genes by qRT-PCR and fluorescent microscopy. Second, I perform DNA and RNA-FISH to determine nuclear position changes of Xi and Xa. I find that loss of Nup153 does not impact transcription of X linked genes or the subnuclear position of X chromosomes during XCI maintenance.

Biological Sciences 11:30 - 12:30

Rachel Skelton

Design and Characterization of Proapoptotic Nanoparticles for Targeted Cancer Therapy

Research Advisor: Ashutosh Chilkoti, Biomedical Engineering

Current cancer therapies are often limited by short half-lives, lack of specificity, lack of potency, and toxicity. The proposed approach directly addresses these key issues by combining the delivery advantages of protein-based self-assembling nanoparticles with the targeting power of engineered protein scaffolds that bind receptors on tumor cells. These genetically encoded self-assembling nanoparticles are composed of three parts: (1) a hydrophobic RLP (resilin-like polypeptide) block, (2) a hydrophilic ELP (elastin-like polypeptide) block, and (3) a targeting moiety engineered from a fibronectin domain. These nanoparticles self-assemble such that the RLP block constitutes the core, and the hydrophilic ELP and fibronectin domain (Fn3) domain are exposed. The nanoparticle thus displays the Fn3 domain, enabling binding to its target, TNF-related apoptosis-inducing ligand receptor 2 (TRAILR2, death receptor 5). TRAILR2 is expressed by a wide variety of cancer cell types, and upon binding to its natural ligand, TRAIL, the receptor homotrimerizes and induces cell death through the extrinsic apoptotic pathway. Interestingly, our results show that the multivalent display of Fn3 domains on the corona of the nanoparticles triggers potent proapoptotic activity upon interaction with TRAILR2, inducing cancer cell death. To explore the impact of nanoparticle architecture on potency, we developed Fn3 fusions to amphiphilic diblocks that self-assemble to form spherical or rod-shaped nanoparticles. We have designed, expressed, characterized, and tested these nanoparticles as proof-of-concept for protein-based targeted nanoparticle therapy and for potential targeted stealth delivery of small molecule anti-cancer agents.

Biological Sciences 11:00 - 12:00

Shobana Subramanian

The effects of the transcription factor PPARA*γ *on late onset Alzheimer's disease-implicated genetic risk factors and downstream cellular phenotypes

Research Advisor: Ornit Chiba-Falek, other department...

Peroxisome proliferator-activated receptor-gamma (PPARg), a ligand-activated nuclear transcription factor, is involved in lipid and carbohydrate metabolism and mitochondrial biogenesis. Here, we investigate the involvement of PPARg in the regulation of genes and cellular phenotypes associated with late-onset Alzheimer's disease (LOAD). The 19q13.32 chromosomal region, composed of the genes translocase of outer mitochondrial membrane 40 (TOMM40), apolipoprotein E (APOE), and apolipoprotein C1 (APOC1), is most strongly associated with LOAD. Bioinformatic analyses revealed several potential PPARg binding sites across this chromosomal region. We demonstrated that PPARg acts as an inhibitor of the 19q13.32 region using two complementary approaches: (1) short-hairpin RNA-mediated knock down of PPARg expression in liver-derived HepG2 cells; (2) treatment of HepG2 cells with PPARg agonists. Gene expression analysis using NanoStringâ„¢ technology further revealed effects of PPARg on the expression of five other LOAD-associated genes. Pathway analysis of affected genes suggested PPARg regulation of cell survival, lipid metabolism, and immune-related phenotypes. In order to extend these findings, we investigated PPARg regulation of relevant cellular phenotypes, including mitochondrial expression and ApoE secretion. We found that PPARg knockdown results in significant increases in mitochondrial expression and decreases in ApoE secretion, corresponding to features of neurodegenerative pathology.

Biological Sciences 12:30 - 1:30

Yujiao Sun

Functional relationship between OPTN, TBK1 and p62 proteins and their implication in amyotyophic lateral sclerosis (ALS) pathogenesis

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

Genome sequencing studies have associated mutations in SQSMT1 gene, which encodes the p62 protein, with amyotrophic lateral sclerosis (ALS), frontotemporal lobar degeneration (FTD) as well as Paget disease of bone (PDB). Mutations in proteins associated with p-62 such as TANK-binding kinase 1 (TBK1) and optineurin (OPTN) have also been linked to ALS and FTD (Freischmidt et al, 2015). TBK1 is a multifunctional kinase protein involved in autophagosomal engulfment and degradation of polyubiquitinated cargo (Matsumoto et al., 2015). Loss-of-function mutations in TBK1 C-terminal coiled-coil domain, which is responsible for binding OPTN, have been shown to have a role in the pathogenesis of ALS (Freischmidt et al, 2015). My experiments have found TBK1, OPTN and p62-S403p colocalize on ubiquitin-rich foci in macrophage cells that are challenged by bacterial lipopolysaccharides (LPS). A time-course experiment shows the number of LPS-induced foci in cells follows a bell-shaped pattern, where the cell accumulates most foci 12 hours after treatment while the foci size continues to increase, which reveals macrophage cell manage these polyubiquitinated foci by concentrating them first then resolve. These previous findings suggest that a common biological process regulated by TBK1, OPTN and p62 likely plays a critical role in the pathogenesis of ALS, FTD and PDB through their involvement in macrophage cells' inflammatory response. Identifying such a pathway would be fundamental to our understanding of these diseases and developing potential therapeutic intervention.

Biological Sciences 11:30 - 12:30

Thomas Wang
Identification of Novel Genes Regulating Cell-Invasive Behavior
Research Advisor: David Sherwood, Biology

Cell-invasion, the process by which cells migrate through basement membrane, is a crucial and highly-regulated component of animal development that is often misregulated in invasive diseases, most notably, metastatic cancers. Although previous research has successfully identified several genes regulating cell-invasion, the complete set of genes that promote this stereotyped process has yet to be established. Amenable to conventional genetic methods and imaging techniques, the nematode, C. elegans, provides an unparalleled experimental model for studying the genetic regulators of cell-invasion in vivo. In C. elegans, cell-invasion occurs normally during the formation of the uterine-vulval connection, when a specialized uterine cell - the anchor cell - breaches the adjacent uterine and vulval basement membranes in a temporally and spatially invariant process. Here, we have begun to identify and characterize novel genes involved in anchor-cell invasion in C. elegans by analyzing two recessive genetic mutants that map to single loci and have defects in anchor cell invasion. Using live-cell imaging techniques and fluorescent markers to study invasion in its native environment, we have shown that these mutations cause improper alignment between the anchor cell and vulval precursor cells, as well as atypical levels of actin polarization in the anchor cell. Identification of the mutated genes via SNP mapping and further characterization will provide a more complete understanding of the genetic regulators of cell-invasion, having the potential to establish novel drug targets for future therapies.

Henry Warder
3D Printed Lower Limb Prosthetic Device
Research Advisor: Ken Gall, other department...

Advancements in rapid prototyping technology are changing the way traditional prosthetic devices are fabricated and designed. 3D printing is proving to be a powerful tool in the field of prosthetics, but the technology is not without its limitations. The plastic materials used by many 3D printers cannot withstand the mechanical stresses and strains created during gait cycles, and therefore, are not considered viable alternatives to stronger traditional materials used in prosthetic device fabrication. This project investigated the feasibility of creating an entirely 3D printed lower-limb prosthetic device, fabricated using carbon fiber-reinforced 3D printing. Designs for a foot, pylon, and knee were created and fabricated, and multiple prototypes underwent rigorous mechanical testing. Clinical trials were conducted, and patient feedback was incorporated into the overall evaluation of feasibility. Devices fabricated using carbon fiber-reinforced 3D printing techniques withstood the forces required to be qualified as energy returning, viable prosthetic devices. The data collected suggests that this new method of 3D printing is a first step in overcoming the limitations of traditional 3D printed prosthetic devices, and provides a framework with which to view and approach future developments in the field.

Biological Sciences 12:30 - 1:30

Angela Wei
Determining the Genetic Basis of Dorsal Closure in Drosophila
Research Advisor: Dan Kiehart, Biology

Cell sheet morphogenesis is a fundamental process that characterizes wound healing and vertebrate tissue development, such as gastrulation, neural tube closure and palate formation. While morphogenesis is essential to many developmental processes, the molecular mechanisms that drive various cell sheet movements are still unknown. By learning more about the fundamental biology that underlies this process, we can set the groundwork for understanding and treating human conditions, such as spina bifida, cleft palate, and severe wounding. Drosophila dorsal closure is an excellent model system for cell sheet morphogenesis. To better understand dorsal closure, we have screened the 2nd chromosome of the Drosophila genome using large deletions, or deficiencies (DFs), to determine regions that affect dorsal closure. We scored phenotypes using time-lapse imaging of flies homozygous for each deficiency with E-cadherin-GFP in the background. 80 of 154 deficiencies displayed a mutant phenotype. In order to further narrow down these regions into specific genes, we used successively smaller, overlapping deficiencies. Df(2L)07, characterized by bunching along the purse string during closure, has been narrowed down to a region containing 13 genes, while Df(2L)08, which causes the embryo to fail to close, has been narrowed down to a region containing 19 genes. Further work will help determine the phenotype causing genes and their molecular mechanisms for morphogenesis. These findings will help create a more comprehensive list of dorsal closure genes and will contribute to the understanding of dorsal closure and cell sheet morphogenesis.

Biological Sciences 12:30 - 1:30

Anchi Wu

Evaluation of Horizontal Gene Transfer in the Evolutionary History of Beta-galactosidase

Research Advisor: Lawrence David, Biomedical Engineering

Eukaryote-to-prokaryote horizontal gene transfer (HGT) events are believed to be rare. Here, we investigate the possibility that select bacterial beta-galactosidase genes are inherited from an ancient eukaryote-to-prokaryote HGT event. We analyzed 433 eukaryotic and prokaryotic beta-galactosidase genes downloaded from the UniProt and IMG databases. These sequences were then aligned and trimmed in order to build phylogenetic trees. Inspecting our phylogenies, we observe an association between select beta-galactosidase genes in amoebas and host-associated bacteria as well as animals and plants. This association may be explained by an ancient HGT event, or by a series of gene duplication and loss events. Independent of inheritance mechanisms, however, these findings point to a carbohydrate-driven association between ancient bacteria and eukaryotes.

Biological Sciences 12:30 - 1:30

Karen Xu

The Role of Integrin Activation in Vinculin Loading and Actin Morphology

Research Advisor: Brenton Hoffman, Biomedical Engineering

Cell adhesion plays a critical role in tissue strength, and misregulation of this process has been linked to mechanically sensitive diseases such as atherosclerosis and cancer. A vital component of cell adhesion are focal adhesions, linkage points between the actin cytoskeleton and extracellular matrix. One adhesion protein in particular, vinculin, is especially important for the mechanical stability of adhesion sites. Furthermore, different components of the extracellular matrix activate combinations of integrins to varying degrees, which likewise modulate force transmission and adhesion reinforcement within the cell. Here, we examine the specific role of the focal adhesion protein vinculin in this mechanosensitive process. This is accomplished by placing a FRET-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. By combining this tension sensor with actin staining, we are able to examine the changes in vinculin tension and actin architecture when fibroblasts spread on two key extracellular matrix proteins, fibronectin and collagen. Initial findings suggest that cells that adhered to a fibronectin-based matrix primarily exhibit a contractile phenotype with large stress fibers. In contrast, collagen-based matrices elicit a protrusive, migratory phenotype and induce large protrusions and fewer stress fibers, as well as higher vinculin tension. Understanding these consequences may give greater insight into the role of integrin-specific mechanotransduction on higher-order processes such as fibrosis and cancer metastasis.

Biological Sciences 12:30 - 1:30

Madison Zamora

Using iPSC-derived neural precursor cells to functionally evaluate the role of SNCA triplication in the context of synucleinopathies

Research Advisor: Ornit Chiba-Falek, other department...

Synucleinopathies are a group of neurodegenerative diseases that are defined by the presence of cytoplasmic protein aggregates in neurons composed of alpha-synuclein protein, which is encoded by the SNCA gene. We used dopaminergic (mDA) and cholinergic (BFCN) neural precursor cells (NPCs) to model Parkinson's disease (PD) and dementia with Lewy bodies, respectively. Induced Pluripotent Stem Cells (iPSCs) from a patient with triplication of the SNCA locus and iPSCs from a control patient were used to develop these cell lines. The objective of this study was to phenotypically characterize the control and SNCA-triplication (tri-SNCA) mDA and BFCN NPCs with the goal of determining cell-specific sensitivity to overexpression of alpha-synuclein. Literature data reports that triplication of the SNCA gene locus leads to decreased mitochondrial function in iPSC-derived neurons and increased levels of apoptosis. Mitochondrial function was characterized using immunofluorescence and assays measuring cytotoxicity, cell viability, and ATP production. Apoptosis was triggered by treating cells with varying concentrations of staurosporine, and activation was characterized using assays measuring cytotoxicity and caspase 3/7 activation. Tri-SNCA mDA NPCs display higher levels of cytotoxicity and ATP production than tri-SNCA BFCN NPCs at late passages, indicating a possible reactive mechanism to stress. Additionally, the tri-SNCA BFCN NPCs display a higher fold response to increasing staurosporine treatment concentrations in caspase activation but not in cytotoxicity when compared to the tri-SNCA mDA NPCs, suggesting that the latter may mediate cell death via an alternative molecular pathway. While both of the cell lines are sensitive to overexpression of alpha-synuclein, the differences in phenotypes related to mitochondrial function and apoptosis suggesting cell-specific responses to SNCA triplication.

Yingying Zhang

A genomic analysis of immune response-induced changes in chromatin accessibility in baboons

Research Advisor: Jenny Tung, Evolutionary Anthropology

Changes in gene regulation via epigenetic modifications are thought to make important contributions to human and nonhuman primate evolution. As there is high similarity at the sequence level of protein-coding regions between humans and other primates, phenotypic variation may instead be explained by changes in regulatory regions. The role of gene regulatory mechanisms has been studied in the cellular response to selectively relevant environmental stimuli (e.g., pathogen attack). To understand the contribution of these mechanisms to traits such as immune defense, it is necessary to identify regulatory elements that may explain variation in gene expression levels. I used ATAC-seq (Assay for Transposase-Accessible Chromatin with high-throughput sequencing) to profile genome-wide chromatin accessibility shifts in Papio anubis peripheral blood mononuclear cells (PBMCs) using lipopolysaccharide (LPS) as the infectious agent. Sites of open chromatin between the LPS-treated and null samples varied. There were 1,131 unique peaks (regions of open chromatin) found across the infected samples, indicating clear differences in accessible genomic regions after LPS stimulation. Focusing on these regulatory regions will contribute to ongoing studies regarding patterns of chromatin accessibility in baseline and immune-stimulated states to differential response to infection.

Biological Sciences 12:30 - 1:30

Mudit Dutta

The role of βIGH3 in the TGF-B signaling pathway in the breast cancer tumor microenvironment

Research Advisor: Gerard Blobe, Pharmacology & Cancer Biology

The transforming growth factor-beta (TGF-B) signaling pathway is crucial for regulating cellular processes such as growth, differentiation, apoptosis, and development, among other processes. Aberrations in the pathway can result in human diseases such as cancer. A secreted protein in the tumor microenvironment known as transforming growth factor-beta-induced (BIGH3) has been identified as an indirect regulator of the TGF-B pathway in breast cancer. It is hypothesized that BIGH3 plays a role in promoting tumor progression via mediating the signaling pathway in the tumor microenvironment. Specific aims of this project involve determining whether BIGH3: (1) directly promotes the TGF-B pathway, (2) acts intracellularly or extracellularly to promote induction of the pathway, and (3) promotes tumor growth and metastasis in vivo. The role of BIGH3 in extravasation and metastasis has been explored in colon cancer, however its association with the TGF-B pathway and breast cancer is not known. The experimental methodology used to achieve the goals aforementioned include western blot protein analyses, binding and crosslinking assays, and cancer mouse studies. It is expected that BIGH3 promotes the TGF-B pathway through an extracellular mechanism in vitro and that its observable effects would be increased tumor growth and metastasis in vivo. These results would confirm BIGH3 as a key promoter of the TGF-B pathway in several cancer diseases and not just limited to breast or colon cancer. This study would also help develop possible intervention methods to alleviate the prognosis of cancer by manipulating BIGH3's actions with respect to the TGF-B pathway.

Biological Sciences,Physical Sciences 12:30 - 1:30

Riley Reardon

Improving the Oral Health Literacy in the Cangrejal Valley

Research Advisor: Martha Ann Keels, other department...

This investigation was launched to assess the oral health literacy within the Cangrejal River Valley region of Honduras. Project H.E.A.L. travelled to eight different communities to conduct research and additionally present educational workshops for children relating to dental health. 100 people were interviewed using a cross-sectional survey consisting of 15 questions. Thus, the upstream determinants of oral health behaviors and practices were identified. This investigation revealed that while there is a wide-spread knowledge of proper oral health behavior in this region, most consider visits to the dentist important solely for the extraction of teeth. This belief discourages regular visits to the dentist, particularly for communities off the main road. Cost, including transportation, also affects the majority of peoples' decision to go to the dentist in 5 out of 8 communities. Consequently, the average number of dental visits in the entire valley was 1.8 for children, and 2.8 for adults, in their respective lifetimes. Therefore, we recommend future volunteers to intervene by presenting more workshops, or "charlas"in communities we did not reach, and offering dental services more frequently throughout the year.

Community Engaged Research 11:30 - 12:30*

Roy Auh

The Polyphonic Poetics of Watchmen by Alan Moore and Dave Gibbons and its Ontological Implications

Research Advisor: Kimberly Lamm, Women's Studies

Polyphonic poetics is a reaction against authors dictating the thoughts of characters to support their own worldview and denying them a human being's innate free consciousness. Soviet litterateur Mikhail Bakhtin saw that Dostoevsky's poetics conceived of characters' consciousnesses that resisted ideological immanence by continually reacting to any limiting descriptions placed on oneself. Humans, therefore, are what Bakhtin calls unfinalizable. My research first argues that the poetics of Alan Moore and Dave Gibbons's groundbreaking graphic novel, Watchmen (1986-87), is also polyphonic. However, polyphony expressed in the graphic dimension brings new layer of meaning to philosophical implications of polyphony. How Moore and Gibbons conceive of characters through their revision of novelistic polyphony reveals an alternative explanation of unfinalizability than the one Bakhtin articulated about Dostoevsky's characters. Through a close reading of Watchmen and engagement with multiple theories of graphic novels and polyphonic poetics, my research concludes with an explication of Watchmen, which suggests that unfinalizability is not an innate quality reminiscent of a soul, but a result of the consciousness being an impersonal site for different societal narratives to dialogically engage with each other. A person's consciousness remains elusive because for every narrative the mind evokes to help frame a particular memory or vision, a counter-narrative springs up to disqualify it. This paper contends that Watchmen's polyphonic poetics is based on an ontological viewpoint that reinterprets Bakhtinian human consciousness within postmodern philosophy.

Humanities 11:00 - 12:00

Elizabeth Barahona
The History of Latinx Students at Duke University
Research Advisor: Sarah Deutsch, History

Why do we research Latinx history at Duke? To not forget? To empower ourselves with a construct of what we have overcome? This history of Latinx from the 1920s to 2017 is mostly intended to discover what has been lost to us. The history of Latinx at Duke University is unknown from before the 1980s. The Latinx history I knew was Mi Gente, La Unidad Latina, and a few mentions of the Spanish-American Latino Student Association known as S.A.L.S.A. Recent faculty, staff, nor students seemed to know about Latinx history beyond S.A.L.S.A. and there grew the need to discover it. We lose an opportunity to empower ourselves in not knowing our history.
By gathering the history of Latinx students at Duke, through knowledge of Latinx student's personal stories, Latinx student's accomplishments, research projects, and the overall status of Latinx students, the university's culture and mindset will be prepared to evolve from negative ethnic stereotypes to accurate representations of Latinx students.
My goals for this project are to create a solid framework about the 88-year old history of Latinx students at Duke. Hopefully, students after me will be able to fill in the gaps and create more extensive projects and any aspect of this thesis. I hope this inspires students, faculty and staff to research the history of students of color at Duke and empower themselves to continue a tradition of social justice at Duke and in Durham.

Humanities 11:30 - 12:30

Ben Brissette

What can we learn about learning by looking at textbooks? The case of literacy in Early Modern Spain

Research Advisor: Elvira Vilches, Romance Studies

With the introduction of the movable type printing press, literacy expanded broadly, but rarely do researchers stop to ask why. Easier access to the written word, alone, does not explain why more people learned to read and write, long before established systems of education. In Spain during this period (from the late 15th through the 18th centuries) literacy was already fairly well-documented among the clergy and aristocracy, with significant increases in literacy occurring in the developing merchant class, artisans and skilled workers, and urban and rural laborers, all groups in society for which there is classically little documentation. In fact, most urban and rural laborers only learned to read, meaning they couldn't leave behind documents explaining their motivations, and though self-referential works do exist for the other groups, they rarely address the individual's desire to learn. Given the dearth of primary sources offering qualitative information, investigators have turned to a wide variety of secondary sources, including period literature, for representations of these groups and their engagement with literacy, but a genre of sources that has been underutilized is that of instructional books. These books taught reading, writing, basic arithmetic, and other, more advanced skills. Through analysis of paratexts, authorial intent, and historical context, this research hopes to show the value of instructional books in providing insight into literacy's role in the development of both national and individual identity.

Humanities 11:00 - 12:00

Ethan Czerniecki
Capitalism's Enduring Paradox: The Falling Rate of Profit and Crisis
Research Advisor: Brenda Baletti, African and African American Studies

Since 1844 and the publication of Economic and Philosophical Manuscripts, Karl Marx's scholarship has been a sight of disagreement and debate amongst scholars across the political spectrum. Published posthumously by friend, fellow scholar, and frequent coauthor Friedrich Engels, Capital Volume 3 contains one of Marx's most contentious theories, which has since been subject to ongoing, differing interpretations amongst varied factions of leftist thought. Designated the law of the tendency of the rate of profit to fall, many Marxists have been quick to claim the tendency is unfounded pseudoscience, or to herald certain, countervailing tendencies that render the theory obsolete. Others, via both theoretical and empirical interventions, hold that Marx's theory remains true to this day and represents an enduring contradiction lying at the center of the capitalist mode of production. The truth of this theory represents a crucial point of contestation because it could provide an explanation for historic, economic disasters and potentially points to a looming, terminal crisis of capitalism. This presentation represents an intercession on behalf of the tendency as stated by Marx and explores the link between falling profit rates and capitalist crises. It will also address multiple criticisms leveled against Marx's theory from a variety of ideologically different thinkers, debunking each in turn and ultimately upholding the truth of the tendency of the rate of profit to fall.

Humanities 12:30 - 1:30

Attyat Mayans

Evaluating changing attitudes towards education in the People's Republic of China: Western disruption and the rise of the study abroad movement

Research Advisor: Eileen Chow, Asian and Middle Eastern Studies

China's educational system has become more internationally visible due to Shanghai receiving the highest scores in in mathematics out of 65 countries on the 2012 Programme for International Student Assessment (PISA). Although this ranking is by no means representative of China's educational landscape as a whole, it places the development of the educational system in what today is the People's Republic of China in a global spotlight. Simultaneously, the number of Chinese students studying abroad in the United States only continues to increase, with American educational institutions housing over 320,000 students in the 2015-2016 school year according to the Institute of International Education. In order to understand and contextualize the backdrop against which high school students in Shanghai are outperforming their peers globally and concomitantly studying abroad at an ever-increasing rate, this paper performs a historical survey of the Chinese educational system from the 19th century to the present-day. It engages with China's educational history through the lens of the study-abroad movement, and examines how Chinese students studying abroad have shaped not only China's educational landscape, but their political and economic impact as well.

Humanities 12:30 - 1:30

Patricia Pinckombe

Post-Mortem Racism: A Politics of Double Death

Research Advisor: Mark Neal, African and African American Studies

Medical welfare and experimentation has had a murderous history for Black Americans. Medical documentation indicates that slaves and poor blacks were often used, without consent, for experimentation. Black bodies were subject to scientific racism, involuntary sterilization, and deliberate falsification of their documentation and/or signatures.

The Tuskegee Syphilis experiment and the eugenics movement demonstrate instances of violence on the black body. As subjects, Black Americans were said to have had "no rights a white man was bound to respect." Today, the law has changed but the poor, which is often synonymous with minority groups, are still disproportionately affected by healthcare policy. Even so, African Americans are still more likely to be enlisted in medical research and experimentation than whites because they are more likely to be recipients of emergency room healthcare than whites.

This work examines the long and shoddy history of medical practice on Black Americans during the 20th century.

Humanities 11:30 - 12:30

Indrani Saha

Being Within: Disruption and Disorientation in 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. The 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 the actions of the participant that provide the context. Cruz-Diez disrupts visual perception 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. Moreover, this collective disorientation yields liberated movements, and presents a break with everyday action. The treatment of the senses and the body of the participant becomes integral to examining the installation, but is often ignored. This lacuna in the discussion of Chromosaturation and other sensorial works warrants examination especially through an interdisciplinary lens, combining neuroscience, phenomenology, anthropology and art history. How each discipline treats the concept of embodiment serves as a site of convergence. Immersive, participatory environments demand a methodology that addresses not only information from the visual faculty, but ultimately, the multi-sensorial body as a whole.

Humanities 11:00 - 12:00

Madeleine Bernstein
Efficacy of "Thresholding Method" in Identifying On-Field Impacts with DASHR Device
Research Advisor: Jason Luck, Biomedical Engineering

Accelerometer devices are used to collect head acceleration data to aid in understanding in vivo head kinematics. These devices are often put into two categories: threshold devices, which trigger only when an event creates an acceleration above an a priori set threshold, and continuous devices, which continuously collect data. This study tracked the development of a new accelerometer device, DASHR, to measure head acceleration during high school football sessions. The DASHR, while capable of both data acquisition methods, falls into the latter category for this study. Continually collecting data likely decreases the possibility of missing relevant impacts and allows for the creation of a more complete exposure profile. With this increase in sensitivity, however, comes the potential of identifying impacts that are not the result of true athletic exposure. This study evaluates how different threshold criteria affect the athletic exposure for a group of high school athletes. Individual events were pulled from the continuous dataset of five high school football players. Linear acceleration thresholds of 5g, 10g, and 20g, and a duration threshold of 15 msec were set using previous literature examples. As the linear acceleration threshold increased, the number of events decreased. The same trend was visible when the duration threshold was added. Appropriate thresholding criteria are critical in creating accurate athletic exposure profiles. These results highlight that a priori thresholds will not record all impacts, some that may be of meaningful value, while an acceleration and duration criteria as compared to acceleration only may further isolate relevant impacts.

Aidan Haney

Predicting Locomotion with the Radius: A study of Functional Morphology of the Radius in Apes and Monkeys

Research Advisor: Ashley Gosselin-Ildari, Evolutionary Anthropology

Comparison between suspensory, arboreal and terrestrial locomotion in primate locomotion has been extensively researched with heavy emphasis on the morphology of the forelimb. Most morphological studies of the forelimb focus attention around the elbow and wrist joints; however, many of these past studies have been done using the distal humerus and the proximal ulna. Although these studies are thorough and well conducted, research regarding the proximal end of the radius has been understudied in its functionality to the elbow joint. This study examines multiple osteological landmarks of the radius of anthropoid primates in order to better understand the possible connection between morphology and locomotion behavior. The goal of our study is to determine if the functional morphology of the radius correlates with locomotion over a larger and more diverse dataset of primates. We used extant species with known locomotion patterns and measured anatomical landmarks to ultimately determine which landmarks best predict locomotion. This information will be used to help predict locomotion patterns in fossil anthropoid species. We hypothesized that the joint morphology of the proximal radius is a useful measurement in predicting locomotion patterns, specifically in primates that use below branch vs. quadrupedal locomotion and arboreal vs. terrestrial locomotion. We created 3-D surface files by collecting data off of CT scans of the radius. Variables measured were the radial and neck length and mediolateral and anteroposterior diameter of the radial head. Isometric scaling with body size showed significant differences in both males and females. In addition, radial neck index was found to be significant between arboreal and terrestrial primates, with arboreal having a higher radial neck index. Brachial index, anterior posterior index and medial lateral index were all found to be not significant when comparing arboreal and terrestrial primates. Below branch individuals had higher brachial and radial neck index, while above branch individuals had higher anterior posterior and medial lateral indexes. In phylogenetic comparisons of cercopithecoids, hominoids, and platyrrhines, platyrrhines had the lowest brachial index and the highest radial neck index, anterior posterior and medial lateral index. The radial neck appears to be promising for using the radius to predict locomotion. We plan to add a surface area measurement of the radial head and radiocarpal joint.

Other 11:00 - 12:00

Rechel Geiger

Characterizing binding interactions between atypical protein kinase 9 and enolase in Plasmodium

Research Advisor: Emily Derbyshire, Chemistry

Plasmodium is the malaria-causing protozoan parasite spread by female Anopheles mosquitoes. Malaria is one of the most widespread infectious diseases in the world with about half of the world's population is at risk of contracting it. This threat is disproportionately distributed throughout the globe as the World Health Organization reporting that well over 75% of malaria-related cases and deaths occur in sub-Saharan Africa, especially among women and children. Despite successful efforts to reduce the effects of malaria, there is still a demand for the development of new anti-malarial drugs to circumvent increasing drug resistance. Protein kinases are of growing interest as anti-malarial drug targets because of their essential roles in proliferation, differentiation, and signaling pathways. Of particular interest to our lab is the Plasmodium protein kinase 9, PfPK9, which has no known human homologue. Recent mass spectrometry experiments have identified several glycolysis proteins to be potential binding partners of PfPK9. The goal of this research is to characterize the interaction between PfPK9 and Plasmodium enolase (Pfeno) through biochemical and thermodynamic assays. Better understanding this interaction will add to our limited knowledge of the Plasmodium kinome and essential biological pathways. Additionally, this study has the potential to illuminate biochemistry relevant to drug development.

Physical Sciences 12:30 - 1:30

Matias Horst

Chelating Polymers to Investigate Coordination Complex Mechanochemistry

Research Advisor: Katherine Franz, Chemistry

Mechanochemistry is the study of the activation of chemical bonds through force. Despite recent advances in the mechanochemistry of organic molecules, little is known about how metal-ligand bonds respond to this exact, directional stimulus. Single-molecule force spectroscopy (SMFS) represents the only method known to date that can apply sufficient force while quantifying molecular-level response. Bond rupture occurs stochastically due to thermal fluctuations in already strained bonds. By analyzing polymer chains containing high loading of non-integral mechanically active species, we can continue to apply load to other bonds of the same type after a single bond has broken. This allows us to obtain an ensemble average value of the force necessary for chemical activation. These data could better prepare us to draw upon the rich array of transition metals as we develop compounds that selectively release small molecules in response to the diverse mechanics found in many human pathologies, nanoscale force probes to explicate material failure or cellular mechanotransduction, or catalysts that are only active following an exquisite mechanical activation event. We hope to employ force to drive dissociation of chelated metal centers from metallopolymers. Through a novel procedure, high molecular weight polymers incorporating a nitrogenous tridentate ligand have been synthesized by entropy-driven ring opening metathesis polymerization. The repeating, unspecific metal-binding motif permits facile synthesis of thermally stable metallopolymers from a wide array of transitions metals. Current work focuses on probing the mechanochemical properties of these resulting species by SMFS.

Physical Sciences 11:30 - 12:30

Craig Madrak
Nonlinear Tissue Dynamics: Oscillations Switching to Ingression
Research Advisor: Glenn Edwards, Physics

Dorsal closure in Drosophila embryos is a model system for wound healing and morphogenesis. Dorsal closure is a key step of Drosophila embryogenesis and is the process by which the epithelial hole is closed to cover the amnioserosa tissue. The amnioserosa is the epithelial tissue that covers the dorsal hole of the Drosophila embryo and is required for proper dorsal closure. If dorsal closure is delayed substantially, development of the Drosophila embryo will fail. We determine what causes the amnioserosa dynamics to switch from reversible oscillations in cellular cross-sectional area to ingression, characterized by persistent loss of cross-sectional area. We extended a model for cell oscillations and for ingression, and to determine the specific mechanism by which the cells switch from oscillation to ingression. In addition, we develop numerical methods to visualize how the model relates to the data that includes time evolution.

Physical Sciences 12:30 - 1:30

Kathleen Marsh

Long-term toxicity and uptake of silver nanomaterials to agriculturally relevant plant species

Research Advisor: Jie Liu, Chemistry

Over the past decades, the use of silver nanomaterials has grown significantly, predominantly due to the favorable properties that they can impart upon new and existing products (e.g. effects may include antimicrobial, optical, electronic). However, due to the increased use, concerns have arisen over increased silver nanomaterial presence in the environment and their potential toxicological impacts. To investigate an aspect of these concerns, we have developed a study to investigate the impact of silver nanomaterial shape on the growth of the agriculturally relevant plant species Lolium multiflorum (ryegrass), Lactuca sativa (lettuce), and Solanum lycopersicum (tomato) in a soil medium. Results from our growth assay will be presented which investigated the impact of silver nanomaterial exposure on the root and shoot length as a function of silver shape (quasi-spheres, cubes, and wires) and silver dosing concentration. Furthermore, Raman spectroscopy will be employed to evaluate the uptake and retention of silver nanomaterials into the plants.

Physical Sciences 12:30 - 1:30

Brandon Ngo

Photo-Induced Electron Transfer Reactions in Well-Defined Nanoscale Objects that Feature Electronically Homogeneous Single Walled Carbon Nanotubes Wrapped by Redox Active Polymers

Research Advisor: Michael Therien, Chemistry

(6,5) chirality single-walled carbon nanotubes (SWNTs) are semiconductors with the ability to serve as charge carriers, finding potential applications in nanoelectronics. Moreover, (6,5) SWNTs can be photoexcited to produce an excited electron in the conduction band and an associated positive hole in the valence band. The coulombically bound excited electron and positive hole pair are known collectively as an exciton. Semiconducting SWNTs have been observed to produce more than one exciton per photon in a process called multiple exciton generation (MEG). Harnessing the additional energy provided by MEG may allow for improvements in solar cell efficiency; however, this has yet to be demonstrated. To better understand the photo-physical properties of SWNTs, a novel polymer wrapped SWNT hybrid structure has been developed. The design utilizes perylene diimide (PDI) containing poly(aryleneethynylene) polymers (S-PBN(b)-Ph6-PDI). Additionally, modification of the PDI subunits allows for the exploration of modulating the excited state dynamics in this polymer-SWNT system. Synthesis of two PDI based polymers has been completed with spectroscopic evidence of successful nanotube wrapping. A thorough understanding of the polymer wrapped SWNT structure will provide insight into the feasibility of harnessing MEG for use in solar cell devices.

Physical Sciences 11:00 - 12:00

Bilva Sanaba

A Chemoinformatic Approach Towards the Synthesis of an Oxazolidinone-Based, RNA-Targeted Small Molecule Library

Research Advisor: Amanda Hargrove, Chemistry

Noncoding RNAs are misregulated in several diseases and represent important therapeutic targets. However, there is very little known about the properties of small molecules that lead to selective RNA-binding. Therefore, the goal of this research is to rationally design and synthesize a library of small molecules to discover the chemical and spatial properties enriched in selective RNA-binding ligands. First, the synthetic design will utilize an oxazolidinone scaffold, which has been identified as RNA-privileged and appears in ribosomal RNA-targeting drugs. In addition, the design will be inspired by cheminformatic work performed in the Hargrove Lab. In this work, statistically significant differences were identified between bioactive RNA-binding small molecules and FDA-approved drugs, including an increase in nitrogen count and ligand rigidity. In line with these design principles, aniline-based subunits have been explored for the diversification of two oxazolidinone-based scaffolds. For both scaffolds, the diversification was achieved via two SN2 reactions by substituting a chloride with an iodide followed by substitution with aniline. The reactions were optimized by varying the concentration of starting material, temperature, and reaction time. Future work will focus on utilizing decorated anilines for substitution and the subsequent synthesis of twenty small molecules. Once synthesized, my library will be screened against RNA secondary structures of different size and sequence to assess selectivity. The results will lead to a better understanding of the chemical and spatial properties important for RNA-targeted library design and will result in small molecules that bind to specific secondary structures present in therapeutically relevant RNAs.

Physical Sciences 11:00 - 12:00

Vaibhav Tadepalli

A Novel Method of Double Network Hydrogel Manufacturing using 3-D Printing and its Potential use as a Synthetic Meniscus

Research Advisor: Benjamin Wiley, Chemistry

This thesis demonstrates a two-step method to 3D print double network hydrogels at room temperature with a low-cost ($300) 3D printer. A first network precursor solution was made 3D printable via extrusion from a nozzle by adding a layered silicate to make it sheer thinning. After printing and UV-curing, objects were soaked in a second network precursor solution and UV-cured again to create interpenetrating networks of poly(2-acrylamido-2-methylpropanesulfonate) and polyacrylamide. By varying the ratio of polyacrylamide to cross-linker, the tradeoff between stiffness and maximum elongation of the gel can be tuned to yield a compression strength and elastic modulus of 61.9 and 0.44 MPa, respectively, values that are greater than those reported for Bovine cartilage. The maximum compressive (93.5 MPa) and tensile (1.4 MPa) strengths of the gel are double that of previous 3D printed gels, and the gel does not deform after soaking in water. By 3D printing a synthetic meniscus from a X-ray computed tomography image of an anatomical model, we demonstrate the potential to customize hydrogel implants based on 3D images of a patient's anatomy.

Physical Sciences 12:30 - 1:30

Grace Wang
Chemical biological approaches toward malaria drug discovery
Research Advisor: Emily Derbyshire, Chemistry

Malaria is an infectious disease that affects millions of people in the world. Each year, pregnant women and children under the age of five are subjected to infections by Plasmodium falciparum, a malaria parasite, and suffer from severe symptoms that lead to death if without proper treatment. The rate of drug resistance developed by the parasites has become a challenge to currently available malaria pharmaceuticals targeting essential Plasmodium proteins. To address the malaria epidemic from a drug discovery perspective, three research projects were carried out to tackle antimalarial drug development from different angels, including computational modeling, high-throughput screen development and in vitro protein biochemical activity characterization.

Physical Sciences 12:30 - 1:30

Kelley White

Characterization of cyclen-based molecules capable of redox tuning and transmetallation

Research Advisor: Katherine Franz, Chemistry

In the fight against bacterial and fungal infections, a drug that would be able to release Cu1+ into the cell and chelate away Mn2+ from the intracellular space would have dual functionality as a source of toxic reactive oxygen species while removing Mn2+, which is used to relieve cells of oxidative stress. In the interest of developing such an agent, the metal binding properties of cyclen, two of its derivatives, DOTA and DOTAm, as well as two common metal chelators, EDTA and DPA, were analyzed. Specifically, UV-Vis spectroscopy was used to probe Cu2+ binding capability of the compounds, as well as the ability of the resulting complexes to be reduced in conditions modelling the cellular environment. The Cu2+ complexes of all ligands were reduced by at least one of the five reducing agents and "sinks"(a reducing agent and Cu1+ chelator) tested. A competition assay with ferrozine revealed that the affinity of DOTA for Cu1+ is weaker than that of ferrozine. In the future, a method of determining the relative binding affinity for Mn2+ will be derived, the Cu1+ affinity of all ligands will be tested using the ferrozine assay, and the efficiency of each reducing method will be evaluated.

Physical Sciences 12:30 - 1:30

Jason Xu

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

Research Advisor: Amanda Hargrove, Chemistry

Recently discovered, long noncoding RNAs (lncRNAs) form a 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 in the nucleus leads to an increase in oncogenic processes. This accumulation has been found to be related to a recently discovered triple helix on its 3' end. A library of small molecule probes is currently being synthesized to target this unique structure and understand what role it plays in cancer processes. We have developed a two-step synthetic pathway that allows for the diversification of both the connectivity and substitution of the diphenylfuran scaffold, which has been demonstrated to bind to DNA triple helices. My contribution to this library is the synthesis of meta-substituted diphenylfurans, which will be evaluated and compared with regioisomers for binding to the MALAT1 triple helix upon completion of the library.

Physical Sciences 11:00 - 12:00

Lindsey Bass
Recognizing Errors in Fiction: Does Reduced Transportation Promote Detection?
Research Advisor: Elizabeth Marsh, Psychology and Neuroscience

People often encounter erroneous information, and not detecting that information has consequences for future memory. Surprisingly, people are generally poor at detecting errors, even when those errors contradict preexisting knowledge. One possible influence on the inability to detect errors in transportation, or the extent to which people become detached from the world due to engrossment in a story. However, the effect of such immersion into a story has not been experimentally analyzed as a factor influencing error detection. Thus, pilot studies were conducted to determine what knowledge people were familiar enough to likely detect under ideal conditions as well as under what conditions transportation could be manipulated. Based on the results of pilot data, a full experimental study was conducted wherein participants either read a story in full or a list of mostly unrelated sentences and were instructed to detect errors. Results of the experiment indicated no difference in detection of erroneous information, but significantly more false alarms in the list condition than the story condition, indicating that people reading a story may be more discriminative. Possible reasons for this finding and future directions are discussed.

Katie Becker

That's Not FAIR: Fact-Checking Trump's $113 Billion Undocumented Immigration Sticker Price

Research Advisor: Elizabeth Ananat, Public Policy

This report examines a recurring claim made by President Trump that illegal immigration into the United States costs U.S. taxpayers $113 billion annually. President Trump received his $113 estimate from a 2010 report by the Federation for American Immigration Reform, which used faulty assumptions to grossly inflate their estimates of the costs of illegal immigration. The 2010 report counted all spending on U.S. citizen children of undocumented immigrants as spending on undocumented immigrants, inflated the overall population of undocumented immigrants in the United States, and double-counted spending in several categories. This project seeks to modify those numbers to present a more accurate portrait of the fiscal impact of illegal immigration. Whereas the 2010 FAIR report found that , this report shows that undocumented immigration costs $36.7 billion annually in social spending (education, healthcare, law enforcement, public assistance, and general expenditures). This reveals that President Trump's frequently cited estimate is actually triple the actual cost of undocumented immigration into the United States.

Social Sciences 11:00 - 12:00

Anna-Katalina Bock

The Coca-Cola Concept: Can Marketing Orientation Mitigate Materialism's Adverse Aftermath?

Research Advisor: Robert Thompson, Psychology and Neuroscience

Materialism, the degree of importance consumers attach to possessions in their lives, has been found to directly lead to negative cognitive, psychological and behavioral consequences. This value is portrayed in modern marketing initiatives and has seen an escalation in society due to the increase in advertising. While the relationship between marketing, materialism and negative consequences has been identified, little research has examined ways to mitigate the mechanism of effects. This study examines whether the marketing message's orientation could prevent materialism's negative results, specifically through mitigating the negative consequences of social comparisons that materialism ensues; and whether the influence of the marketing message varies by individual characteristics such as personality traits and perfectionism. To address these questions, participants were randomly assigned to view a self-oriented commercial, meaning the marketing message focused on the attributes and personal benefits derived from a product, or an other-oriented commercial, meaning the marketing message focused on the experience of consuming the product and interaction between product users. They then completed measures of marketing message effectiveness, social comparison, materialism, empathy, self-esteem, and overall well-being. The information provided from this study illuminates tactics that advertisers can utilize to maintain their sales yet spare individuals and society the negative consequences of materialism and social comparisons. It can therefore act as a guide for the formation of marketing messages in a more pro-social manner.

Julia Carp

A qualitative study of Women, Infants, and Children providers' perceptions of managing obesity in pregnancy

Research Advisor: Gary Bennett, Psychology and Neuroscience

Obesity is exceedingly common among low-income pregnant mothers. While protocols at Women, Infants, and Children (WIC) address this nutritional problem in pregnancy, WIC nutritionists' perceptions of the challenges of managing obesity in pregnancy are unknown. A qualitative study was conducted using data transcribed from audiotapes of focus groups among 27 Philadelphia WIC nutritionists to identify barriers and facilitators they hold to counseling this population. Transcripts were coded for most common themes. Findings revealed 11 major themes clustered into 3 categories. The first category focused on barriers to counseling that WIC providers perceive are client driven. They perceived mothers with obesity are burdened by the competing demands; lack interest in changing their nutrition behaviors; misperceive their weight and healthfulness of diet; and have difficulty prioritizing WIC nutritionist input due to conflicting advice. The second category addressed barriers WIC providers perceive are WIC driven. They felt they are constrained by WIC structural barriers; counseling is protocol driven; and they fear offending mothers. The last category described the facilitators to creating more effective counseling. Providers' strategies were to meet mothers where they're at; set small behavioral goals together; frame messages around baby's development; and build rapport. WIC nutritionists' barriers exceeded facilitators to counseling pregnant clients with obesity. Yet, several potential solutions to more effectively address obesity in pregnancy were uncovered including: training WIC staff in a patient-centered counseling approach; incorporating technology to overcome structural issues; and developing collaborations with family and healthcare providers to help clients better adhere to their nutrition goals.

Mikella Green

The Effects of Mindfulness-Based Cognitive Therapy: A Quality Improvement Project

Research Advisor: Noga Zerubavel, other department...

Mindfulness-Based Cognitive Therapy (MBCT) aims to target depression susceptibility by teaching patients to cultivate a decentered perspective and to view thoughts and feeling with a non-judgmental curiosity. In April 2014, Duke University Medical Center started an MBCT program for individuals struggling with depression and anxiety. The purpose of this quality improvement project was to examine to what extent the MBCT program at Duke has produced effects in line with the theoretical basis of the intervention. More specifically, this project examined changes in curiosity, decentering, rumination, reflection, self-compassion, worry and depression symptoms following an MBCT intervention. Further, this project looked at what roles decentering and self-compassion played in predicting worry and rumination in order to better understand what aspects of the intervention are most relevant to improvement. There was not a statistically significant decrease in depression symptoms following the program. Significant changes were reported for worry, self -compassion, decentering, and rumination. Neither decentering nor self-compassion predicted posttest worry or rumination scores. The findings from this project can be used to refine the MBCT program at Duke.

Social Sciences 11:30 - 12:30

Arielle Kahn

Reducing the Achievement Gap: Why Are Self-Affirmation Interventions Effective?

Research Advisor: Christina Grimes, Psychology and Neuroscience

The achievement gap between white and black students and white and Latino students remains one of the largest issues in education today despite countless efforts to reduce it. Previous reforms have focused on school-centered initiatives such as improving teacher quality or expanding Pre-Kindergarten programs. While these attempts are laudable, they have not found great success. However, recent trends in social-psychological research have pointed to student-centered intervention strategies that are "subtle but powerful"and that have achieved long-lasting effects like heightened GPA and standardized test scores. These strategies are appealing because they are cheap, simple, and easy to execute. The present review focuses on a self-affirmation intervention strategy that has proven to mitigate the effect of stereotype threat and thus diminish the achievement gap. In order to understand this intervention, the paper brings together the literature on stereotype threat and the literature on self-affirmation to shed light on how the processes interact with each other. More specifically, the review explores how self-affirmation, in the form of values affirmation exercises, disrupts negative self-reinforcing recursive processes that inhibit success in school for minority students. Self-affirmation reduces the stress students experience in psychologically threatening situations and frees up cognitive resources to focus on the task at hand, thereby beginning an alternative recursive cycle that leads to greater success in school. The paper reviews self-affirmation intervention studies that have been both successful and unsuccessful at lessening the achievement gap. Finally, policy implications and future research directions are conveyed.

Social Sciences 11:00 - 12:00

Mirai Matsuura

Remembering and Reinforcing: The relationship between autobiographical memory and food reward response

Research Advisor: Nancy Zucker, Psychology and Neuroscience

With over a 36% prevalence of obesity in the United States, it is becoming increasing important to understand the various factors that put certain individuals at higher risk of becoming obese. Two of the individual difference factors that have been studied with respect to obesity risk are responsiveness to food reward and food-related memories, which have both been shown to independently influence food intake. In addition, individuals with obesity have shown impairments in both reward learning and episodic memory, which raises the question of whether these two constructs could interact to influence consumption, and thus obesity risk. The purpose of this study was to explore the relationship between the vividness of food-related autobiographical memories and responsiveness to food reward, and whether the relationship differed depending on whether the memory was of positive or negative valence. Participants were 10 undergraduate women who completed two self-report questionnaires that measure response to food as a reward, and a novel version of the qualitative Autobiographical Interview, which was be modified to include both general and food-specific memories. The results of this study looked at whether the quantitative and qualitative scores on the level of detail for the recalled memories were correlated with the scores on the measures of food reward response. The findings could potentially inform interventions in which food-related memories are used to manipulate the reward value of certain foods, and in turn facilitate healthier consumption in individuals at high-risk for obesity.

Gaurie Mittal

Pathologically Picky Eating in Children and Sensory Sensitivty

Research Advisor: Nancy Zucker, Psychology and Neuroscience

This study aimed to determine what foods were preferred by children who are picky eaters and children with ARFID in comparison to children who are not picky eaters. Further, this study aimed to show the differences in sensory features among these foods. Previous research has shown that picky eaters tend to eat less fruits, vegetables and proteins than children who aren't picky eaters. Tactile sensitivity may play a role in this disparity, such that children who are picky eaters are more tactilely sensitive than children who are not picky eaters. Therefore, I hypothesized that there would be a difference in the foods preferred by children who are picky eaters and children who have ARFID vs. children who are not picky eaters, and that the sensory features of these foods would differ as well. These hypotheses were tested using an online survey that parents of picky eaters filled out, including questions regarding their child's general picky eating habits as well as habits corresponding to specific foods. The foods were then rated on their sensory features, and the frequencies of the foods most regularly eaten by each group (children who are picky eaters, children with ARFID, and children who are not picky eaters) were determined. Initial results indicate that there is a difference in the types of foods preferred by these three groups as well as in the sensory features of these foods. This implies that tactile sensitivity may play a significant role in the development of picky eating in children.

Social Sciences 11:30 - 12:30

Cam-Ha Nguyen
Scaling up Alternative Education in Vietnam (SAEV)
Research Advisor: David Malone, Education

Scaling up Alternative Education in Vietnam (SAEV) hopes to add a comparative perspective to existing literature on alternative education. In response to the rigid educational approach of Vietnamese public schools, in recent years, the number of afterschool and summer programs that employ experiential learning models has increased. However, many Vietnamese parents and students are reluctant to participate in those programs out of concern that they are not relevant to the public schools' curricula. The effects of the alternative education curricula on students' emotional and intellectual development are also not well documented in both Vietnamese and English literature. These facts present an opportunity for in-depth study on the developmental potential of Vietnamese alternative enrichment programs. The current study conducted case studies at 3 alternative education programs in Hanoi and Ho Chi Minh City. Through surveying 40 students, observing 7 classrooms, and interviewing 9 teachers in the 3 programs, the study found positive perception of the teachers and the students in the programs towards the effects of alternative education models. Teachers were highly aware of the differences between their pedagogical approaches and that in the Vietnamese public schools. They valued teachers' ability to facilitate students' independence and creativity. Teachers reported that Vietnamese educational policies and parents' perception posed as the main challenges to expanding alternative education. Models that facilitate both student autonomy and parental engagement are potential sites for future quantitative researches on the effectiveness of alternative education in Vietnam.

TuanDat Nguyen

The Relationship between Religiosity and Psychosocial Factors in Lung Transplant Candidates

Research Advisor: James Blumenthal, Psychology and Neuroscience

The current study explores the relationship between four measures of religiosityâ€”religious coping, religious attendance, religious practices, and intrinsic religiosityâ€”and psychosocial well-being, as indicated by levels of depression, anxiety, and perceived social support in a cohort of patients being assessed for lung transplantation. The purpose of the study was to determine whether religiosity is associated with psychosocial well-being, and to address the methodological problems of past studies in the field. We hypothesized that higher levels of religious coping, intrinsic religiosity, and frequency of religious practices would be negatively associated with depression and anxiety, and that frequency of religious attendance would be positively associated with perceived social support. Multivariate regression models found statistically significant support for these hypotheses, but further research is required to better understand the complex relationship between religion and health.

Social Sciences 11:00 - 12:00

Meghana Vagwala
A Moral Ecology of Student Smart Drug Use
Research Advisor: Walter Sinnott-Armstrong, Philosophy

. Few empirical studies have examined the influence of value systems and normative environments on smart drug usage. We conducted a qualitative investigation of the social and moral attitudes that shape smart drug practices among university students in the United Kingdom. Our thematic analysis of eight focus group discussions identifies a moral ecology that operates within the social infrastructure of the university. The architecture of this moral ecology consists of collective values and cultural norms, with implications for influencing individual choices. We find that in UK universities, smart drug resilience is mediated by normative judgments disfavoring competition and prescription drug taking, while risk can be augmented by social factors such as soft peer pressure and biases within friendship groups. We argue that moral ecological dynamics should be viewed as key mechanisms of smart drug risk and resilience in universities. Effective smart drug governance within universities should therefore attend to the moral ecology of smart drugs.

Social Sciences 12:30 - 1:30