PENN PAVILION
Thursday, April 19, 2018
10:00 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

Sarah Russell, Director
Jen Fry, Program Coordinator
Brittany Kelly, Staff Assistant
undergraduateresearch.duke.edu

Acknowledgments
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The Duke Undergraduate Research Society
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Undergraduate Research Support at Duke University

Duke undergraduates have received support from the following College and University programs in AY 2017-2018:

All Disciplines

ACCIAC Summer Research Fellowship Baldwin Scholars Program
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Psychology Vertically Integrated Partners Program
Research in Practice Program - Engage
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Schiff Family Foundation Summer Research Fellowships

Undergraduate Research Support at Duke University (cont'd)
Service Opportunities in Leadership Program
Women's Studies Undergraduate Grants

Natural & Quantitative Sciences and Engineering
Biochemistry Department Summer Fellowships
Chemistry Summer Research Fellows
Computer Science Undergraduate Research Fellowships
Duke BioCore Scholars
Duke Data+ Fellowships
Duke Clinical Research Institute NC Collaborative
Duke Skin Disease Research Fellowships
Evolutionary Anthropology Molly Glander Awards
Marine Lab Rachel Carson Research Fellows
Molecular Genetics and Microbiology Summer Fellowships
Genomics & Computational Biology Summer Fellowships
Goldman Sachs Summer Research Fellowships
Howard Hughes Research Fellows Program
Mathematical Biology Summer Research Program
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

BASS CONNECTIONS

Student	Mentor	Title	Time
Mitchell Abrams	Jason Luck	Improvements in Baseline Drift Removal from EOG Signal and Headset Design	10am-11am
Anuhita Basavaraju	Elizabeth Johnson	A Cognitive Evaluation of Unconscious Markers of Bias: From Implicit Bias to Eye Contact	10am-11am
Joshua Grubbs	William Pan	Evaluation of a Dietary Intervention for Chronic Methylmercury Exposure Among Communities in Madre de Dios, Peru	12pm-1pm
Daniel OConnell	Daniel OConnell	Tackling Concussions – An Investigation of an Objective Assessment Modality for Pediatric Athletes Experiencing Concussive and Sub-concussive Head Impacts	10am-11am
Anna Ruta	Jennifer West	Design of a Light-Mediated, Reversible Sol-Gel Transition PEG Hydrogel	10am-11am
Prithvir Jhaveri	Kyle Bradbury	Automating Electricity Access Predictions with Satellite Imagery	12pm-1pm
Meghana Vagwala	Brandon Kohrt	Mental health attitudes and implications for patient care: A qualitative study of medical students and physicians in urban Nepal	11am-12pm

BEHAVIORAL SCIENCES

Student	Mentor	Title	Time
Mia Carlyle	Sarah Gaither	Emotional Outcomes of Online Identity Denial in Biracial Individuals	10am-11am
Rachel Lamparelli	Walter Sinnott-Armstrong	Does the Statistical Nature of Neuropredictive Models Bias Juror Decision-Making?	12pm-1pm
Sujal Manohar	John Pearson	Implicit Judgments in Legal Decision-Making	10am-11am
Madeline Plachy	Sarah Gaither	Racial Constancy in Biracial and Monoracial Children: The Importance of Age and Stimuli	1pm-2pm
Camila Vargas Restrepo	Elizabeth Marsh	Judgments of Deceptive Bar Graphs	12pm-1pm
Adriana Santomero	Leslie Digby	Empathetic Response to Captured Group Members in Lemur catta	12pm-1pm

BIOLOGICAL SCIENCES

Student	Mentor	Title	Time
Stephanie Asdell	Guido Ferrari	Human Antibody-Dependent Cellular Cytotoxicity-mediating Antibodies Do Not Recruit Non-Human Primates CD20+ NK Cells	11am-12pm
Namratha Atluri	Marc Caron	Characterization of the Side-Effect Profile of a Î²-arrestin Biased Neurotensin Receptor 1 Ligand	10am-11am
George Barlow	Daniele Armaleo	Deactivation of Cas9 to reduce off-target mutations in CRISPR systems	12pm-1pm
Rachel Borczuk	Rochelle Schwartz-Bloom	Engaging Female Interest in High School Science: The Use of a Virtual Neuroscience Experiment paired with Undergraduate Female Mentorship	10am-11am
James Bradford	Emily Derbyshire	Bacterial Natural Products in the Mosquito Microbiome	10am-11am
Francesca Brancati	Emily Derbyshire	Evaluation of the knockout of the glycerol and water channel host protein AQP7 on parasitemia levels of Plasmodium in human hepatocyte cell line	1pm-2pm
Usamah Chaudhary	Nimmi Ramanujam	Development of algorithms for cervix region of interest segmentation: First steps toward automated cervical cancer screening in low-resource settings	10am-11am
William Chen	Cagla Eroglu	Role of MERTK in Muller Glia on Retinal Synapse Formation and Function	12pm-1pm
Lilly Chiou	Daniele Armaleo	Deactivation of Cas9 to reduce off-target mutations in CRISPR systems	12pm-1pm
Ankita Das	Emily Derbyshire	Potential Mutation of Protein Kinases Critical to Malaria Infection Proliferation	12pm-1pm
John Deng	Stephen Craig	Investigation of Molecular Forces in Swollen Silicone Elastomer	11am-12pm
Daniel Doyle	Christine Wall	Fiber Type and Human Skeletal Muscle Evolution: A Consideration of Differences in Day Range and Size Scaling within the Great Apes	12pm-1pm
Katie Freedy	David Sherwood	Developing a Basement Membrane Toolkit in C. elegans	1pm-2pm
Rechel Geiger	Emily Derbyshire	Protein Signaling in the Plasmodium Parasite	10am-11am
Lauren Hale	Mehreen Arshad	The Gut Microbiota of Healthy Infants in the Community is a Reservoir for ESBL and Carbapenemase Producing Bacteria.	12pm-1pm

BIOLOGICAL SCIENCES (cont'd)

Student	Mentor	Title	Time
Jordan Hatfield	Richard Mooney	Role of Medium Spiny Neurons in Avian Model of Huntington's Disease: Techniques for Selective Ablation and Visualizing Regeneration	10am-11am
Alexandria Hurley	Mohamed Noor	Understanding Sex Comb Tooth Number in Drosophila simulans	1pm-2pm
Varun Jain	David Sherwood	Tissue-specific targeting of collagen IV to developing basement membranes in C. elegans	1pm-2pm
Sydney Jeffs	Sydney Jeffs	A Perfusable Hollow Fiber in a 3D Poly(ethylene glycol)-based Vascularized 3D Scaffold	12pm-1pm
Jill Jones	Mary Foster	Optimizing Human Immune System Models in Studies of Human Autoimmune Diseases	10am-11am
Joseph Kreitz	Lingchong You	Interaction network optimization improves the antimicrobial efficacy of phage cocktails	1pm-2pm
Napasorn (Nina) Kuprasertkul	Corinne Linardic	Characterizing a novel genetically engineered mouse model of alveolar rhabdomyosarcoma	12pm-1pm
Anna Li	Scott Randell	Adenoviral transduction of CXCR1 into human bronchial epithelial cells may stimulate directed migration towards IL-8	11am-12pm
Jing Li	Dan Kiehart	Investigation of the role of zyxin expression on actin dynamics in spreading Drosophila melanogaster hemocytes.	10am-11am
Youlei Li	David Sherwood	How Do Cells Invade? The Role of Lipid Metabolism in Invasive Cell Behavior	1pm-2pm
Samantha McLendon	Charles Nunn	Social Function of Disgust Reactions in Lemur catta	12pm-1pm
Vincent Miao	Ashutosh Chilkoti	UV-stabilized biomimetic polymers self-assemble into complex microarchitectures	12pm-1pm
Prarthana Minasandram	Leslie Digby	Effects of encephalization quotient on lemur learning and problem solving	1pm-2pm
Chandler Moore	Ashutosh Chilkoti	Design and Delivery of Pro-apototic Glioblastoma Therapeutics	10am-11am
Margo Orlen	Marc Caron	Investigations of GPCR/Beta-arrestin Complex Interactions via a BRET Assay	12pm-1pm
Samuel Pan	Jen-Tsan Ashley Chi	Effects of Protein Kinase ATM on Ferroptosis	10am-11am

BIOLOGICAL SCIENCES (cont'd)

Student	Mentor	Title	Time
Hee Su Park	Phuong Doan	Examining the Role of Chromosome Maintenance Region 1 (CRM1) in Myelodysplastic Syndromes	12pm-1pm
Breanna Polascik	Karthik Raghunathan	What are the Characteristics of Patients who want Perioperative Music Therapy?	10am-11am
Breanna Polascik	Daniel Schmitt	Biomechanics of Dance and Dance Injury: Impact Forces and Shockwaves associated with Years of Tap Dancing Experience	10am-11am
Breanna Polascik	Ban Leong Sng	Acceptability and Feasibility of the Implementation of Perioperative Music Listening	10am-11am
Bryce Polascik	Dilraj Grewal	Assessment of Differences in Retinal Microvasculature Using OCT Angiography in Alzheimer's Disease: A Twin Discordance Report	11am-12pm
Bryce Polascik	Hamid Rahmatullah Bin Abd Razak	Total Knee Arthroplasty Yields Acceptable Short-Term Outcomes in Stiff Asian Knees	11am-12pm
Ivana Premasinghe	Orint Chiba-Falek	Optimizing Methodology and Determining Gene Expression Profiles across Alzheimerâ€™s Disease Pathologies through Single-Cell Capture	11am-12pm
Laura Quillen	Erin Ehmke	The Effect of Housing Conditions on the Behavior of Captive Propithecus coquereli	1pm-2pm
Sarah Rapaport	Brad Kolls	A Triple Transgenic Conditional LRP1 Knockout Murine Model For Traumatic Brain Injury	1pm-2pm
Anna Savelyeva	Scott Floyd	The Role of the Lysine Demethylase KDM2B in the Response to Ionizing Radiation	1pm-2pm
Annika Sharma	Christine Drea	Investigation of the oxytocin system in monogamous and promiscuous Eulemur using receptor autoradiography	11am-12pm
Grace Smith	Doug Williamson	Neuronal spine density in the subgenual anterior cingulate cortex in postmortem brain of controls and subjects with posttraumatic stress disorder and major depressive disorder	10am-11am
Jake Thomas	Miles Berger	Changes in Cerebrospinal Fluid Leukocyte Levels in Patients before and after Surgery Using an Optimized Polychromatic Flow Cytometry Panel	10am-11am

BIOLOGICAL SCIENCES (cont'd)

Student	Mentor	Title	Time
Paul Wang	Mohamed Abou-Donia	Repetitive Exposure of O,O-Diisopropyl Phosphofluoridate (DFP) In Vitro Disrupts Cell Surface Markers and Dysregulates Cytoskeletal Proteins	10am-11am
Yifei Wang	Martina Kovarova	Building a BLT-Humanized Mouse Model on the Clade C HIV-1 Infection	11am-12pm
Angela Wei	Dan Kiehart	Identifying Key Genetic Regions in the Drosophila Genome Important for Cell Sheet Morphogenesis	1pm-2pm
Abigail Xie	Kris Wood	Loss-of-Function CRISPR Screening Metabolic-Apoptotic Interactions in Acute Myeloid Leukemia	10am-11am
Madison Zamora	Orint Chiba-Falek	Multiplication of the SNCA Locus Exacerbated Neuronal Nuclear Aging	12pm-1pm
Karen Zhao	Jennifer Ingram	Investigation of Eotaxin Production by Lung Fibroblasts in Obese Asthma	1pm-2pm

COMMUNITY ENGAGED RESEARCH

Student	Mentor	Title	Time
Joyce Er	Alma Blount	Growing Pains: Adaptive Analysis of Singapore's Aging Population	1pm-2pm
Spencer Flynn	Jehanne Gheith	A Holistic Investigation into Appointment Keeping in a Mid-sized Urban Free Clinic	10am-11am
Ebony Hargro	Alma Blount	Under-Representation in Gifted Education Programs	12pm-1pm
Zhong Huang	Alma Blount	Strengthening Chinese-American Health Coalitions: Mobilizing Chinese-Americans	12pm-1pm
Emily McAuliffe	Rebecca Vidra	Sexual Assault at Duke	12pm-1pm
Ashlyn Nuckols	Robert Korstad	Barriers to Political Participation for Working Class People of Color in Durham, North Carolina	11am-12pm
Chinemerem Nwosu	Anthony Fuller	Evaluating the Feasibility of Multi-Modal Educational Interventions to Improve Neurosurgery Patients' and Caretakers' Health Literacy in Mulago Hospital, Uganda. Authors	1pm-2pm
Olivia Pennoyer	Philip Stern	Batson Up, Strike Three You're Out: Eliminating Racial Bias in North Carolina Jury Selection	1pm-2pm
Michaela Stith	Dane Emmerling	Critical Conversation Tool: Duke Faculty's Implementation of Critical Service-Learning	10am-11am
Amulya Vadapalli	Alma Blount	Yemen: A Forgotten War, A United Nations Crisis	11am-12pm
Samantha Villalobos	Alma Blount	Building Back Better: Architecture and policy of Mexico City's housing system after the earthquake of September 19, 2017	12pm-1pm
Erin Williams	Anne Allison	Collecting Stories of Murdered and Missing Native American Women and Girls	10am-11am
Carter Zenke	David Malone	Mobile Citizens: Broadening Participation in Computer Science by Increasing Self-Efficacy	1pm-2pm

HUMANITIES

Student	Mentor	Title	Time
Elizabeth Barahona	Sarah Deutsch	The History of Latinx Students at Duke University	11am-12pm
Angeli Sharma	Margaret Humphreys	Physician Behavior and Treatment of Patients with Low Socioeconomic Statuses in Developed and Developing Countries: A Case Study	10am-11am
Gabrielle Stewart	William Johnson	Rostovtzeff and the Yale Diaspora: How Personalities and Communities Influenced the Development of North American Papyrology	11am-12pm

PHYSICS

Student	Mentor	Title	Time
Azim Dharani	Katherine Franz	Development of prostate cancer targeted prodrugs based on the copper chelator Disulfiram	10am-11am
Xiaochen Du	Volker Blum	HybriD3 Materials Database	10am-11am
Matias Horst	Katherine Franz	Synthesis of chelating polymers and their applications in the study of inorganic mechanochemistry	10am-11am
Jaewon Moon	Katherine Franz	Assessing Cu-redox properties of Î²-amyloid peptides by modulation of metal-coordination environment	11am-12pm
Elena Puccio	Katherine Franz	Synthesis of Î²-Lactamase-Activated Prochelators Based on Cephalosporin and Clavulanic Acid Cores	12pm-1pm
JR Smith	Steven Churchill	The Biomechanics of Lateral Iliac Flare	12pm-1pm
Aditya Sridhar	Krishnendu Chakrabarty	Design Automation and Microfluidic Resource Optimization of Reconfigurable Flow-Based Biochips	10am-11am
David Wang	Piotr Marszalek	Accurate Refolding of Experimentally Determined Protein Mechanical Unfolding Intermediates Via All-Atom Molecular Dynamics Simulations	1pm-2pm
Max Xu	Katherine Franz	Assessing the Tunability of Copper-Redox Activity of Histatin-5 by Modulation of the Coordination Environment	10am-11am

PSYCHOLOGY- GRADUATION WITH DISTINCTION CANDIDATES

Student	Mentor	Title	Time
Elizabeth Adler	Kim Carpenter	Social Attention in Autism Spectrum Disorder	12pm-1pm
Afua Ansah	Steven Asher	When Two Worlds Collide: The association between beliefs, relationship quality, and attachment orientations in friendships and romantic relationships	10am-11am
Chloe Banker	Mark Leary	The Hypo-Egoic Nonentitlement Model of Humility	11am-12pm
Rachel Buchanan	Nicole Schramm-Sapyta	Distress in Durham: Neighborhood Characteristics and Use of Police-Based Mental Health Interventions	12pm-1pm
Lucy Cao	Gavan Fitzsimons	Social class and brand prominence preferences	11am-12pm
Coco Chen	Gavan Fitzsimons	The influence of positive emotions on consumer brand preference	1pm-2pm
Aleksandra Czarkowska	James Shah	Exploring Regulatory Fit and Self-Regulatory Outsourcing in Goal Pursuit	10am-11am
Jack Dolgin	Scott Huettel	Separating the Influence of Budget and Numeric Priming on Willingness to Pay	10am-11am
Jacqueline Emerson	Dr. Kimberly Carpenter	Sensory Over-Responsivity is Associated with Restricted, Repetitive Behavior in Children with Autism Spectrum Disorder	11am-12pm
Aquinnah Fox	Steven Asher	Why Some Co-Ruminative Friendships Are More Damaging than Others: Associations Among Co-Rumination, Friendship Quality, and Internalizing Problems	10am-11am
Madison Heath	Nancy Zucker	Effects of exercise type and intensity on depression in a non-sedentary population	10am-11am
Ehi Ihionkhan	Christina Meade	Does HIV/HCV co-infection correlate with more neurocognitive deficits than HIV mono-infection in a stimulant using population?	1pm-2pm
Taylor Ikner	Ruth Day	Alternative Displays for Medical Information: Consequences for Cognition & Action	1pm-2pm

PSYCHOLOGY- GRADUATION WITH DISTINCTION CANDIDATES (cont'd)

Student	Mentor	Title	Time
Sarah Jackson	Timothy Strauman	Like Mother, Like Child? The Role of Maternal Depression on Future Child Internalizing Symptoms	1pm-2pm
Nona Kiknadze	Mark Leary	Comfort Zone Orientation	1pm-2pm
Mikaela Kovach-Galton	Sarah Gaither	Gender differences in displays of stress within cross-race interactions	10am-11am
Chris Lea	Timothy Strauman	How Health and Religion Interact: An Interplay between PTSD, Pain, and Religious Involvement in Veterans	10am-11am
Savannah Grace Lynn	Makeba Wilbourn	Internet Usage & Mental Health of Transgender Adolescents: An Exploratory Study	12pm-1pm
Samantha Neal	Sarah Gaither	Cross-Cultural Examinations of Children's Perceptions of Ambiguous Race Asian/White Faces	1pm-2pm
Erik Savereide	Nancy Zucker	Exploring Body Image in the Context of Gender Dysphoria & Hormone Replacement Therapy	12pm-1pm
Christine Townsley	Rick Hoyle	If at First You Don't Succeed, Reconsider: Attainability Cues and Adaptive Disengagement	1pm-2pm
Sarah Walker	Nancy Zucker	Speaking the Language of Your Body: Distorted Interoceptive Awareness in Anorexia Nervosa	12pm-1pm
Madeline Wilkerson	Nancy Zucker	Associations Between Positive Body Image, Exercise Type, and Eating Disorder Symptoms	10am-11am
Grace Williams	Timothy Strauman	Mental Health of NCAA Division One Student Athletes	11am-12pm
Catherine Yang	Makeba Wilbourn	What's the Story? A Qualitative Analysis of Birth Stories Across Race	12pm-1pm
Idil Yazgan	Kenneth Dodge	Cumulative early childhood stressors and later antisocial behavior: The potential mediating role of neurocognitive functioning	1pm-2pm
Karen Young	Makeba Wilbourn	How to Speak without saying a word: A Comparison of Infants Responses to Three Nonverbal Cues	12pm-1pm

SOCIAL SCIENCES

Student	Mentor	Title	Time
Blaine Elias	Jay Pearson	To Seek or Not to Seek: Examining Health-Seeking Behaviors among Ethiopian Immigrants in the United States	10am-11am
Chelsea Liu	Janet Prvu Bettger	Rehabilitation Provider Type Influences Functional Outcome and Mortality of Acute Ischemic Stroke Patients with Severe Neurological Deficits: Findings from the China National Stroke Registry II	1pm-2pm
Joshua Lovett	Jennifer Hill	Exploring Identity Dissonance Among First-generation Students at Highly Selective Institutions	10am-11am
Attyat Mayans	Eileen Chow	Chinese students studying abroad at Duke Kunshan University: Examining the implications of the Chinese study-abroad movement at an International Branch Campus	10am-11am
Adair Necalli	Gareth Price	Color, Class, and Language Ideology: Loving a Language Without Those Who Speak It	10am-11am
Gino Nuzzolillo	Alma Blount	Addressing Mass Incarceration in Cook County, Illinois	12pm-1pm
Raichel Perper	Sherryl Broverman	Labor Attrition between South Africa's Public and Private Health Sectors: A Mixed-Methods Case Study of KwaZulu-Natal Dietitians	10am-11am
Elizabeth Speed	Alma Blount	Women's Underrepresentation in United States Elective Office: Why Women are Less Likely to Run and How This Imbalance Can be Addressed	10am-11am

BASS CONNECTIONS ABSTRACTS

Mitchell Abrams

Improvements in Baseline Drift Removal from EOG Signal and Headset Design

Faculty Mentor: Jason Luck, Biomedical Engineering

Systems such as SR Research's Eyelink 1000 have been utilized in diagnostic tests of concussion based on oculomotor assessment, but are expensive and limited in sampling rate. Here, an electrooculography (EOG) headset using dry electrodes was investigated as a cheaper, yet higher resolution, eye tracking system. The subject was positioned in the Eyelink 1000 while wearing the EOG headset and instructed to follow a prosaccade routine while both systems simultaneously recorded eye movement. The EOG signal was sampled at 10,000 Hz, then low-pass filtered (fc=55 Hz) and attenuated by 40 dB in the stop-band within MATLAB. A baseline was approximated using a piecewise linear extrapolation over regions of eye movement to shift segments (10,000 points/segment) back to the baseline. This was then subtracted from the original EOG signal. This was then compared to a moving median filter (0.4s), which was likewise subtracted from the original EOG signal. To develop a unified toolkit, an Oculus Rift Virtual Reality headset, MATLAB and Psychophysics Toolbox 3 (PTB-3) were utilized, to present stimuli to the VR headset and to record and save the EOG signal data. With sinusoidal drift character, the median correction performed slightly better with an error of 1.09 +/- 0.91 degrees to the Eyelink. For monotonic drift, the linear regression method performed better with an error of 1.03 +/- 0.66 degrees. Future work will focus on stimulus presentation and testing using only the Oculus Rift, as well as on the application of this drift correction to additional oculomotor testing routines.

Bass Connections 10am-11am

Anuhita Basavaraju

A Cognitive Evaluation of Unconscious Markers of Bias: From Implicit Bias to Eye Contact

Faculty Mentor: Elizabeth Johnson, Neurobiology

Though race relations in America have been an extremely pressing issue throughout the country's history, Americans are currently worried about them at unprecedentedly high levels. The perceived deterioration of race relations in the United States makes understanding how we observe, perceive, and think about race extremely pressing and socially relevant. Cognitive science can play an important role in effectively improving race relations, as the field's aims are to understand human behavior and thought processes. Faces are extremely rich social stimuli that function as a form of nonverbal communication and convey much an individual's socially relevant labels. This categorization mechanism is actually an evolutionarily conserved process to help determine whether an individual is an "ally" (in-group member) or a "threat" (out-group member). The racial categorization of a human face reveals social information to the viewer based on the qualitative associations they unconsciously hold about the face's perceived racial group. Thus, before verbal communication even occurs between two individuals, there are two critical and interconnected processes that may contribute to racial tension: 1. The sensory observation and visual exploration of a face; 2. The categorization of a face to a given racial group and the qualitative associations tied to the given grouping. I asked two questions with regards to these two dimensions: 1. Do we explore new faces differently based on whether the face is the same race as the observer or a different race? 2. Is there an effective way to decrease the associations made between the sensory recognition that an individual has certain phenotypical racial markers and the qualitative traits attributed to them? I conducted three distinct experiments to help answer these questions: 1. A cursor gaze task 2. Eye Tracking Experiment 3. Examination of the role of social interventions at decreasing implicit bias against Middle Eastern descendants of refugees in Copenhagen, Denmark. Ultimately, my findings suggest that there may be a correlation between the amount of time spent looking at the eyes of in-group vs. out-group faces, with people spending a longer amount of time on in-group faces. Moreover, implicit biases are malleable even in historically homogenous countries like Denmark but require direct contact and active participation of the participants. Future investigations will involve examining how the findings relate to behavior.

Bass Connections 10am-11am

Visible Thinking- Abstracts

Joshua Grubbs

Evaluation of a Dietary Intervention for Chronic Methylmercury Exposure Among Communities in Madre de Dios, Peru

Faculty Mentor: William Pan, Global Health

Communities in Madre de Dios, Peru experience an extremely high burden of mercury exposure as a result of artisanal and small-scale gold mining in the region. Inorganic mercury released by mining operations is converted to organic mercury and biomagnified along the aquatic food chain, causing mercury to accumulate in fish, a critical food source for riverine communities. Mercury exposure is responsible for many developmental and neurocognitive health issues, and thus presents a major health concern. During the summer of 2017, two communities in Madre de Dios, Peru were enrolled in a pilot study to assess the effectiveness of a dietary intervention for reducing exposure to mercury, in accordance with the evidence for dietary fiber and selenium as potential agents for decreasing blood mercury. Participants were provided with supplemental food baskets on a weekly basis and their blood mercury levels were tested pre- and post-intervention. One community also participated in educational workshops to determine if greater knowledge improved intervention outcomes. The study did not provide evidence for food baskets as an effective intervention for reducing mercury exposure in Madre de Dios. Educational workshops were effective in communicating knowledge about mercury, but did not translate to significantly greater reduction of blood mercury levels. Nevertheless, the models suggest greater decreases in blood mercury among older, heavier individuals. An improved understanding of the relationship between selenium and mercury as well as the role of adipose tissue in mercury uptake and body distribution can help elucidate the nuances of dietary exposures to mercury.

Bass Connections 12pm-1pm

Daniel OConnell

Tackling Concussions An Investigation of an Objective Assessment Modality for Pediatric Athletes Experiencing Concussive and Sub-concussive Head Impacts

Faculty Mentor: Daniel OConnell, Biomedical Engineering

Concussions, or mild traumatic brain injuries (mTBI) present a major health concern for today's athletes. Heightened awareness of concussion in sports and on-going research into whether concussive or sub-concussive loading may lead to later-life cognitive deficits has accelerated interest in identifying improved injury assessments. Current concussion assessments are often subjective or susceptible to sandbagging during baseline. These limitations, coupled with the fact that the symptomology of a concussed individual may be highly variable, have led to assessments that incorporate a multi-modal approach. Despite this approach, no single objective assessment currently exists that can diagnose a concussion or indicate "injury" in a sub-concussed individual. Oculomotor tracking may provide an additional objective modality that shows promise in detecting cognitive deficits. Eye tracking requires the integration of sensory and motor systems, and small changes to visual, motor, working memory, and executive function may be detected. We are collaborating with local high school, middle school and youth football programs to collect pro-, anti-, and memory guided saccades and smooth pursuit eye movement data at multiple points throughout the season. Baseline measurements can then be compared to post-injury measurements to determine if cognitive changes are present. In addition, we are developing a less expensive, highly portable oculomotor tracking system using electrooculography (EOG) to measure eye movements based on changes to the eye's electric dipole potential. Finally, we are also using head accelerometer devices (DASHR) to measure in vivo head kinematics to gather insight into the effects of sub-concussive impacts and how they may impair cognition.

Bass Connections 10am-11am

Visible Thinking- Abstracts

Anna Ruta

Design of a Light-Mediated, Reversible Sol-Gel Transition PEG Hydrogel

Faculty Mentor: Jennifer West, Biomedical Engineering

Three-dimensional cell encapsulation within synthetic hydrogels has been shown to support development of complex structures including synthetic tissues and organoids. However, extraction of these multi-cellular structures is limited to using enzymatic gel digests that can potentially damage biological material. Therefore, this project aims to design a dynamic poly(ethylene glycol) (PEG) hydrogel that can reversibly transition between gel and solution using light-mediated protein interactions to provide a gentler alternative for reclaiming encapsulated cells. To achieve the light-mediated phase transition, the LOVTRAP system composed of a light-oxygen-voltage 2 (LOV2) domain and its binding partner Zdark (Zdk) was implemented. These two proteins associate in the dark with high affinity, dissociate upon blue-light exposure and re-bind following a relaxation period. To utilize the LOVTRAP system as a reversible gelation chemistry, the proposed hydrogel consists of two components: a multi-domain Zdk crosslinker molecule and homobifunctionalized PEG with terminal LOV2 domains. The initial focus of this project was to design and validate the functionality of the Zdk crosslinker component. The Zdk crosslinker gene was designed to contain four sequential Zdk domains tethered via flexible linker sequences and a terminal mCherry domain. The protein construct was recombinantly expressed in Escherichia coli and purified using Ni-NTA affinity chromatography. Topical application of Zdk crosslinker onto the surface of PEG hydrogels with immobilized LOV2 allowed for validation of retained Zdk/LOV2 association and blue-light stimulated dissociation. With the synthesis of the Zdk crosslinker complete, the next steps entail LOV2-PEG-LOV2 synthesis and subsequent component combination to form the proposed photo-responsive hydrogel

Bass Connections 10am-11am

Visible Thinking- Abstracts

Prithvir Jhaveri

Automating Electricity Access Predictions with Satellite Imagery

Faculty Mentor: Kyle Bradbury, Energy Initiative

Energy access is highly correlated with improvements in the wellbeing, economic prosperity, and gender equality of a region. Despite these benefits, an estimated 1.2 billion people do not have electricity access, and even more have too unreliable electricity to achieve the aforementioned welfare gains. This study aims to fill current data gaps on global energy access assessments through producing high resolution geographic energy access metrics. In particular, a trained gradient boosted decision tree classifier using VIIRS Lights at Night, population density, vegetation indices, and spectral band data were used to predict energy access at the village level in Bihar, India. 16, 389 villages were classified as either electrified or un-electrified. Furthermore, two additional models were evaluated to explore the discriminative abilities of our classifier limited to villages with at least 100 or 400 households. Results demonstrated through Receiver Operating Characteristic (ROC) curves show an area under the curve of 0.693, 0.730, and 0.799 respectively. Moreover, the general-purpose model was then used to predict electrification status in Uttar Pradesh, a state in India where these data are unavailable.

Bass Connections 12pm-1pm

Visible Thinking- Abstracts

Meghana Vagwala

Mental health attitudes and implications for patient care: A qualitative study of medical students and physicians in urban Nepal

Faculty Mentor: Brandon Kohrt, Global Health

This qualitative study outlines a preliminary understanding of how stigma coexists alongside medical knowledge, education, and practice in the realm of mental health and psychiatry among MBBS students and professionals in Kathmandu, Nepal. Seven key dimensions of stigma - peril, empathy, origin/controllability, aesthetics/concealability, stability, disruptiveness, and courtesy stigma - were synthesized from literature and catalogued in participants' responses. Positive attitudes were largely mediated by empathy for the patients as well as beliefs in biological or psychosocial origins of mental illness. Negative attitudes corresponding to every dimension were identified, with the perceived behavioral disruptiveness of a mentally ill individual in a social setting being the lead cause of stigma. The origin dimension also played a major role in shaping negative attitudes, by suggesting that patients were responsible for and ought to control their mental illnesses. Courtesy stigma was also very common, with the entire institution of psychiatry -- practitioners, referrals, and medications -- being affected by negative attitudes related to mental health stigma. The cross-sectional data showed that improvements in attitudes may occur as students progress from first years to fourth years, but the qualitative data suggests that the improved attitudes may not be sustained in medical practice if the student does not pursue psychiatry. Ultimately, the themes of origin, disruptiveness, empathy, and courtesy related attitudes, run strongly through the knowledge, attitudes, practices of members of the medical community in Nepal.

Bass Connections 11am-12pm

BEHAVIORAL SCIENCES ABSTRACTS

Mia Carlyle

Emotional Outcomes of Online Identity Denial in Biracial Individuals

Faculty Mentor: Sarah Gaither, Psychology and Neuroscience

Previous research has shown that Asian Americans present with increased levels of stress after having their American identity denied (often a result of being perceived as "foreign" based on appearance). The biracial demographic is known to experience higher levels of social exclusion and social identity threat than any other racial group as a result of having multiple racial identities that are often denied by others. Although identity denial—the failure of others to recognize an important social identity- is prevalent within this population, we know very little about how identity denial specifically influences the self-esteem, emotions, and overall well-being of biracial individuals. This study is novel in examining the response to identity denial in the biracial population. The denial was conducted online among 150 participants in the form of a monitored survey, where they would encounter "live" messages (not actually live, but pre-programmed) from a supervising researcher, and the denial took place through these messages. There were two conditions- the denial condition (n=66) in which one of the racial identities belonging to the participant was denied, and the control condition (n=84) which denied a racial identity they did not possess. The results showed an increase in stress level for those in both conditions, significant differences in negative affect between the two conditions both before and after the denial, and higher positive affect in the control condition after the denial.

Behavioral Sciences 10am-11am

Rachel Lamparelli

Does the Statistical Nature of Neuropredictive Models Bias Juror Decision-Making?

Faculty Mentor: Walter Sinnott-Armstrong, Philosophy

As neuroscientific research continues to enhance the reliability of predictive risk assessments, a greater fire is being put underneath questioning how this knowledge can be ethically and justly applied to the legal system. An important step towards the normalization of neuropredictive models in criminal trials is to develop a better understanding of how jurors are applying this evidence to their decisions. There has not yet been extensive study on juror valuations of neuroscience-based risk assessments as they are concerned with sentencing decisions. This study investigated how jurors interpret neuroscientific evidence by analyzing how they apply evidence of a statistical nature to their sentencing decisions. Using vignettes of mock neuroscientific expert testimony, this study examined whether individuals can discriminate between different kinds of conditional probability statements. It was hypothesized that participants would interpret the probability of the evidence given a certain hypothesis the same as the probability of a certain hypothesis given the evidence. Indeed, varying the direction of the probability statements did not result in participants adjusting their responses to vignette-dependent questions. This supported the hypothesis that participants did not notice the distinction between the two probability statements. These results suggest that in a trial setting, if statistical evidence is not presented to jurors in a sufficiently explanatory way, they are likely to misinterpret the testimony and inappropriately use this information to make judgements about the case. I suggest that the routine appointment of technical advisors to educate the judge and jury during the trial could help mitigate the issues of statistical inference identified in this study.

Behavioral Sciences 12pm-1pm

Sujal Manohar
Implicit Judgments in Legal Decision-Making
Faculty Mentor: John Pearson, Psychology and Neuroscience

Implicit judgments of traits like aggressiveness and trustworthiness are among the most important decisions humans make in social interaction. In particular, jurors' assessments of defendants' guilt play an important role in the justice system. It is unknown how trait assessments contribute to guilt assessments, and eye tracking can shed more light on implicit processes during decision making. In this study, we used mugshots from a statewide database as stimuli to understand judgments in the context of the criminal justice system. We asked subjects to rate a stimulus on a trait question or judge which crime (the actual crime or a foil crime) they were charged with. We developed a paradigm which randomly asked these questions, and in our initial pilot phase, participants performed 50 trials. We observed that participants rated the three traits (trustworthiness, competence, and aggressiveness) similarly on a scale from 1 to 6. Further directions include incorporating eye tracking and observing the impact (if any) of race on these judgments. For the eye tracking studies, we hypothesize that if subjects spend more time viewing the eyes, they may be more likely to choose a lesser crime for the criminal since it could generate higher empathy. The findings of this study will increase understanding of visual and facial perception when making judgments of others. It can also shed light on implicit judgment processes in the context of legal decision making.

Behavioral Sciences 10am-11am

Madeline Plachy

Racial Constancy in Biracial and Monoracial Children: The Importance of Age and Stimuli

Faculty Mentor: Sarah Gaither, Psychology and Neuroscience

Although research shows racial constancy develops around ages 5-6, possible age and racial group differences have not been explored. Furthermore, whether the race of the stimuli used for measuring racial constancy has also not been examined. We recruited 453 children (ages 3-7; 234 male; 148 White, 84 Black, 50 Asian; 29 Hispanic/Latino; 142 biracial) from Chicago, IL and Durham, NC. They completed a racial constancy measure that examines children's beliefs about the immutability of racial group membership. These tasks used either Black and White (B/W) or Asian and White (A/W) faces as stimuli, and allowed children to provide reasoning for whether race was a stable trait or not, which was coded. Supporting past research, the average age of racial constancy was 5.85 years. However, children in the A/W task adopted racial constancy beliefs later (M = 6.21) compared to the B/W task (M = 5.64). Children with racial constancy also spoke more about race-specific characteristics in the B/W task (83.49%) compared to the A/W task (36.51%). Furthermore, biracial children with racial constancy mentioned race-specific characteristics more than other racial groups (B/W = 96.97%, A/W = 50.00%). These results suggest that children may see less difference between Asians and Whites as groups compared to Blacks and Whites. Additionally, biracial children may be more comfortable using race-specific words than their monoracial peers. Here, we replicate past work regarding the age at which racial constancy develops and highlight that the stimuli utilized matters.

Behavioral Sciences 1pm-2pm

Camila Vargas Restrepo
Judgments of Deceptive Bar Graphs
Faculty Mentor: Elizabeth Marsh, Psychology and Neuroscience

Anchoring effects research has shown that judgments are easily biased by initially presented values. We show that, in a similar way, bar graphs can bias people's qualitative judgments of the differences between quantities. Experiment 1 found a significant effect of y-axis truncation — a graph manipulation technique that can exaggerate quantitative differences— on people's qualitative judgments. Experiment 2 found that encouraging people to notice the y-axis manipulation significantly reduces, but does not eliminate, the truncation effect. Results from Experiment 3 suggest that axis truncation leads to overestimation of the difference between two bars, even when participants are given an initial warning and explanation of the y-axis truncation techniques. Our research shows that the choices made by those who design visual representations of data can have a substantial influence on the story that is told and the way the information is understood.

Behavioral Sciences 12pm-1pm

Adriana Santomero

Empathetic Response to Captured Group Members in Lemur catta

Faculty Mentor: Leslie Digby, Evolutionary Anthropology

The purpose of this study was to test for empathy in the strepsirrhine primate, Lemur catta (ringtailed lemur). Empathy is a complicated emotion that requires the ability to imagine beyond one's own self-concept and feel on another's behalf. Due to the cognitive sophistication of this process, empathy is often thought of as a uniquely human trait. However, studies of non-human species indicate that empathy is not singular to humans and is apparently exercised by many other species. For this study, we were particularly interested in determining if L. catta are among such empathetic species. Our interest stemmed from the observation that capture events at the Duke Lemur Center are distressing not only for the animal caught, but also for the captured individual's group members, which may indicate that group members feel stress out of concern for the captured individual rather than out of pure fear. We tested for evidence of this explanation by documenting the behavior of L. catta before, during, and after capture events using focal-animal sampling. We compared the behavior of L. catta across these experimental states and determined that, in relation to baseline, lemurs exhibited a decrease in calm behaviors, an increase in nervous behaviors, and an increase in gazing behaviors in the wake of capture+separation events. It is difficult to determine the root cause of these behavioral changes, and more work must be done before labeling the lemurs' behavior "empathetic." However, we did map a number of interesting trends in the emotions and stress responses of L. catta.

Behavioral Sciences 12pm-1pm

BIOLOGICAL SCIENCES ABSTRACTS

Stephanie Asdell

Human Antibody-Dependent Cellular Cytotoxicity-mediating Antibodies Do Not Recruit Non-Human Primates CD20+ NK Cells

Faculty Mentor: Guido Ferrari, Molecular Genetics & Microbiology

The antibody-dependent cell-mediated cytotoxicity (ADCC) response represents one of mechanisms through which the immune system destroys tumor or infected cells. During the ADCC response to HIV-1, natural killer (NK) cells are recruited by natural infection- or vaccine-induced antibodies (Abs) bound to the HIV-1 envelope glycoproteins expressed on infected CD4+ T cells via Fc-gamma Receptor IIIA (Fc-R IIIA). The NK cells' Ab-mediated recognition of the infected cells leads to the release of granzymes and perforin by degranulation, triggering apoptotic signal pathways in the infected cells and ultimately leading to their elimination. We have optimized an assay to investigate the degranulation of non-human primate (NHP) NK cells from five different NHP donors by measuring levels of CD107a, a marker present on the inner membranes of NK lysosomes. Using one NHP and two human monoclonal antibodies (mAbs), we compared degranulation of NK in NHP splenocytes, NHP peripheral blood mononuclear cells (PBMC), and human PBMC. We observed that both NHP and human mAbs recruited NHP and human NK effector cells. Of note, we examined the activity of CD20+ and CD20- NK cells, with the former being NK cells from a unique subset of NHP NK splenocytes. Our analysis suggests that CD20+ cells likely do not play a role in the NHP ADCC response. In conclusion, we can identify the cellular populations responsible for the Ab-mediated killing of HIV-1 infected cells, and we will be able to further analyze their full functional profile at the level of messenger RNA expression, i.e. their transcriptomic profile.

Biological Sciences 11am-12pm

Namratha Atluri

Characterization of the Side-Effect Profile of a Î²-arrestin Biased Neurotensin Receptor 1 Ligand

Faculty Mentor: Marc Caron, Cell Biology

Neurotensin (NT) and its high affinity G protein-coupled receptor (GPCR) neurotensin receptor 1 (NTR1) are promising targets for the treatment of drug addiction. As with other GPCRs, NTR1 signals not only through the canonical activation of G proteins, but also through Beta-arrestins to mediate distinct cellular and physiological effects. In pursuit of an anti-addiction therapeutic, our laboratory identified a novel small molecule NTR1 ligand, known as SBI-553, that selectively activates the NTR1 Beta-arrestin signaling arm. This Beta-arrestin biased ligand counters the effects of stimulant drugs in mouse models of addiction. Generally, the therapeutic potential of NTR1-targeting agents may be compromised by dose-limiting side effects. In addition to attenuating addiction-associated behaviors, unbiased NTR1 agonism promotes aberrant cell growth, hypothermia and reduction of food intake. To characterize the side effect profile of this Beta-arrestin biased NTR1 ligand, we evaluated SBI-553's effects on cell growth, thermoregulation and hedonic feeding. In a cell viability assay, NT increased viability of NTR1-expressing HEK293T cells while SBI-553 had no significant effect. In C57BL/6J mice, the unbiased NTR1 peptide ligand PD149163 produced dramatic and long-lasting hypothermia while SBI-553 did not alter core body temperature. In a hedonic feeding assay based on milk consumption, SBI-553 increased latency to initiate milk drinking and reduced total intake, as compared to vehicle-treated control mice. Together, these data suggest that unbiased and Beta-arrestin biased NTR1 ligands will have distinct side effect profiles. Critically, SBI-553 did not stimulate cell proliferation or hypothermia, two effects characteristic of unbiased NTR1 agonism that would limit clinical utility.

Biological Sciences 10am-11am

George Barlow

Deactivation of Cas9 to reduce off-target mutations in CRISPR systems

Faculty Mentor: Daniele Armaleo, Biology

The CRISPR-Cas9 process for modifying DNA relies on the Cas9 enzyme binding to a small guide RNA (gRNA) which directs Cas9 to its target. However, the persistence of the active Cas9 gRNA complex in the cell leads to occasional off-target mutations. Deactivating Cas9 after it has acted on its target could improve the precision of the CRISPR-Cas9 system. We are developing two methods of deactivating Cas9, one reversible, and one permanent, using yeast as a model. Both methods involve transforming yeast with a plasmid containing the Cas9 gene and a gRNA targeting a reporter gene in the host DNA. For reversible Cas9 deactivation, a second plasmid will be introduced containing an inducible small inhibitory RNA (iRNA) complementary to the gRNA directed at the reporter gene. When the iRNA is not expressed, Cas9 will inactivate the reporter gene, but when expressed, the iRNA will interfere with the gRNA and prevent Cas9 from damaging the reporter gene. For permanent Cas9 inactivation, the second plasmid will constitutively express a gRNA targeting Cas9 to its own gene on the first plasmid. The expectation is that Cas9, initially transcribed and translated from its intact plasmid gene, will partition itself between the two gRNAs, one targeting the reporter gene, and the other targeting the Cas9 gene. The deactivation of the single chromosomal reporter gene will happen more quickly than the deactivation of Cas9 present on a multi-copy plasmid, but eventually all Cas9 gene copies will be silenced. Initial results of the permanent inactivation experiment are presented.

Biological Sciences 12pm-1pm

Rachel Borczuk

Engaging Female Interest in High School Science: The Use of a Virtual Neuroscience Experiment paired with Undergraduate Female Mentorship

Faculty Mentor: Rochelle Schwartz-Bloom, Pharmacology & Cancer Biology

The underrepresentation of females in Science, Technology, Engineering, and Math (STEM) careers is an example of gender inequality in the United States. Factors that contribute to this phenomenon, such as negative gender stereotypes, low self-efficacy in science, and lack of positive female role models, may negatively impact a young woman's interest in science and subsequent motivation to pursue a STEM career. To address this issue, I used an engaging, scalable, and low-cost science education online program along with female mentorship in an afterschool setting for 7th-11th grade girls. I tested the effects of a 3-hour science activity--a virtual online laboratory called Rex, led by female undergraduate mentors, on student interest and critical thinking in science. Rex was designed to engage the situational interest (short-term interest) of students using an online neuroscience experiment that tests the effects of alcohol on the development of zebrafish larvae. Situational interest, individual interest (sustained interest), critical thinking, and career aspirations were measured before and several weeks after the Rex activity (N = 13); the same surveys were given to students who did not participate in Rex (N = 6 ; controls). The Rex activity engaged student situational interest to a moderate degree, but there were no statistical differences between the control and experimental groups for individual interest, critical thinking, and career aspirations. Since one 3-hour activity may not be enough time to have a measurable effect on the interests and career aspirations of young women, future studies should explore the impact of long-term science-related programs on the development of female scientists and engineers.

Biological Sciences 10am-11am

James Bradford

Bacterial Natural Products in the Mosquito Microbiome

Faculty Mentor: Emily Derbyshire, Molecular Genetics & Microbiology

The mosquito gut and salivary glands house myriad bacteria symbiotically that constitute its microbiome. Research has revealed that the mosquito microbiome is crucial for the health and survival of the organism. Specifically, the microbiome is implicated in the interaction between the mosquito vector and the causal agent of malaria, the Plasmodium parasite. It is hypothesized that natural products produced in the microbiome mediate this interaction. Our project aims to characterize the natural products synthesized by various bacterial species in the mosquito microbiome by isolation and structural characterization via NMR spectroscopy and mass spectrometry techniques.

Biological Sciences 10am-11am

Francesca Brancati

Evaluation of the knockout of the glycerol and water channel host protein AQP7 on parasitemia levels of Plasmodium in human hepatocyte cell line

Faculty Mentor: Emily Derbyshire, Molecular Genetics & Microbiology

Malaria is a mosquito-borne parasitic disease caused by the Plasmodium species that infects 214 million people each year. Currently, most malaria therapies target the blood stage and are becoming increasingly ineffective due to the emergence of drug-resistant strains. The human liver presents a promising target for new therapies. The liver stage in the Plasmodium life cycle is an obligatory developmental stage that precedes the onset of symptoms and the ability of the parasite to be transmitted to the next Anopheles host. Additionally, targeting the human host would hinder the ability of the Plasmodium parasite to develop drug resistance. The Plasmodium parasite has previously been shown to localize two aquaporin (AQP) glycerol and water channel proteins, AQP3 and AQP7, to the liver cell. A complete AQP3 knockout was shown to decrease parasite load by 75% and an AQP7 knockdown was shown to decrease parasite load by 60%, both without significantly impacting cell viability. The impact that a complete AQP7 knockout, or a complete AQP3 and AQP7 double knockout, would have on parasite load and cell viability is currently unknown. I attempted to generate an AQP7 knockout hepatocyte line using CRISPR/Cas9 genome editing techniques. While no complete AQP7 knockouts were generated, one single-allele knockout did not have a significant change in cell viability or parasite load compared to a control hepatocyte cell line (p-values = 0.82, 0.18). In the future, this experiment should be repeated to determine the impact of a full AQP7 knockout on parasite load and cell viability.

Biological Sciences 1pm-2pm

Usamah Chaudhary

Development of algorithms for cervix region of interest segmentation: First steps toward automated cervical cancer screening in low-resource settings

Faculty Mentor: Nimmi Ramanujam, Biomedical Engineering

Throughout many parts of the undeveloped world it is extremely difficult for women to be tested for cervical cancer and this is one of the major reasons that it leads to the death of over 250,000 deaths a year. The World Health Organization recommends visual inspection with acetic acid (VIA) and/or Lugol's Iodine (VILI) for cervical cancer screening in resource deprived areas of the world. Our project's goal is to develop a low cost device that can be used in these areas to aid in the detection of cervical cancer. The Pocket colposcope is a tampon shaped device with a camera at the end and LEDs that is able to capture photographs of the treated cervix. The device is connected through usb to be used with a phone or tablet in order to keep costs of the device low and make it easy for the user. The device then takes the raw image and runs it through a series of algorithms that first segment the raw image then extracts features of the cervix by converting the image into various color spaces makes a prediction on if the cervix has potential for being cancerous. My primary contribution to the project was with the portion of the algorithm that automatically finds the region in the raw image that contains the cervix.

Biological Sciences 10am-11am

William Chen

Role of MERTK in Muller Glia on Retinal Synapse Formation and Function

Faculty Mentor: Cagla Eroglu, Cell Biology

Synaptic dysfunction and synapse loss are hallmarks of neuro- and retina-degenerative diseases. However, underlying molecular and cellular mechanisms that initiate these diseases are not clearly understood. Royal College of Surgeon rat has been widely studied as a model for retinal degeneration caused by a nonsense mutation in MER Receptor Tyrosine Kinase (MERTK). In humans, the MERTK mutation leads to a retina-degenerative disease called retinitis pigmentosa. Although the MERTK gene is expressed in multiple cell types in the retina, cell-type specific contribution to retinal degeneration has not been studied. This study investigated the role of MERTK in Muller glia (MG) on retinal synapse formation and function. The effect of MERTK deletion was exclusively studied in MG by using a novel approach developed in the Eroglu Lab. This approach utilized Adeno-Associated Virus combined with gene-targeting CRISPR delivery (AAV-CRISPR) to knock-out MERTK in MG of wild type Long-Evans rat. The results demonstrated that MG-specific knock-out of MERTK led to functional deficits and induced reactive changes of MG, which led to impaired retinal synapse development. Because the role of MERTK in MG has not been studied, this study has significant implications for understanding the cellular and molecular mechanism that leads to visual impairment.

Biological Sciences 12pm-1pm

Lilly Chiou

Deactivation of Cas9 to reduce off-target mutations in CRISPR systems

Faculty Mentor: Daniele Armaleo, Biology

The CRISPR-Cas9 process for modifying DNA relies on the Cas9 enzyme binding to a small guide RNA (gRNA) which directs Cas9 to its target. However, the persistence of the active Cas9 gRNA complex in the cell leads to occasional off-target mutations. Deactivating Cas9 after it has acted on its target could improve the precision of the CRISPR-Cas9 system. We are developing two methods of deactivating Cas9, one reversible, and one permanent, using yeast as a model. Both methods involve transforming yeast with a plasmid containing the Cas9 gene and a gRNA targeting a reporter gene in the host DNA. For reversible Cas9 deactivation, a second plasmid will be introduced containing an inducible small inhibitory RNA (iRNA) complementary to the gRNA directed at the reporter gene. When the iRNA is not expressed, Cas9 will inactivate the reporter gene, but when expressed, the iRNA will interfere with the gRNA and prevent Cas9 from damaging the reporter gene. For permanent Cas9 inactivation, the second plasmid will constitutively express a gRNA targeting Cas9 to its own gene on the first plasmid. The expectation is that Cas9, initially transcribed and translated from its intact plasmid gene, will partition itself between the two gRNAs, one targeting the reporter gene, and the other targeting the Cas9 gene. The deactivation of the single chromosomal reporter gene will happen more quickly than the deactivation of Cas9 present on a multi-copy plasmid, but eventually all Cas9 gene copies will be silenced. Initial results of the permanent inactivation experiment are presented.

Biological Sciences 12pm-1pm

Ankita Das

Potential Mutation of Protein Kinases Critical to Malaria Infection Proliferation

Faculty Mentor: Emily Derbyshire, Molecular Genetics & Microbiology

Malaria is a life-threatening disease caused by infection by Plasmodium parasites, single-celled protozoans, which are transmitted via the bite of a female Anopheles mosquito. The disease poses significant danger to the ecological balance, patterns of reproduction, and demographic structures across several regions of the world. In particular, P. falciparum, the species responsible for the most lethal consequences in the humans they infect, proves to be a promising target for anti-malarial efforts. Proliferation of malarial infection is highly dependent on signal transduction of critical cellular processes facilitated by protein kinase pathways. These kinases carefully regulate induction of protein phosphorylation within both the parasite and the host cell protein synthesis infrastructure to promote intraerythocytic development. Advances in the sequencing of the P. falciparum genome have allowed collaborators in the Derbyshire and Haystead laboratories at Duke University to identify and characterize kinases, such as PfPk9, that may be valuable druggable targets. Here, I propose a potential mutation of an amino acid residue critical to the kinase's catalytic site as encoded by the PfPk9 kinome to hypothesize about the necessity and sufficiency of its presence to conserved kinase function. I then postulate about the prospective consequent effects of the mutation on the signaling cascade requisite to the cell processes that sustain malarial infection. By defining and demonstrating the specific role of individual molecular components underlying the mechanism of malaria infection, we may better direct anti-malarial development initiatives to augment patient and population outcomes.

Biological Sciences 12pm-1pm

John Deng

Investigation of Molecular Forces in Swollen Silicone Elastomer

Faculty Mentor: Stephen Craig, Chemistry

Solvent swelling in a silicone elastomer detrimentally affects the mechanical properties of the polymer network by straining and consequently weakening the network. However, the extent that swelling influences molecular forces in swollen polymer networks has not been experimentally investigated. Here, we incorporate spiropyran, a color-changing, molecular force probe, into a silicone elastomer to investigate the molecular forces experienced by chains in strained, swollen networks. To determine the percent of chains that experience sufficient force to activate spiropyran (SP) to merocyanine (MC), the percent of SP activation under strain was determined for poly(dimethylsiloxane) (PDMS) films swollen in each solvent condition (no solvent, methanol, ethanol, dimethyl sulfoxide, and dichloromethane). UV absorbance was measured as a function of strain in each solvent and the first invariant of Cauchy-Green deformation tensor was used to account for different elastomer deformation in various solvent environments. The amount of SP activation at maximum percent strain by stretching is close to 1% in all solvents. Only dichloromethane caused enough strain from solvent swelling alone to activate SP in the polymer network, suggesting that solvents with high enough swelling ratios could strain the polymer network enough to activate SP.

Biological Sciences 11am-12pm

Daniel Doyle

Fiber Type and Human Skeletal Muscle Evolution: A Consideration of Differences in Day Range and Size Scaling within the Great Apes

Faculty Mentor: Christine Wall, Evolutionary Anthropology

Recent evidence has suggested that humans developed a slow phenotype that favors type 1 muscle fibers to accommodate large day ranges based on comparisons with the chimpanzee. However, the high number of skeletal muscle cells expressing primarily type 1 myosin heavy chains within humans relative to chimpanzees could also be a result of size scaling instead of adaptation to increased daily costs of transport. To test this, muscle fiber type proportions were calculated for the vastus lateralis, gastrocnemius lateralis, and biceps femoris muscles within the chimpanzee (P. troglodytes) and western gorilla (G. gorilla) and subsequently compared to human proportions in the literature. Immunohistochemistry with the NOQ7.5.4D, SC-71, and BF-35 antibodies was used to identify fiber types within samples. Proportions within chimpanzee and gorilla were found to be similar, with a predominance of fast type 2 fibers as well many hybrid fibers. These results are consistent with the theory that human fiber type proportions contain a higher percentage of type 1 fibers than what is predicted by size scaling alone. Thus, increased day ranges requiring higher costs of transport could have resulted in a slow phenotype within human locomotor muscle. However, humans express a large degree of variation in fiber type proportions and thus it is difficult to properly compare them to other great apes.

Biological Sciences 12pm-1pm

Katie Freedy

Developing a Basement Membrane Toolkit in C. elegans

Faculty Mentor: David Sherwood, Biology

Basement membranes (BMs) are specialized extracellular matrices composed of a meshwork of proteins that surround and support tissues. Dysfunctions of basement membrane components result in human pathologies like inflammatory immune disease and metastatic cancer. Using CRISPR/Cas-9 genome engineering, the Sherwood lab endogenously tagged 30 BM components in C. elegans. The "BM toolkit" developed by the Sherwood Lab, using the genetically tractable and transparent worm, allows for the first in vivo study of major BM components like type IV collagen and laminin. This toolkit will facilitate live imaging of BM component dynamics in real time. However, because the addition of a fluorescent tag on endogenous proteins may disrupt protein function, the viability of each new CRISPR edited strain must be determined. Protein localization imaging, growth rate studies, and brood size assays provide insight into the effect of genome engineering on an organism. By examining the worm at this level, we can determine possible effects of genome editing prior to use of the worm strains for experimental analysis.

Biological Sciences 1pm-2pm

Rechel Geiger
Protein Signaling in the Plasmodium Parasite
Faculty Mentor: Emily Derbyshire, Molecular Genetics & Microbiology

Malaria is responsible for hundreds of thousands of deaths annually and is a challenge to treat due to growing resistance to medications by the disease-causing parasite, Plasmodium. Therefore, it is necessary to expand the understanding of the Plasmodium parasite life cycle and its biochemistry to better treat and prevent this disease. This research explores parasite and host protein chemistry and biology to elucidate mechanisms of parasite survival and host response. A small molecule inhibitor was recently found to have activity against the Plasmodium falciparum kinase 9 (PfPK9), so a structure-activity relationship campaign was used to optimize small molecule inhibitors to this orphan kinase. Inhibition of this kinase, which has no known human homologues, reduces parasite load in human cell infection and provides a promising route of action for future antimalarial chemotherapeutics. Additionally, the Plasmodium binding partners of PfPK9 were studied to better understand its essential role in the parasite life cycle. Finally, microscopy studies were used to explore a young but exciting area of innate immunology – that of human guanylate-binding protein (hGBP) recognition of invading parasites.

Biological Sciences 10am-11am

Lauren Hale

The Gut Microbiota of Healthy Infants in the Community is a Reservoir for ESBL and Carbapenemase Producing Bacteria.

Faculty Mentor: Mehreen Arshad, Duke pediatric infectious disease

The recent rapid rise of Extended-spectrum Beta Lactamase producing Gram Negative bacteria (ESBL-GNB) has threatened the treatment of common infectious diseases. Neonates have an immature immune system and a delay in appropriate treatment due to ESBL-GNB sepsis can be fatal. ESBL E. coli such as the strain ST131 are known to be persistent gut and vaginal colonizers. In animal models, these strains out-compete colonization with drug-sensitive, commensal E. coli. Gut colonization with ESBL-GNB in infants may have a profound impact on their microbiome and increase their risk of sepsis. Objective: To estimate the prevalence of gut colonization with ESBL-GNB in high incidence setting and determine phenotypic differences between these strains and commensal E. coli. Methods: Stool samples were collected from 100 healthy infants in a Pakistani suburban community between the ages of 5-7 months. Samples were plated on MacConkey agar to select for Gram negative bacteria. Isolates were screened for resistance against several antimicrobial classes. Molecular testing of the stool samples was done using primers targeting conserved regions of resistance genes. Results: Forty-eight percent of infants were positive for ESBL producing Gram negative bacteria, the majority of which were E. coli. ESBL producing E. coli were found to be better growers than commensal E. coli in nutrient restricted growth medium when grown as individual strains. In in vitro competition experiments some of these strains can also out-compete commensals in enriched media. Conclusions: The resistome of otherwise healthy infants may be a major reservoir of antibiotic genes in the community.

Biological Sciences 12pm-1pm

Jordan Hatfield

Role of Medium Spiny Neurons in Avian Model of Huntington's Disease: Techniques for Selective Ablation and Visualizing Regeneration

Faculty Mentor: Richard Mooney, Neurobiology

Huntington's disease (HD) severely disrupts the ability to move normally by selectively targeting the medium spiny neurons (MSNs) of the basal ganglia for death. Songbirds have a homologous basal ganglia circuit dedicated to song that can be directly infected with HD and induce erratic singing. Additionally, unlike mammals, the zebra finch is capable of significantly regenerating MSNs over a lifetime. Previous research in our lab observed the spontaneous recovery of song several months following the infection of HD. In this study we examined two aspects of HD. First, the role of MSNs in disrupting singing behavior and secondly, the potential for MSN regeneration to be the source of spontaneous recovery. To further study the basal ganglia circuit, we devised a diphtheria toxin-based viral construct in order to selectively kill MSNs within the basal ganglia. We showed that death of MSNs in juvenile zebra significantly impaired motor learning. To study the regeneration of MSNs, we developed a novel technique in bird to label newborn neurons. This tool allowed us to visualize newborn neurons, track their migration throughout the brain and identify different levels of regulation. We hoped to use these tools in tandem to identify changes in the levels of neurogenesis and newborn MSNs in the basal ganglia following the death of MSNs; currently, there is a lack of sufficient histological data to examine this interaction. Further exploration of the role of neurogenesis in motor recovery is required and could present neuronal replacement as a potential therapeutic avenue for patients suffering from HD.

Biological Sciences 10am-11am

Visible Thinking- Abstracts

Alexandria Hurley
Understanding Sex Comb Tooth Number in Drosophila simulans
Faculty Mentor: Mohamed Noor, Biology

Why does fitness-related variation (such as sexually selected variation) persist if it tends to be directionally selected? Drosophila sex combs are male-specific structures located on their inner forelegs that are used for tactile interactions between mating pairs. This structure shows great variation both within and between Drosophila species. This project studies why D. simulans sex combs, which are putatively under sexual selection, continue to show fitness-related variation, how that variation is being maintained, and how each chromosome contributes to sex comb variation. Mate preference assays were performed to experimentally test for a correlation between mating success and sex comb size or symmetry. In the No Choice Assay, one male F2 and one virgin female F1 offspring were observed for 90 minutes in observation vials. For the Choice Assay, one F1 virgin female, one F1 male, and one F2 male were observed for 90 minutes in observation vials. Males were fed colored media to allow for distinction. F2 males were used to increase variation. Reciprocal crosses were performed with both parental strains to compare the effect of the X chromosome on sex comb variation. To examine the effect of the third chromosome, a male parent backcross was performed. Offspring were then genotyped through PCR with marker 3R. Results from the No-Choice Assay suggest that larger sex combs are preferred by D. simulans ($p=0.0016$). These results refute conclusions from a previous study. Additionally, genotypic analysis reveals effects of both the X and third chromosome on sex comb tooth number.

Biological Sciences 1pm-2pm

Varun Jain

Tissue-specific targeting of collagen IV to developing basement membranes in C. elegans

Faculty Mentor: David Sherwood, Biology

The basement membrane (BM) is a thin and dense extracellular matrix that surrounds most tissues and organs. Collagen IV is the most abundant BM component, forming a cross-linked network that provides BMs mechanical strength. Loss of collagen IV leads to embryonic lethality, BM ruptures, and causes a wide array of congenital developmental disorders in humans. Despite its fundamental role, it is not known how collagen IV is recruited to BMs. Knockdown of collagen IV by RNAi causes ruptures, indicating a critical role for collagen in organ development and function. The nematode C. elegans encodes all major BM components with single genes, making it an excellent model to explore how collagen IV is targeted to BMs. The C. elegans pharynx (a rigid contractile organ) and gonad (a flexible organ) are both BM-encased tissues. Visualization of laminin (another network forming matrix protein) and collagen molecules revealed the pharyngeal BM has approximately three-fold less laminin but three-fold more collagen than the gonadal BM, indicating differences in BM composition and properties. Based on these observations, I hypothesize that collagen IV may be recruited to BMs either by other matrix proteins or cell surface receptors, and that distinct matrix protein and cell surface receptor machineries may regulate collagen localization to pharyngeal and gonadal BMs. To investigate these possibilities, I performed a targeted screen of matrix proteins and cell surface receptors by knocking them down via RNAi and/or examining null mutant alleles and quantifying mCherry-collagen levels at the BM. While discoidin-domain-receptors are not required for collagen IV localization to the BM, loss of syndecan and matrix proteins nidogen, perlecan, and agrin individually and in combination, significantly reduced pharyngeal BM collagen levels. Interestingly, gonadal BM collagen was unaffected in these animals. Together, our findings reveal a tissue-specific regulation of collagen IV incorporation into developing BMs.

Biological Sciences 1pm-2pm

Sydney Jeffs

A Perfusable Hollow Fiber in a 3D Poly(ethylene glycol)-based Vascularized 3D Scaffold

Faculty Mentor: Sydney Jeffs, Biomedical Engineering

Complex tissue engineering is necessary for the repair of damaged tissues and organs and requires the engineering of 3D, biomimetic scaffolds that are capable of delivering oxygen and nutrients. However, the applications of engineered scaffolds have been limited by insufficient vascularization of thick scaffolds. Our lab has previously shown that human umbilical vein endothelial cells (ECs) and pericytes co-cultured in degradable and cell-adhesive poly(ethylene glycol) (PEG) hydrogels form lumenized and perfusable microvascular networks. These hydrogels can be patterned to incorporate channels for fluid flow and the vascular networks within the hydrogels have been seen to anastamose to these channels. Here, we show that EC's and pericytes can form tubules around a semi-porous, hollow fiber (HF). The use of HFs in tissue engineered constructs is ideal for translational technologies because the pore size can be controlled to reduce immunogenic response. For example, a fiber with a molecular weight cut off of 100-150 kDa would allow free transport of larger carrier proteins such as albumin (~60 kDa) while preventing transport of immunoglobulins (~150 kDa), complement proteins (~200 kDa), and viruses. This increases the number of cell-sources for therapeutic tissue engineered constructs as well. Hydrogels containing polysulfone hollow fibers were successfully formed within the PDMS molds. The standard diffusion gradient for a blank hydrogel was established by running fluorescein (100 uM) through an HF channel contained within an acellular gel. After 96 hours, fluorescein was run through the hollow fiber at 0.2 ml/min and imaged at minutes 1, 2, 5, 10, 20 and 60 in blank gel to establish a standard diffusion gradient within our hydrogel system. Hydrogels containing ECs and HBVPs were prepared around HFs and exhibited robust tubule networks within 72 hours of encapsulation. Cell-laden V-hydrogels containing HFs exhibited increased tubule connectivity and vessel diameter (69.54±12.37 um) as compared to cell-laden V-hydrogels not containing HFs (35.89±11.76 um). Improved tubulogenesis within the HF system is a promising indication for the successful anastomosis of vessel networks to the HF which will be quantified by the diffusion of fluorescein through cell-laden gels.

Biological Sciences 12pm-1pm

Jill Jones

Optimizing Human Immune System Models in Studies of Human Autoimmune Diseases

Faculty Mentor: Mary Foster, Dept. of Medicine Nephrology

The study of autoantibodies is crucial to our understanding of human autoimmune disease. However, the B-cells producing them reside in lymphoid tissues that are not readily accessible. An alternative approach to study these cells in vivo is to use the human immune system mouse. The conventional model involves injecting human hematopoietic stem cells (HSC) into immunodeficient NOD scid gamma (NSG) mice, enabling a human immune system with human B- and T-cells to develop within 2-3 months post-engraftment. Though insightful, this model has one major limitation: human T-cells develop in the mouse thymus in the context of the mouse major histocompatability complex (MHC). Once they reach lymphoid tissues, mature human MHC+ B-cells and CD4+ T-cells cannot optimally engage with each other. To address this issue, we have adapted an optimized model. We use mutant NSG mice with a human MHC class II transgene inserted in the place of the mouse MHC class II. We inject HSC expressing the same human MHC gene, and human T-cell precursors develop in the mouse thymus in the context of the human MHC. Mature human B- and T-cells in lymphoid tissues can then properly interact. We report chimerism, a comparative measure of human and mouse CD45 expression, as a determiner of engraftment efficiency with this optimized model. To date, we have obtained a mean of 61% human chimerism in our mice, indicating that a human immune system successfully established in our model. Ongoing studies will determine the level of human immunoglobulin recovery (specifically IgG) after immunization.

Biological Sciences 10am-11am

Visible Thinking- Abstracts

Joseph Kreitz

Interaction network optimization improves the antimicrobial efficacy of phage cocktails

Faculty Mentor: Lingchong You, Biomedical Engineering

Bacteriophage therapy is a niche antimicrobial technique that has recently gained significant interest due to the emergence and rapid spread of multidrug-resistant bacterial pathogens. Unlike many chemical antibiotics, which can be active against a broad spectrum of bacterial targets, phages often need to be assembled into polyvalent cocktails consisting of ten or more unique phage isolates to achieve a level of breadth that is consistent with other modern antimicrobials. Although previous studies have documented several cases of synergistic or antagonistic interactions between competing phage strains, little is known about how prevalent these interactions are, or about how significantly they influence the efficacy of therapeutic cocktails. Here, I undertake a systematic in vitro characterization of pairwise interactions among a set of naturally-isolated phages using high-throughput combinatorial growth profiling. Notably, these experiments reveal that synergistic and antagonistic relationships are common among phages in vitro, suggesting that a rational cocktail design framework that optimizes these interaction networks ("iNets") could improve the antimicrobial efficacy of phage cocktails. Using a simple regression model incorporating the results of pairwise phage screening experiments, I thus identify higher-order cocktails that minimize mutual antagonism and maximize synergy. This work illustrates that a rational phage cocktail design framework incorporating information about pairwise phage-to-phage interactions can improve the net antimicrobial efficacy of polyvalent phage preparations, and suggests that interaction-based optimization strategies should be examined further for their ability to improve combination therapies involving other drug classes.

Biological Sciences 1pm-2pm

Napasorn (Nina) Kuprasertkul

Characterizing a novel genetically engineered mouse model of alveolar rhabdomyosarcoma

Faculty Mentor: Corinne Linardic, Pharmacology & Cancer Biology

Rhabdomyosarcoma is a rare pediatric cancer arising from mesenchymal cells that have features of skeletal muscle. Of the two histological subtypes, alveolar rhabdomyosarcoma (aRMS) and embryonal rhabdomyosarcoma (eRMS), aRMS has the worse prognosis with a 5 year survival rate of 50%. High risk aRMS cases are hallmarked by the t(2;13) chromosomal translocation encoding for the oncogenic fusion protein PAX3-FOXO1. These tumors are frequently metastatic at diagnosis, for which the 5-year survival rate reduces to less than 10%. Previous investigations from our laboratory revealed that the Hippo (MST1/2) tumor suppressor pathway may play a role in aRMS. To further explore this, we developed a novel genetically engineered mouse model (GEMM) of aRMS showing that Pax3:Foxo1 fusion positive mice null for the MST1/2 kinases (Pax3 -/-; Cdkn2a -/-; Stk3/4 -/-; Myf6 ICN/+) develop significantly more tumors compared to wild-type MST controls ($p = 0.0009$). In the present study, I show by immunohistochemistry that GEMM derived tumor tissues have aRMS morphology and stain positively for the skeletal muscle markers used in clinical diagnosis: MyoD, Myogenin, and Myf5. I then confirm allelic recombination in our model using PCR. In vitro assays on GEMM derived cell lines demonstrate that compared to MSTwt controls, MSTnull cells have increased motility, proliferation, and stemness. Overall, the results show that the MSTnull model encompasses the expected genetic changes and histopathology of aRMS, and presents promising avenues for characterizing disease progression of aRMS. Future studies can use the model to interrogate underlying biological mechanisms of aRMS and probe for therapeutic targets.

Biological Sciences 12pm-1pm

Visible Thinking- Abstracts

Anna Li

Adenoviral transduction of CXCR1 into human bronchial epithelial cells may stimulate directed migration towards IL-8

Faculty Mentor: Scott Randell, Cystic Fibrosis Center at UNC-CH

Cystic fibrosis somatic epithelial stem cell therapy has the potential to be a mutation-blind treatment or even cure for cystic fibrosis, but it is significantly hindered by the inefficiency of reintegration of CFTR-corrected cells into the lung stem cell niche. In order to help overcome this barrier, we opted to take advantage of the same mechanism neutrophils use to migrate into the lung epithelium to fight infections in cystic fibrosis (which has chronic inflammation due to these infections); i.e. to express the chemokine receptor CXCR1 in primary human bronchial epithelial cells (HBEs) cultured using the CRC method (which has been shown to keep HBEs in a more "stem-like" state such that they can be passaged for longer periods and still retain differentiative ability) in the hopes that expression of CXCR1 can encourage them to migrate toward an IL-8 gradient (which is very heavily expressed in the inflamed lung epithelium). To test this hypothesis, we created an adenovirus to express CXCR1, confirmed expression into HBEs using a western blot, looked at surface expression of CXCR1 using immunostaining and flow cytometry, and then finally conducted migration assays in an IL-8 gradient chamber and confirmed the presence of downstream signaling by tracking Akt and P-Akt levels in HBEs +/- CXCR1 and +/- IL-8 using a western blot. We found that CXCR1 could be stably expressed on the HBE cell surface and that it causes P-Akt to be chronically activated, which may lead to cell migration towards IL-8. This is, to the best of our knowledge, the first time that CXCR1 has been expressed in HBEs and tested in a migration chamber.

Biological Sciences 11am-12pm

Jing Li

Investigation of the role of zyxin expression on actin dynamics in spreading Drosophila melanogaster hemocytes.

Faculty Mentor: Dan Kiehart, Biology

Cell migration is central for many physiological and pathological processes, including embryonic development, immune response to injury or infection, and cancer metastasis. Adhesion-related proteins, in conjunction with actin cytoskeleton rearrangements, are essential for normal cell migration (Moreira et al., 2013). However, the detailed mechanisms of how these proteins affect cell migrations remain unclear. In this study, we examined how zyxin, an adhesion-related protein, affects actin dynamics in Drosophila melanogaster hemocytes, the insect equivalent of white blood cells. We genetically altered the levels of zyxin, specifically in hemocytes, using the GAL4/UAS system (Brand and Perrimon 1993). We isolated hemocytes from the Drosophila larvae, plated them on coverslips and imaged them using live confocal microscopy. After the cells adhered to the glass, we measured the rearward movement of actin at the leading edge, termed retrograde flow. The rate of retrograde flow was proportional to zyxin levels, with increased rates in cells with increased zyxin levels. This suggests that increased zyxin levels, and therefore increased adhesion strength (Ngu et al. 2010), promotes actin dynamics at the leading edge. In addition, more than half of the larvae overexpressing zyxin produced melanotic tumors, suggesting that zyxin expression promotes tumorigenesis. In the future, we plan to observe the structure of the cell adhesions that form when zyxin levels are manipulated, quantify cell adhesion and migration in hemocytes overexpressing zyxin, and explore the downstream factors that promote tumor formation in animals with increased zyxin levels.

Biological Sciences 10am-11am

Youlei Li

How Do Cells Invade? The Role of Lipid Metabolism in Invasive Cell Behavior

Faculty Mentor: David Sherwood, Biology

During development and disease progression, certain specialized cells can invade through basement membranes and into different tissues. In the nematode Caenorhabditis elegans, a specialized uterine cell, the anchor cell, invades through the basement membrane to establish a uterine-vulval connection during normal larval development in a highly precise and stereotyped manner. As such, anchor cell invasion in the C. elegans is a valuable in vivo model system to study invasive cell behavior. Due to the increased energy and resource demand of metastatic cells, I hypothesized that lipid metabolism would be uniquely important for invasive cell behavior. In this study, I identified three novel regulators of anchor cell invasion by RNAi knock-down screen, of which two were further confirmed by mutant knock-out screen. To investigate the mechanism by which the two hits, pod-2 and fasn-1, affects invasion, I performed a neutral lipid dye stain to compare anchor cell lipid levels to surrounding uterine cell lipid levels. I found the anchor cell contained a statistically significant higher level of lipids in wild N2 worms as did fasn-1 knock-outs. However, this phenotype was not observed in pod-2 knock-outs, suggesting a possible mechanism of pod-2 in regulating cell invasion. Future work will focus on CRISPR/Cas9 fluorescently tagging these two novel regulators to further understand the mechanism by which these regulators influence cell invasion. In the long run, understanding the unique energetic requirements of invasive cell behavior could help further elucidate mechanisms behind normal development and cancer metastasis.

Biological Sciences 1pm-2pm

Visible Thinking- Abstracts

Samantha McLendon
Social Function of Disgust Reactions in Lemur catta
Faculty Mentor: Charles Nunn, Evolutionary Anthropology

Disgust is defined in psychology as "revulsion at the prospect of oral incorporation of an object". Although it has been primarily discussed in humans, research shows that many primates respond to bitter stimuli with facial expressions similar to the human "disgust face" Disgust could help prevent primates from ingesting parasites or toxins. Lemur catta display disgust reactions (head-shaking) in response to sour stimuli, and previous primate research has demonstrated social learning related to accepting novel foods, though little evidence suggests social learning of food avoidance. This study investigated whether head-shaking serves as a social cue (information used by observers to make a decision), a social signal (intentional message sent by performer), or neither. The experiment presented a performing lemur with a control and sour-flavored food item on different colored plates, and in some trials an observing lemur had the opportunity to watch the performer's behavior from an adjacent enclosure. The observer was then presented with the same set up where applicable. Video analyses found that headshake observation did not facilitate avoidance of sour stimuli, indicating that head-shaking does not serve a social cue. Observer presence did not significantly affect likelihood of head-shaking, which implies that it is not also not an intentional signal. The data do suggest that individual learning may play a role in avoidance, and that food acceptance may be socially influenced. The results also indicate a possible impact of social rank on attention paid to conspecifics.

Biological Sciences 12pm-1pm

Visible Thinking- Abstracts

Vincent Miao

UV-stabilized biomimetic polymers self-assemble into complex microarchitectures

Faculty Mentor: Ashutosh Chilkoti, Biomedical Engineering

Biomimetic polymers, inspired by naturally-occurring materials found in the body, have shown great promise in myriad biomedical applications to address today's most pressing healthcare challenges. In particular, many peptide biopolymers have demonstrated significant clinical utility as drug and cell delivery platforms due to (1) their overall biocompatibility from their similarity to endogenous materials and (2) exact sequence control on the amino acid level and (3) facile attachment to biologically active motifs through high-yield recombinant synthesis techniques. Elastin-like polypeptides (ELPs) are one such class of biopolymers that have been extensively studied as drug delivery agents due to their tunable thermally-stimulated phase behavior. Recent research in our lab has also indicated that the addition of interspersed ordered polyalanine domains into intrinsically disordered ELP constructs results in partially-ordered polymers (POPs) that self-assemble into microporous fractal networks and are therefore enticing candidates for cell scaffold applications. In this work, a library of UV-crosslinkable POPs (xPOPs) was created through the incorporation of para-azidophenylalanine directly during recombinant protein synthesis. These polymers demonstrate the same temperature-responsive behavior of their non-crosslinkable counterparts before stabilization as well as self-assembly into tunably-porous fractal networks. Furthermore, stabilized xPOPs were used for the first ever example of a porous peptide microparticle system stable in aqueous solution as well as constituents of two complex xPOP-ELP microarchitectures with highly-tunable geometries. Both the "fruits-on-a-vine" and core-shell architectures created present significant progress in the biomaterials field, as their architectural complexities are greater than any other self-assembling peptide system found in the literature to date.

Biological Sciences 12pm-1pm

Prarthana Minasandram

Effects of encephalization quotient on lemur learning and problem solving

Faculty Mentor: Leslie Digby, Evolutionary Anthropology

This project explores the relationship between encephalization quotient (EQ) and lemurs' problem-solving ability by investigating lemur puzzle box response across trials. Trials were conducted with seven groups of four lemur species (n = 14) from the Duke Lemur Center. The main finding showed that all lemur species learned how to solve the puzzle box and had an increased rate of puzzle solving across trials, but EQ had no significant relationship to these variables. Alternatively, species, age, sex, and diet all had significant relationships to average time to solve. Ruffed lemurs had a significantly longer time to solve (40.50 seconds ± 12.54) than ring-tailed lemurs (9.51 seconds ± 1.50), red-fronted lemurs (7.89 seconds ± 2.09), and blue-eyed black lemurs (4.14 seconds ± 0.58). Young adult groups take less time to solve the puzzle (n= 3, 5.26 s ± 0.74) than the prime age (n = 5, 7.81s ± 0.75) and elderly groups (n = 5, 19.30s ± 4.51). Female lemurs (n = 6, 6.99s ± 4.76) solved the puzzle box faster than male lemurs (n = 7, 15.55s ± 3.29). The obligately frugivorous group (40.50 seconds ± 12.54) had a longer time to solve than the moderately frugivorous (5.59 seconds ± 0.92) and generalist groups (9.51 seconds ± 1.50). These findings may suggest that EQ has less predictive quality of cognition at a species level than previously thought and serves as a branching point to understand what variables are the most predictive of problem solving.

Biological Sciences 1pm-2pm

Chandler Moore
Design and Delivery of Pro-apototic Glioblastoma Therapeutics
Faculty Mentor: Ashutosh Chilkoti, Biomedical Engineering

There is a critical need for development of effective and targeted therapeutics for glioblastoma treatment. With a mean survival time of 10 months after diagnosis and a recurrence rate of over 90%, glioblastoma multiforme (GBM) remains the most malignant form of brain cancer and one of the most harrowing diagnoses. Current treatments, including surgery, radiotherapy, and temozolomide, remain insufficient and nonspecific. While targeted pro-apoptotic protein therapeutics have shown promise in many preclinical cancer models, their utility in GBM treatment has been significantly hindered by drug resistance and delivery limitations. Specifically, agonists of pro-apoptotic receptors, such as TNF-related apoptosis-inducing ligand receptor 2 (TRAILR2), could be powerful targeted anti-cancer drugs if these hindrances are addressed in the context of GBM treatment. The current proposal aims to address two barriers to use of pro-apoptotic protein therapeutics in the treatment of GBM: delivery and potency. To tackle the delivery problem, we engineer thermally sensitive protein drugs that form three-dimensional gel depot structures in vivo for sustained drug release into the brain. To improve sensitivity to pro-apoptotic receptor agonists in GBM cell lines, we test rationally designed drug combinations that overcome GBM drug resistance to TRAIL receptor agonists. This project first focuses on design and cloning of the pro-apoptotic fusions, analysis of the depot-forming protein fusions using light scattering and spectrophotometry, and evaluation of potency using in vitro cytotoxicity assays. Second, these fusions are tested in combination with small molecule therapeutics aimed at further sensitizing GBM cell lines to the pro-apoptotic TRAILR2 superagonist.

Biological Sciences 10am-11am

Margo Orlen

Investigations of GPCR/Beta-arrestin Complex Interactions via a BRET Assay

Faculty Mentor: Marc Caron, Cell Biology

Beta-arrestins regulate G protein-coupled receptors (GPCRs) by inhibiting GPCR signaling through G proteins. Beta-arrestins are also important regulators for mediating endocytosis of GPCRs in clathrin-coated pits and initiating G protein-independent signaling cascades. The interaction between GPCRs and beta-arrestin can be measured using a bioluminescence resonance energy transfer (BRET) assay. However, a BRET assay currently does not exist that measures interaction between tripartite complexes of the GPCR, arrestin, and an effector. Therefore, our lab has developed a BRET assay capable of detecting GPCR and beta-arrestin in complex with internalization and signaling components. By combining a recently described split luciferase, which generates bioluminescence upon beta-arrestin binding to a GPCR, with BRET acceptor tagged effectors, we can monitor these complexes in real time. This project specifically investigates the interaction of the beta-2 adrenergic receptor (B2AR), vasopressin receptor 2 (V2R), and dopamine D2 receptor (D2R) with beta-arrestin and multiple effectors of signaling and internalization using the BRET assay. We show that our BRET assay can be used to monitor the formation of known GPCR/arrestin/effector complexes in real time. Future experiments will use this assay to investigate further how the scaffolding protein beta-arrestin mediates both receptor internalization and G-protein-independent signaling and will investigate the kinetics of these events. The results will contribute to elucidating the underpinnings of GPCR signaling by further characterizing the multifaceted actions of beta-arrestin.

Biological Sciences 12pm-1pm

Samuel Pan

Effects of Protein Kinase ATM on Ferroptosis

Faculty Mentor: Jen-Tsan Ashley Chi, Molecular Genetics & Microbiology

Ferroptosis is a form of programmed cell death with implications in kidney failure and cancer. Ferroptosis requires iron in order to occur, and can therefore be inhibited by iron chelators. While protein kinases ATM and ATR are traditionally activated by DNA double-strand breaks, a decrease in the expression of ATM/ATR is associated with increased resistance to ferroptosis, though the mechanism is unknown. Through gene silencing using siRNA, we observed induction of iron homeostasis genes FTH1 (heavy subunit of ferritin), FTL1 (subunit of ferritin), and FPN1 (iron export), as well as suppression of TFRC (iron import) when depleting ATM. Ferritin is an iron storage protein and a chelator target that can prevent ferroptotic cell death. Additionally, we have observed that decreased activity of transcription factors NRF2, MTF1, and MZF1(ATM/ATR targets) increases sensitivity to ferroptosis. ATM may affect these activity levels through phosphorylation. We will aim to elucidate a potential mechanism through which ATM/ATR phosphorylate these transcription factors, ultimately conferring resistance to ferroptosis.

Biological Sciences 10am-11am

Hee Su Park

Examining the Role of Chromosome Maintenance Region 1 (CRM1) in Myelodysplastic Syndromes

Faculty Mentor: Phuong Doan, Pharmacology & Cancer Biology

Myelodysplastic syndromes (MDS) are a collection of heterogeneous bone marrow disorders in which there are insufficient healthy blood cells, often leading to acute myeloid leukemia (AML). Approximately a third of patients develop AML, and half of patients with high risk disease die within a year. This demonstrates that current therapies are insufficient to achieve a cure, so we wanted to explore novel therapies and focused on chromosome maintenance region 1 (CRM1), a major nuclear export receptor protein. Previous studies have shown that CRM1 is overexpressed in solid tumor types and hematologic malignancies, so it has been linked to resistance to therapy and poor prognosis of malignancies. However, its role specifically within MDS still needs to be investigated. We hypothesized that CRM1 is a promising therapeutic drug target for MDS and expected high CRM1 expression in MDS cells. To test this hypothesis, we measured levels of expression using complementary methods of real-time polymerase chain reaction (PCR) and immunofluorescence. We discovered that CRM1 mRNA expression was four-fold greater in human myelodysplastic cells by real-time PCR compared to normal human hematopoietic cells (n = 3, *p < 0.0001). Likewise, human MDS cells display high levels of CRM1 protein expression by immunofluorescence detection. Since CRM1 is differentially expressed in MDS cells compared to non-malignant hematopoietic cells, it could be targeted to treat MDS while sparing toxicity to non-malignant hematopoietic cells. We will confirm these findings in other cancer types including AML. Future directions will involve loss-of-function studies using different CRM1 inhibitors, like selinexor (KPT-330).

Biological Sciences 12pm-1pm

Breanna Polascik

What are the Characteristics of Patients who want Perioperative Music Therapy?

Faculty Mentor: Karthik Raghunathan, Department of Anesthesiology, Duke University School of Medicine

Perioperative music reduces anxiety, pain, analgesia, sympathetic nervous system activity, and improves patient satisfaction. We offered music via iPods/headphones to Veterans scheduled for major surgery at Durham VA Medical Center to examine characteristics of patients who did want/did not want perioperative music based on Yes/No answers to "If available, do you want to listen to music?" Via text-mining, we contrasted patients based on their answer of Yes/No. Visits to Mental Health, Pain, and Substance Use Disorder (SUD) Clinics within 2 years before surgery, opioid use within 180 days before surgery, and mean pain scores within 90 days before surgery were compared for answers Yes vs. No. Of 3,307 Veterans, 68% said Yes. 31%, 8%, and 6% had visited a Mental Health, Pain, and SUD Clinic respectively. 26% (n=852) had chronic preoperative opioid use. 36% (n=1204) reported a mean pain score >4 within 90-days preoperatively. Veterans who answered Yes were slightly younger, more likely to be female, or African-American, were more likely to have visited Mental Health, Pain, and SUD Clinics and to have mean pain scores >4. Chronic opioid use was not associated with Yes/No. Younger adults may be more likely to report and seek alternatives to reduce perioperative pain. Greater acceptance of music among women may be related to differences in pain perception across genders. African-Americans report higher pain sensitivity than Caucasians. The finding that music is more acceptable to Veterans with Mental Health, Pain, or SUD Clinic visits suggests opportunities to implement effective non-pharmacological interventions for pain management.

Biological Sciences 10am-11am

Visible Thinking- Abstracts

Breanna Polascik

Biomechanics of Dance and Dance Injury: Impact Forces and Shockwaves associated with Years of Tap Dancing Experience

Faculty Mentor: Daniel Schmitt, Evolutionary Anthropology

The biomechanics of tap dance, an impact-heavy style of percussive dance, may predispose to musculoskeletal injuries. Do years of tap dancing experience influence the magnitude of the forces and shockwaves produced at the foot? We studied 15 female tap dancers aged 18-49 years old. Dancers who had not danced for > 4 years and those with major musculoskeletal injuries within the last 6 months were excluded. Years of tap dancing experience, height, and body weight were recorded. Each subject performed 3 trials of a tap combination containing specific steps (cramp roll, flap, heel cannon, toe cannon). Data were collected from accelerometers, markers, force plates, and video cameras. Data were transferred to MATLAB to find the maximum ground reaction force and shockwave during each of the four steps and kinematic data was analyzed in DLTDataviewer. Ankle angle, average vertical velocity of the foot, and relative height of the wrist and shoulder were also calculated for each of the four steps. Peak forces as well as arm position, ankle angle, and average foot velocity were compared between steps within performers and as a function of experience level across performers. Results will be presented. Knowledge gained could help understand the likelihood of injury for tap dancers with varying experience and help develop strategies to mitigate risk.

Biological Sciences 10am-11am

Breanna Polascik

Acceptability and Feasibility of the Implementation of Perioperative Music Listening

Faculty Mentor: Ban Leong Sng, Anesthesiology

Perioperative music decreases pain, anxiety, and analgesia requirements and increases patient satisfaction. We investigated the strategy for implementing organizational change introducing perioperative music in a Singapore women's and children's hospital, including healthcare workers' acceptability, and challenges with facilitation. Participants included nurses and anesthesiologists in the pre-operative clinic, operating room, and recovery. A written baseline questionnaire assessing attitudes/knowledge about perioperative music was answered by participants, followed by a presentation introducing perioperative music intervention and study debriefing. Nurses/anesthesiologists repeated the survey assessing attitudes and knowledge and also implementation exposure. Nurses were interviewed with semi-structured questions targeting attitudes, knowledge, and barriers to implementation. Nurses completed the survey again one month later. Our study surveyed 37 nurses and 33 anesthesiologists. Acceptability of perioperative music increased over time for nurses and anesthesiologists but was sustained in nurses. Nurses' attitudes about perioperative music were consistently positive and strong. Anesthesiologists' attitudes changed from neutral to positive. Qualitative semi-structured nurse interviews supported the findings and revealed several implementation barriers including patient interest, timing, and added workload. Most nurses supported the intervention, noted positive benefits, and suggested that perioperative music could also be effectively implemented in major operating rooms. Implementation of perioperative music was both acceptable and feasible in Singapore. The nurses' and anesthesiologists' acceptability of perioperative music increased over time with mostly positive qualitative feedback. Implementation barriers appeared minor and could potentially be overcome utilizing the intervention pre-operatively instead of post-operatively, in major instead of minor operating rooms, and by evenly distributing workload to circumvent individual workload

Biological Sciences 10am-11am

Visible Thinking- Abstracts

Bryce Polascik

Assessment of Differences in Retinal Microvasculature Using OCT Angiography in Alzheimer's Disease: A Twin Discordance Report

Faculty Mentor: Dilraj Grewal, Department of Ophthalmology, Duke University School of Medicine

We report the optical coherence tomography angiography (OCTA) based comparative assessment of the retinal microvasculature in a rare pair of 96-year-old female monozygotic twins discordant for Alzheimer's disease. Using automated mapping of the superficial capillary plexus, we observed that the twin with the advanced Alzheimer's disease had a significantly reduced vessel density and a larger foveal avascular zone in the superficial capillary plexus as well as a thinner choroid compared to the twin who was cognitively normal. This unique twin discordance report adds to the evidence supporting the use of retinal microvasculature changes in the superficial capillary plexus on OCTA as a possible noninvasive biomarker for Alzheimer's disease.

Biological Sciences 11am-12pm

Bryce Polascik

Total Knee Arthroplasty Yields Acceptable Short-Term Outcomes in Stiff Asian Knees

Faculty Mentor: Hamid Rahmatullah Bin Abd Razak, Orthopedics

This study aims to evaluate outcomes following total knee arthroplasty in Asians with stiff knees. Registry data of patients undergoing primary total knee arthroplasty between 2004 and 2013 were collected. Sociodemographic and anthropomorphic data together with Knee Society Score, which consists of the Knee Society Knee Score and the Knee Society Function Score, and Oxford Knee Score were collected. These scores were collected prospectively, preoperatively and postoperatively up to 2 years. Cases were patients with a preoperative flexion range of ≤ 20°. Controls were patients with a preoperative flexion range of > 90°. Patients were matched for age, gender, and all preoperative scores in a 2:1 fashion. 2-year outcomes and 5-year revision rates were then compared between cases and controls. There were 28 cases and 56 controls. Controls had a significantly higher body mass index than the cases (p=0.0003) and had a shorter hospitalization (p<0.0001). More controls were discharged directly home as compared to cases (p=0.011). There were no differences in inpatient complication rates. At 2 years, controls had significantly higher flexion range (p<0.0001) and a higher Knee Society Function Score (p=0.020). Cases had significantly greater improvement in the flexion range (p<0.0001). Mean change in functional outcomes from preoperative to 2 years was comparable. 71% of cases and 84% of controls were satisfied. There was a significant difference in the 5-year revision rate (10% vs 0%; p=0.013). Total knee arthroplasty is reliable for improving flexion range and has acceptable outcomes and satisfaction in stiff Asian knees.

Biological Sciences 11am-12pm

Ivana Premasinghe

Optimizing Methodology and Determining Gene Expression Profiles across Alzheimer's Disease Pathologies through Single-Cell Capture

Faculty Mentor: Orint Chiba-Falek, Neurology

Single-cell capture methods have only recently become utilized for human brain analysis techniques, which are usually dominated by whole brain tissue examination. The use of single-cell capture methods allow for specific analysis of the functions of individual cells. The goal of this project was to utilize single-cell capture to analyze gene expression profiles of normal, mild-cognitive impairment (MCI), mild AD, and severe AD frozen human brain samples. The study took place in two parts. The first part of the study focused on the optimization and comparison of two single-cell capture techniques. The two methods- Laser capture microdissection (LCM) and Fluorescence-activated nuclei sorting (FANS)- were conducted, analyzed, and compared on the basis of counts, efficiency, and experimental process. Through the comparison of experimental measures and counts for genes of interest, cell-specific genes, and housekeeping genes, it was determined that the FANS process was the preferred method of choice- due to more consistent, increased number of counts and greater experimental efficiency. The second portion of the project is still underway. This involves the continuation of the FANS method as well as post-FANS analysis, which includes ATAC-Sequencing and RNA extraction. The ultimate goal of the project is to utilize data from the post-FANS analysis to examine genetic trends across pathology. Thus far, the FANS analysis method continues to be optimized. The counts show favorable trends, with a decrease in neuronal counts across pathology, and an increase in non-neuronal counts across pathology.

Biological Sciences 11am-12pm

Laura Quillen

The Effect of Housing Conditions on the Behavior of Captive Propithecus coquereli

Faculty Mentor: Erin Ehmke, Duke Lemur Center

In captivity, primates often experience routine, seasonal, or permanent changes in their housing conditions. As primates have been known to modify their behavior in response to changing environmental conditions, it is important to consider the role of variable housing conditions in captive animal behavior. While the effects of variable housing conditions have been well-documented for many primate species, few studies have described such impacts in Lemuriformes. In this study, I evaluate the effect of seasonal housing changes on the behavior patterns of captive Propithecus coquereli groups at the Duke Lemur Center. Using continuous focal animal sampling, I compared the behavioral activity budgets of two free-ranging groups (n=8) as they experienced a seasonal reduction in enclosure size from large, forested enclosures to building enclosures. Across groups, I found slight increases in locomotion and resting behavior and a small decrease in social behaviors between forested and building housing conditions. However, these patterns were not statistically significant and thus suggest that the impact of seasonal housing changes for captive P. coquereli groups are minimal. Future studies should investigate the effects of variable housing conditions for a longer study period to determine if any long-term trends in behavior emerge.

Biological Sciences 1pm-2pm

Sarah Rapaport

A Triple Transgenic Conditional LRP1 Knockout Murine Model For Traumatic Brain Injury

Faculty Mentor: Brad Kolls, Neurobiology

Traumatic Brain Injury (TBI) is a major public health problem that can cause devastating neurological outcomes. Presently there are no proven pharmacological treatments for TBI. Research has shown that the devastation from TBI is due in large part to a secondary inflammatory response that is characterized by cerebral edema, microglia and astrocyte activation, and the release of inflammatory cytokines and reactive oxygen species. There is evidence that derivatives of the apolipoprotein E (apoeE) compound, if small enough to cross the blood brain barrier, can modify this neuroinflammatory response by down regulating glial activation. However, the mechanism by which apoE modifies neuroinflammation is presently unknown, although it is suspected that apoE works through the LRP1 receptor. To study this, we developed a triple transgenic conditional neuronal LRP1 knockout mouse model. This model shows no functional behavioral differences when compared to the wild type C57BL/6 mouse and when temporally controlled by tamoxifen, exhibits evidence of LRP1 deletion. Thus, when used to study TBI, this knockout model is both truly an LRP1 neuronal knockout and functionally the same as the wild type C57BL/6 mouse and therefore can be used to study the role of the LRP1 receptor in mediating functional outcomes in TBI in future experiments.

Biological Sciences 1pm-2pm

Anna Savelyeva

The Role of the Lysine Demethylase KDM2B in the Response to Ionizing Radiation

Faculty Mentor: Scott Floyd

Many cancers are treated with a combination of chemotherapeutic drugs and radiation therapy. Radiation is particularly important in cancers that have limited chemotherapeutic options, such as brain tumors. Agents that strengthen the effects of ionizing radiation, i.e. radiation sensitizers, can improve treatment and clinical response. A screen performed by our group identified epigenetic modifiers, in particular the lysine demethylase KDM2B, as a mediator of the DNA damage response. KDM2B is an a-ketoglutarate dependent jumonji-domain lysine demethylase. Preliminary data shows that knockdown of KDM2B with siRNA increases H2AX phosphorylation (YH2AX) both at baseline and following exposure to ionizing radiation. Following radiation, damage to the DNA induces the phosphorylation of the core histone protein H2AX. Levels of YH2AX are indicative of the amount of DNA damage in the cell. Thus, KDM2B knockdown cells are more sensitive to both endogenous DNA damage and that induced by ionizing radiation. Abrogation of KDM2B also delays the repair of radiation induced double strand breaks. In addition, inhibition of KDM2B results in a loss of signaling through downstream DNA repair pathways, as seen by a global decrease in phosphorylation of targets of the critical repair enzymes ATM and ATR. Further investigation revealed a decrease in phosphorylation of the checkpoint enzyme Chk2. Chk2 phosphorylation inhibits progression of damaged cells through the cell cycle, affording time to repair DNA damage before attempting mitosis. Additionally, 53BP1, a DNA repair protein that promotes the non-homologous end joining (NHEJ) repair pathway shows decreased localization and foci formation following radiation in knockdown cells. These data indicate that KDM2B inhibition increases sensitivity to ionizing radiation, making it a potential therapeutic target for improving cancer therapy.

Biological Sciences 1pm-2pm

Visible Thinking- Abstracts

Annika Sharma

Investigation of the oxytocin system in monogamous and promiscuous Eulemur using receptor autoradiography

Faculty Mentor: Christine Drea, Evolutionary Anthropology

Across mammalian taxa, oxytocin (OT) is a well-known hormone and neuropeptide commonly associated with parturition, nursing, and maternal behavior. Many evolutionary biologists argue that these ancestral functions have been co-opted in some species to mediate mating bonds. This project makes use of natural variation in mating systems (i.e., monogamous vs. promiscuous) within seven species of Eulemur (a genus of Strepsirrhine primates endemic to Madagascar) to characterize intra- and inter-species variation in the OT system. If OT underlies monogamous pair bonds, receptor density in target brain regions should be greater in monogamous than in promiscuous Eulemur species. After sectioning preserved Eulemur brain tissue from eleven subjects (made available following the natural mortality of animals at the Duke Lemur Center) at 20 micron on a cryostat and mounting on adhesion slides, we will measure the distribution of OT receptors (OXTR) via autoradiography procedures. Unlike in rodent tissue (on which most of the existing work in this field has been done), commercially available OT radioligands exhibit a high affinity for both OXTR and arginine vasopressin receptors (AVPR1a) in many primates, necessitating the use of a competitive binding protocol developed using rhesus macaque brain tissue. Understanding the underlying differences in the OT system of nonhuman primates could elucidate the evolutionary mechanisms driving the appearance and maintenance of social systems, while also shedding light on the neurobiological basis of social attachment in humans.

Biological Sciences 11am-12pm

Grace Smith

Neuronal spine density in the subgenual anterior cingulate cortex in postmortem brain of controls and subjects with posttraumatic stress disorder and major depressive disorder

Faculty Mentor: Doug Williamson, Department of Psychiatry & Behavioral Sciences, Translational Neuroscience, School of Medicine

Post-traumatic stress disorder (PTSD) and major depressive disorder (MDD) impact 6-9% of American adults with serious implications of suicidality and disability. The subgenual region of the anterior cingulate cortex (sgACC) connects with the amygdala and hippocampus to modulate emotional behavior associated with fear and memory. The sgACC has shown trait volume decreases and state hyperactivity in MDD and PTSD. These changes may be associated with alterations in structural connectivity of dendritic spines in cortical neurons. This study examined the differences in spine morphology in the sgACC among control subjects and subjects with PTSD or MDD. The sgACC from 111 postmortem human brains was obtained from the National Center for PTSD Brain Bank and prepared using the Golgi-Cox method to classify and count visible spine heads (classifications were mushroom, stubby, thin, and filopodial). Spine densities (number/um) of control (n=28), PTSD (n=42), and MDD (n=41) subjects were measured. There is a significant diagnostic difference in filopodial density (ANOVA, p=0.0191), and a posthoc Wilcoxon comparison revealed that the density of filopodial spines are higher in PTSD versus MDD (p=0.0058). Filipodial spines are a transition phase of dendritic spines that can indicate the establishment of stable spines or the retraction of a spine. These findings suggest that in the sgACC, PTSD and MDD have differential densities of filopodial spines that may indicate greater transitions of spine morphology. This will help to further understand how changes in neuronal connectivity in the prefrontal cortex may contribute to the cortical dysfunction observed in subjects with mental illness.

Biological Sciences 10am-11am

Jake Thomas

Changes in Cerebrospinal Fluid Leukocyte Levels in Patients before and after Surgery Using an Optimized Polychromatic Flow Cytometry Panel

Faculty Mentor: Miles Berger, Anesthesiology

Post-Operative Cognitive Dysfunction (POCD) is the development of a new cognitive impairment following surgery and has been shown to affect up to 40% of patients over age 60. Mouse model studies have identified mechanisms that might underlie POCD, such as malfunction of the blood-brain barrier, failure to resolve inflammation, and/or neuroinflammation. Here, we explore human postoperative neuroinflammation by examining cerebrospinal fluid (CSF) leukocyte profiles before and after surgery using flow cytometry. We first designed a 12-plex polychromatic flow cytometry panel to detect changes in CSF cell populations in surgical patients. We then analyzed CSF leukocytes in 5 patients with POCD and 5 matched patients without POCD. CSF cells were isolated, cryopreserved, thawed, surface stained, acquired using a custom-LSRFortessa, and analyzed using FlowJo software. Key populations were identified via gating. We detected 12,654 +/- 1631 cells/10 ml CSF sample (~1.2 cells/uL). The CSF monocyte/lymphocyte ratio increased 24 hours and 6 weeks after surgery in patients who developed POCD, but not in those who did not. Patients with POCD also showed decreased MCP-1 receptor density (mean fluorescence intensity) on CSF monocytes 24 hours after surgery ($p=0.03$, via log rank test). These data demonstrate the feasibility of performing polychromatic flow cytometry on the CSF of older adults before and after surgery. These data also suggest that postoperative changes in CSF monocyte levels warrant further investigation as a potential neuroinflammatory mechanism underlying POCD and/or delirium.

Biological Sciences 10am-11am

Paul Wang

Repetitive Exposure of O,O-Diisopropyl Phosphofluoridate (DFP) In Vitro Disrupts Cell Surface Markers and Dysregulates Cytoskeletal Proteins

Faculty Mentor: Mohamed Abou-Donia, Pharmacology & Cancer Biology

O,O-Diisopropyl phosphofluoridate also known as Diisopropylfluorophosphate (DFP) a model compound used to understand the mechanisms of toxicity, as some of the other phosphates such as sarin and soman are synthesized and produced as a chemical warfare agent, one of the first being cholinesterase inhibitor organophosphate. Since this was used in the first rodent model to describe Gulf War Illness (GWI), we were interested in exploring its effect in-vitro in various cell types. We used human cell lines from various organs, lung cells, retinal epithelial cells, cardiac myocytes, STTG neuronal cells, T cells, Macrophages, B cells and LnCap prostate gland cancer cell lines. Since DFP undergoes hydrolysis when subjected to moisture, we subjected the cells to five-minute repetitive exposures at the concentration of 0.1uM DFP, interspersed with 24-hour recovery periods. We collected the supernatants to assay for matrix metalloproteinase and cellular proteins to look for up-regulation or down-regulation of various inflammatory protein markers. We observed a time-dependent decline of cell-specific surface markers, androgen receptors in LnCap cells, and (Major Histocompatibility Complex) MHC Class I in T cells and MHC class II in B cells, RPE65 in ARP19 cells. The dysregulation of actin or tubulin was gradual but minimal, interestingly we observed many cellular proteins such as CaMKII, ErK and AKT phosphorylated. We hypothesize that repetitive exposure to DFP even at a sub-lethal dose causes cellular dysfunction.

Biological Sciences 10am-11am

Visible Thinking- Abstracts

Yifei Wang

Building a BLT-Humanized Mouse Model on the Clade C HIV-1 Infection

Faculty Mentor: Martina Kovarova, UNC School of Medicine

In the last decade much effort has been put into developing a small animal model that would support HIV replication and recapitulate HIV pathogenesis in humans. The BLT (bone marrow, liver, thymus) humanized mice, immunodeficient mice engrafted with functional human cells and tissues, have served as a valuable model for the study of various aspects of HIV infection including mucosal transmission, novel antiretroviral therapies, viral latency, and reservoir eradication. Currently, the BLT humanized mouse model on the clade B HIV infection, found primarily in North America and Western Europe, has been built and characterized. An in vivo modeling of the clade C HIV infection, which comprises 48% of the global HIV infections, has yet to be developed. In this project, we intravaginally inoculated female BLT humanized mice with a transmitted/founder clade C HIV, ZM246F_10. We monitored the infection by assessing HIV-RNA levels in the plasma and cervico-vaginal lavage (CVL) via real-time RT-PCR and by evaluating percent circulating human CD45+ cells, CD4+ T cells, and activated CD8+ T cells in the peripheral blood via FACS. In conclusion, we established 66% infection in the BLT humanized mice challenged with 3.0×10^5 TCIU of the virus, building the first in vivo modeling of the clade C HIV infection and allowing for the future in vivo study of antiretroviral therapies targeting the clade C HIV.

Biological Sciences 11am-12pm

Visible Thinking- Abstracts

Angela Wei

Identifying Key Genetic Regions in the Drosophila Genome Important for Cell Sheet Morphogenesis

Faculty Mentor: Dan Kiehart, Biology

Cell-sheet morphogenesis plays a key role in wound healing and vertebrate developmental processes, such as neural tube and palate formation. Many molecular mechanisms that drive cell-sheet movements are still unknown. Increased understanding of these processes can lead to advancements in therapies to treat human developmental abnormalities. Dorsal closure is a process during Drosophila melanogaster (fruit fly) embryogenesis that uses similar tissue movements to vertebrate morphogenesis, and is amenable to in vivo microscopy and gene discovery, making it an ideal model for cell-sheet morphogenesis. In order to better understand the molecular mechanisms underlying closure, we have screened ~1/5th of the Drosophila genome using large genome deletions, or deficiencies (Dfs). By time-lapse imaging GFP-labeled cell junctions in embryos homozygous for each deficiency, we were able to score for dorsal closure phenotypes to determine regions of the genome that contain novel dorsal closure genes. To narrow down a deficiency to the gene(s) responsible for the phenotype, we used smaller, overlapping sub-deficiencies. I focused on two deficiencies, Df(2R)07 and Df(2R)08, and have narrowed down each deficiency from 111 genes to regions containing 10-15 genes. Df(2R)07 is characterized by pinching and scarring during closure and altered localization of actin and myosin, whereas Df(2R)08 embryos rip apart and fail closure. Further work using single gene mutants and CRISPR techniques will determine the precise gene(s) causing the dorsal closure phenotype. These findings will provide a more complete list of dorsal closure genes and contribute to the understanding of the molecular mechanisms that drive cell-sheet morphogenesis.

Biological Sciences 1pm-2pm

Abigail Xie

Loss-of-Function CRISPR Screening Metabolic-Apoptotic Interactions in Acute Myeloid Leukemia

Faculty Mentor: Kris Wood, Pharmacology & Cancer Biology

The reprogramming of metabolic pathways to fuel uncontrolled cell proliferation is a defining hallmark of cancer, but the extent to which these vulnerabilities can be exploited to potentiate programmed cell death, or apoptosis, remains largely uncharacterized. To systematically explore the intersection between metabolic dysregulation and the apoptotic paradigm in the cancer cell, we performed CRISPR/Cas9-based loss-of-function screens with a library targeting 2300 metabolic enzymes and transporters. The screens were performed in two Bcl-2-dependent acute myeloid leukemia (AML) cell lines, using Bcl-2 inhibitor ABT-199 as a molecular probe for apoptotic sensitivity. This screening platform was employed to comprehensively identify the metabolic genes and pathways that can be targeted to potentiate apoptosis in AML; notably among those pathways are glutathione synthesis and de novo purine and pyrimidine synthesis, which we have functionally validated with pharmacological handles. The screen also identifies the heme biosynthetic pathway as an unreported apoptosis-promoting pathway. We determine that deficiency of heme, a key prosthetic group, compromises electron transport chain integrity, resulting in baseline depolarization of the mitochondrial membrane and an increased propensity for apoptosis. Overall, we have produced the first metabolic map of apoptosis, systematically detailing both known and novel associations between metabolism and apoptosis and providing a template for designing metabolically-engaged combination treatment strategies.

Biological Sciences 10am-11am

Madison Zamora
Multiplication of the SNCA Locus Exacerbated Neuronal Nuclear Aging
Faculty Mentor: Orint Chiba-Falek, Neurology

Over the last decade, induced Pluripotent Stem Cell (iPSC)-derived models have advanced the study of such neurodegenerative diseases as Parkinson's disease (PD) and dementia with Lewy Bodies (DLB). While age is a critical factor in the etiology of these disorders, iPSC-derived models more closely represent rejuvenated neurons, as the differentiation process "resets" the cells to a juvenile phenotype. Here I describe the development of iPSC-derived "aged" dopaminergic and cholinergic neurons to model PD and DLB, respectively. I aimed to induce aging through a semi-"natural" process by applying multiple passaging at the Neural Precursor Cell (NPC) stage prior to terminal differentiation. Analysis of isogenic iPSC-derived neurons using heterochromatin markers, nuclear envelope markers, and DNA damage quantification validated this method of inducing aging. I next compared neurons derived from a patient with SNCA-triplication (SNCA-Tri) to neurons derived from an apparently healthy control. The SNCA-Tri neurons displayed exacerbated nuclear aging, showing advanced aging signatures already at the juvenile stage. Having successfully developed and optimized a protocol for aging neurons in vitro, I suggest a link between the effects of aging, SNCA overexpression, and neuronal nuclear architecture.

Biological Sciences 12pm-1pm

Karen Zhao

Investigation of Eotaxin Production by Lung Fibroblasts in Obese Asthma

Faculty Mentor: Jennifer Ingram, Medicine

In obese allergic asthma, increased levels of leptin and Interleukin-13 (IL-13) recruit eosinophils to lung airways, which causes inflammation of airway tissue and contributes to airway fibrosis. Several studies have observed that increased numbers of eosinophils are found in the airway tissue of obese asthma patients, indicating more inflammation. It is hypothesized that in obese patients with allergic asthma, increased airway fibrosis contributes to increased tissue eosinophilia through increased production of eotaxin, a chemoattractant for eosinophils, by lung fibroblasts. This hypothesis was studied by collecting lung tissue, blood, and BAL fluid from 3 lean wildtype mice and 3 obese leptin-deficient mice. Through quantitative real-time PCR, ELISA, and immunohistochemistry for CCR3 (a receptor present in eosinophilia) and CCL11 (eotaxin), the relationship between fibroblasts and eosinophils was investigated. Cell differential analysis and airway examination through PAS, H+E, and trichrome staining were also used to determine baseline relationships.

Biological Sciences 1pm-2pm

COMMUNITY ENGAGED RESEARCH

Joyce Er

Growing Pains: Adaptive Analysis of Singapore's Aging Population

Faculty Mentor: Alma Blount, Public Policy

Singapore is projected to become a fully aged population by 2030, with one in four residents over the age of 65. Economically developed countries who are facing a rapidly aging population are concerned with the economic burden that social spending on elderly citizens will create. The impact of, and the Singapore state's policy response to, its aging population was examined to determine the state's readiness to manage the aging population challenge. This research found that while the state has taken significant steps in the past five years to increase the level of financial assistance for elderly citizens who previously "fell through the gaps," discourse surrounding the issue of aging populations remains confined to the financial burden. Jingzhou Lim, the founder of the Cassia Resettlement Team, a non-profit that befriends elderly residents in Singapore, was interviewed about the gaps in existing eldercare policy. Key issues discussed included manpower shortages in the social services sector, a lack of nuance in public discourse about aging, and a lack of awareness about available aid schemes for underprivileged elderly citizens. Policy recommendations include increased consultation of organizations working with the elderly, additional research into eldercare talent retention, and increased targeted outreach about available aid schemes. Keywords: aging population, eldercare, Singapore, welfare state, demographic transition, adaptive analysis.

Social Sciences 1pm-2pm

Spencer Flynn

A Holistic Investigation into Appointment Keeping in a Mid-Sized Urban Free Clinic

Faculty Mentor: Jehanne Gheith

An exploratory investigation into patterns of patient attendance in a novel patient population was conducted. The study was performed in a mid-sized free clinic that services an impoverished and uninsured population of predominantly undocumented Hispanic/Latinx people in Los Angeles. Computerized patient attendance data, surveys (n=62), and interviews (n=15) were utilized. Interesting findings include that health status and caregiving status are strong predictors of patient attendance, that shorter time (less than 2 months) between diabetic appointments may be correlated with poorer attendance, that patients underestimate their poor attendance and fail to realize the negative effects of poor attendance on clinics, and that patients cite clinics as playing substantial causal roles in their poor attendance. Interventions from attendance literature, such as predictive overbooking and SMS reminder systems, as well as new recommendations based off of this study's findings, are discussed and recommended for the novel patient population.

Community Engaged Research 10am-11am

Visible Thinking- Abstracts

Ebony Hargro
Under-Representation in Gifted Education Programs
Faculty Mentor: Alma Blount, Public Policy

One of the biggest controversies within gifted education is the fact that minority students such as Black, Latino, English-Language Learning (ELL) and/or students from low-income families are under-identified and thus underrepresented in gifted and talented programs. Every student in the United States is guaranteed a free education, but factors like how much a parent spends on a child and how much informal educational experience the child has can determine whether or not the system identifies them as being gifted and talented. This research paper identifies different processes by which levels of performance are both determined and achieved. To accomplish this, this research conducted a literature review of relevant studies in gifted education, compiled their findings, and interviewed an expert at the Duke Talent Identification Program (TIP).

Social Sciences 12pm-1pm

Zhong Huang

Strengthening Chinese-American Health Coalitions: Mobilizing Chinese-Americans

Faculty Mentor: Alma Blount, Public Policy

High-socioeconomic status Chinese-Americans are uniquely positioned to alleviate difficulties in access to healthcare among low-income Chinese-Americans, particularly those in the healthcare field. However, no such movement has materialized. This project diagnoses the barriers to this movement and explores the means by which high socio-economic status Chinese-Americans can be mobilized to take responsibility for the issues of the wider community. Data was collected by qualitatively synthesizing works in sociology and public health, a case study, an interview with a Chinese-American health coalition, and 2017 census data. I contextualize patterns in access to healthcare among Chinese-Americans within our culture of individuality, preferences towards ethnic identity, historical trends of immigration and settlement, and overwhelming normative aspirations. Ultimately, I found that mobilization can only exist if we overcome the current culture of individuality and develop a unique new norm of Chinese-American belongingness through unity.

Community Engaged Research 12pm-1pm

Visible Thinking- Abstracts

Emily McAuliffe
Sexual Assault at Duke
Faculty Mentor: Rebecca Vidra, Nicholas School of the Environment

For my research project, I investigated the important issue of sexual assault on Duke's campus. Since enrolling, 40% of undergraduate women have experienced sexual assault. This startling statistic fueled my exploration of why the rate at Duke is so high, and what the university can do to reduce this number. My findings led me to identify the overarching problem that students are not discussing consent prior to engaging in sexual activity. I also found that alcohol and misogynistic gender norms serve to create a gray area of confusion surrounding what sexual assault is, and what authentic consent looks like. In order to combat the shockingly high rate of sexual assault at Duke, the university should work to better educate students about sexual assault, and foster real conversations about consent amongst students. Furthermore, I believe that Duke is in a unique position as an elite institution to take an innovative, proactive approach to educating students about healthy sex and consent.

Community Engaged Research 12pm-1pm

Ashlyn Nuckols

Barriers to Political Participation for Working Class People of Color in Durham, North Carolina

Faculty Mentor: Robert Korstad, Public Policy

Why does local level political participation remain so low among working class people of color? This exploratory report is a synthesis of nine interviews in which working class people of color shared their experiences living, working and participating in politics in Durham, North Carolina in 2017. As in most cities in the United States, the level of participation in local elections and other political activities is both very low and stratified by race and class. In personal stories related to government and politics, participants described their perceptions of local government and factors that impact whether or not they choose to engage in political activities. My analysis synthesizes these stories to identify common barriers to political participation. Based on these results, I make a series of recommendations for Durham For All, a non-profit organization that has made it their goal to bring 10,000 working class people of color into the election process by 2020.

Community Engaged Research 11am-12pm

Chinemerem Nwosu

Evaluating the Feasibility of Multi-Modal Educational Interventions to Improve Neurosurgery Patients' and Caretakers' Health Literacy in Mulago Hospital, Uganda. Authors

Faculty Mentor: Anthony Fuller, Duke Global Neurosurgery and Neurology

Background Due to physician and nurse shortage, family members are the primary caretakers for patients at Mulago National Referral Hospital (MNRH), Uganda. Their responsibilities include feeding patients and reporting symptoms to nurses, administering oral medications and providing emotional support. Many caretakers have little or no knowledge of the patient's illness and proper overall health management, which puts the patient at risk for poor health outcomes. Limited medical personnel and resources hinder progress in educating caretakers. The objective of this study was to test the feasibility of multi-modal educational interventions to improve the health literacy of caretakers and patients with SMS reminders, posters and an accessible patient-caretaker educator. Methods The interventions involved:(1) Reminding immobile patients' caretakers of patient turning to avoid bed sores via SMS sent at two-hour intervals over two days, and observing the frequency of the task within each time frame to compare to an original baseline frequency, (2) Mounting pictorial posters with information and on proper patient feeding techniques in three languages (3) Employing a health educator in the ward for a week to provide verbal instructions to caretakers. Standardized interviews and surveys, were collected from 53 caretakers, hospital staff and patients to measure feasibility through satisfaction, applicability and acceptability. Findings The frequency of patient turning increased as compared to the baseline frequency after the SMS reminder intervention was implemented. This frequency depended on the time of day, and presence of hospital staff and multiple caretakers. SMS reminders and posters had the highest level of satisfaction because they were easy to understand. Most caretakers found having an accessible health educator in the ward helpful for understanding their responsibilities and reducing the burden on limited nurses. Interpretation The feasibility of the interventions depends on the availability and accessibility of mobile technology and caretaker's ability to read and understand instructions. Interventions can be useful in conveying important healthcare messages without the presence of a nurse or physician. In low-literacy settings or hospitals with nurse shortage, posters and SMS reminders can be potentially useful in educating caretakers and keeping them accountable on patient care. There is the need to evaluate how these interventions can be scaled up.

Community Engaged Research 1pm-2pm

Olivia Pennoyer

Batson Up, Strike Three You're Out: Eliminating Racial Bias in North Carolina Jury Selection

Faculty Mentor: Philip Stern, History

In the state of North Carolina, there is an epidemic of race-based peremptory strikes perpetrated by the prosecution. Peremptory strikes are used by both the prosecution and defense to remove potential jurors from the jury pool. Each attorney is not required to state a constitutionally based justification to explain the purpose of the strike, but recent publications have demonstrated that race is overwhelming a predictor of who will be struck by the prosecution. My investigation was into the scope and maintenance of this system of racial bias in the North Carolina court system. The research concluded that Batson claims which were designed to prevent race-based strikes have been made over 100 times in capital cases in North Carolina but to this day, none of the claims have been upheld in the appellate court. Despite the fact that race has been proven as a motivating factor for prosecuting attorneys, the appellate court has never recognized this continued racial discrimination. This pattern is a result of a mixture of implicitly and explicitly biased strikes, and they continue to exist because the courts are afraid to make accusations of racial bias against prosecuting attorneys.

Community Engaged Research 1pm-2pm

Michaela Stith

Critical Conversation Tool: Duke Faculty's Implementation of Critical Service-Learning

Faculty Mentor: Dane Emmerling, Education

Critical service-learning pedagogy endeavors to redistribute power between the university and community partners; explicitly integrate social justice concepts in the classroom; and develop authentic relationships. The literature on service-learning endorses critical frameworks, but lacks a concrete assessment to help faculty implement critical pedagogy and programming. Duke Service-Learning has created a guided conversational tool for faculty seeking to implement critical service-learning in their courses. The tool presents illustrative scenarios and action-oriented questions grouped into five themes: authentic relationships with community partners, decolonizing the classroom, social change orientation, social change skills development, and redistribution of power. This study 1) assesses Duke Faculty's self-reported strengths and weaknesses in their implementation of critical service-learning themes and 2) seeks ways to improve the tool. We conducted semi-structured interviews with seven Duke faculty and collected structured surveys from 17 non-Duke faculty who attended our session at PACE, a regional conference on service-learning. Interviews with Duke faculty were recorded and qualitatively analyzed for themes which emerged from the conversations. We quantitatively compared how Duke and non-Duke faculty ranked the five themes from least to most implemented. On average, we found that Duke Faculty rank their implementation of social change skills development lower than PACE participants and their implementation of authentic relationships higher than PACE participants. Additionally, Duke Faculty reported greater implementation of decolonizing the classroom, though these differences were not statistically significant. Overall, faculty reported that the tool provided actionable suggestions to improve their critical service-learning practice.

Community Engaged Research 10am-11am

Amulya Vadapalli
Yemen: A Forgotten War, A United Nations Crisis
Faculty Mentor: Alma Blount, Public Policy

This project examines the role of the United Nations in Yemen's second and current civil war (2015-present). The research focuses on the question of why the war in Yemen, though the worst humanitarian crisis of our time (as declared by the U.N.), is severely underserved in terms of U.N. aid and resources. My research uses interviews with experts, a review of current literature, newspaper articles, and books to assess the impact of the war and its subsequent place in international politics. I find that the U.N is bound by its reliance on important actors in play at the war, including the United States and Saudi Arabia, but can best serve Yemen by focusing on empowering local civil society actors and partnering with the European Union.

Community Engaged Research 11am-12pm

Samantha Villalobos

Building Back Better: Architecture and policy of Mexico City's housing system after the earthquake of September 19, 2017

Faculty Mentor: Alma Blount, Public Policy

Among the two-thirds of Mexico City's population residing in non-engineered, self-built housing, many residents of Mexico City's peripheral communities lack the economic status to legally purchase land and thus gain access to public works such as plumbing and electricity. The poor living conditions imposed on the impoverished citizens of Mexico City demonstrate a lack of concern for the most vulnerable members of the city. Furthermore, these unregulated dwellings lack structural stability and often serve as makeshift housing while permanent housing is built elsewhere. Lack of regulated, structurally and hygienically safe housing places these marginalized communities at unnecessary risk. The destruction caused by the 2017 earthquake in Mexico City has provided a new basis on which to rebuild communities. This gives the city a chance to build back better – to create a sustainable, safe and comfortable living environment for Mexico City's impoverished peripheral communities. But the concept of building back better goes beyond the structures; the city government, commercial housing developers and impoverished citizens must work towards building mutual relationships and meeting each other's needs in order to create an improved housing system for the impoverished peripheral residents of Mexico City.

Community Engaged Research 12pm-1pm

Erin Williams

Collecting Stories of Murdered and Missing Native American Women and Girls

Faculty Mentor: Anne Allison, Cultural Anthropology

This project attempts to both uncover and raise awareness of the phenomenon of murdered and missing Native women in the United States. The documentary, Silent No More, is a compilation of interviews from family members of the murdered or missing from reservations across the Great Plains. The four most prominently featured women in the documentary are Lisa Lone Hill, Carla Cheyenne, Lucille White Dress, and Malinda Harris. These mothers bravely agreed to share the stories of how they lost their daughters, in order to help raise consciousness of the phenomenon, and to help prevent it from happening to others. The common threads within each of the stories highlight that the root of the problem is both historical trauma and modern racism. The perpetrators are sometimes outsiders, but they are often community members as well. Domestic violence has become the norm in many Native communities, and the Bureau of Indian Affairs officers in charge of handling these cases are frequently underqualified, understaffed, and unconcerned about the safety of Native women. This all culminates in murder rates of nearly 10x the national average. Most of the women interviewed for this project recalled this Cheyenne proverb in some form: “A nation is not conquered until the hearts of its women are on the ground. Then it’s finished; no matter how brave its warriors or how strong their weapons.” If they cited this proverb, they cited it as their motivation for continuing to fight for justice.

Community Engaged Research 10am-11am

Carter Zenke

Mobile Citizens: Broadening Participation in Computer Science by Increasing Self-Efficacy

Faculty Mentor: David Malone, Education

Quality Computer Science (CS) education is the door to opportunities of the future, yet underrepresented students in North Carolina are actively having this door shut in their faces. Compelled by the reality of "privileged-only" access to CS education in a state where technological skills are in high demand, our research proposes and analyzes the effectiveness of a solution with impact at the public middle school level. By analyzing current CS education initiatives in North Carolina, we have found that truly addressing the problem of underrepresentation in CS requires designing pedagogies that increase both underrepresented learners' self-efficacy and CS competence. Therefore, by targeting these students with strategies that build quality CS skills and self-efficacy, we can work to broaden their participation in CS in the long-term. Our program, Mobile Citizens, broadens participation for underrepresented students (specifically low-income public middle school students) by building confidence and competence in CS. We employ three strategies that past research has shown to increase student self-efficacy and academic achievement: a partnership with an expanded learning time after-school program, service-learning pedagogy, and near-peer mentors. We discuss these strategies and their effectiveness within the context of our program. We make use of relevant literature, our observations, and student reflections to argue why each component increases student self-efficacy and CS competency. We also share how our approach is an adaptable and useful model for educators seeking to start CS education initiatives in their home communities with the goal of broadening participation.

Community Engaged Research 1pm-2pm

HUMANITIES ABSTRACTS

Elizabeth Barahona
The History of Latinx Students at Duke University
Faculty Mentor: Sarah Deutsch, History

This thesis uncovers the history of Latinx students at Duke University since the arrival of the first Latinx student—Class of 1928 Rodolfo Rivera --to the protests and demands that led to the creation of La Casa, a space dedicated to Latinx students in 2017. This thesis investigates how Latinx students racially identified themselves since their arrival, and how the Duke University administration identified them, at a time when Duke felt encapsulated in a Black/White racial paradigm. Since their arrival to Duke in 1928, Latinx students were racially identified as "other." This distinction that is was neither Black nor White, allowed for Latinx students to attend the racially segregated university. From 1928 to the late 1950s, Latinx students did not consistently unite as a community, organization, or under a common identity. Instead, some Latinx students organized nonconsecutively as part of the Cosmopolitan, Alien, International and Pan-American club. In the 1950's, students began to consolidate themselves as a Spanish-speaking community but not as a community based on a common ancestry, ethnicity or race. This thesis traces how a disconnected group of students became the Latinx community that protested eighty-nine years later.

Humanities 11am-12pm

Angeli Sharma

Physician Behavior and Treatment of Patients with Low Socioeconomic Statuses in Developed and Developing Countries: A Case Study

Faculty Mentor: Margaret Humphreys

Socioeconomic statuses (SES) have direct implications on the accessibility, satisfaction, and quality of health care received. Current research suggests that physician biases for low SES patients lead to inequalities in allocation of time and quality of care. Factoring in the differences between developing versus developed countries complicates the issue. Currently, research is based on systematic reviews of databases with a focus on the patients. However, by investigating physician-patient relationships through detailed case studies on the physicians- in developing and developed countries, physician perception and behavior towards low SES patients can be better understood. This case study research used semi-structured interviews and participant observations to study eight physicians over the span of two months in the United States and India. Each physician was observed for a week in their healthcare setting. Markers of respect shown to patients and lengths of appointments were recorded. The markers of respect considered were eye contact, tone, evidence of cultural competency, phone call answer rate, and thoroughness of explanation of diagnosis and treatment. Afterwards, a semi-structured interview was conducted regarding the physicians' clinical experiences and medical ethics. The findings showed that physicians preferred treating lower SES patients due to higher compliance rate and increased respect for physicians. Although physicians in developed countries believed their care was standardized, more time was spent on lower SES patients finding them alternative, cost-efficient treatment plans. There was a positive correlation between the length of appointments and markers of respect, overall; however, physicians with substantial clinical experience could spend less time while maintaining similar display of respect. In developing countries, physicians efficiently handled a larger caseload while showing evidence of all markers of respect. Contrary to previous research, this study showed evidence of physicians explicitly, in stated preference, and implicitly, through additional time spent, treating low SES patients better.

Humanities 10am-11am

Gabrielle Stewart

Rostovtzeff and the Yale Diaspora: How Personalities and Communities Influenced the Development of North American Papyrology

Faculty Mentor: William Johnson

My thesis traces the development of papyrology in North America from 1925-1973, paying particular attention to Yale's papyrological shop and the lineage of papyrologists and historians who built it. The acclaimed historian Michael I. Rostovtzeff began developing Yale's papyrology program when he became Sterling Professor of Classics in 1925. Rostovtzeff was first and foremost an historian, but he saw documentary evidence as indispensable to his historical work, understanding documents as "pictures of life" that lend powerful insight into the nature of ancient society. His approach resonated with the junior faculty and graduate students at Yale, who formed a nearly-familial community around Rostovtzeff and his approach. After a series of conflicts decimated Yale papyrology, Rostovtzeff's successors were able to spread his approach across North America. Hallmark features of North American papyrology today—namely its focus on making papyrology accessible to scholars of any specialty and its leadership in utilizing digital technologies for papyrological research—are products of the Rostovtzeffian approach to the discipline. It is impossible, however, to understand the Rostovtzeff tradition's influence on papyrology without considering how personalities and interpersonal connections and tensions informed the work of its members. My analysis seeks to parse how the personal and the academic inflected upon each other during papyrology's early development.

Humanities 11am-12pm

PHYSICS ABSTRACTS

Azim Dharani

Development of prostate cancer targeted prodrugs based on the copper chelator Disulfiram

Faculty Mentor: Katherine Franz, Chemistry

While there are currently many approved prostate cancer drugs contributing to high ten-year survival rates (99%), there is a lack of chemotherapeutic treatments for metastatic castrate-resistant prostate cancers (mCRPC), which have a ten-year survival rate of 28%. Disulfiram, a dimer of diethyldithiocarbamate (DTC), has shown to inhibit mCRPC growth by chelating copper (II) in the tumor to form the highly toxic DTC-Cu(II) complex. However, disulfiram lacks specificity to cancer and induces apoptosis in non-malignant cells. In phase 1 clinical trials, disulfiram exhibited significant toxicity without improvement in efficacy with 6 of the 12 patients developing grade three adverse events. To minimize these side effects, we sought to synthesize a library of targeted disulfiram prodrugs which have greater specificity to mCRPC over normal tissue. Since many receptors are overexpressed in mCRPC, these receptors serve as ideal targets for enhanced tissue specific uptake of disulfiram. In our prodrug design, we block the ability of DTC to bind to Cu(II) via a disulfide linker thus preventing cytotoxicity. The blocked DTC is further conjugated to a targeting moiety and receptor-targeting group to enhance the specificity of the drug to mCRPC cells. Not only does this drug delivery system exploit the overexpression of biomarkers, but each component of the prodrug can be modified to provide specific cytotoxicity. The formed DTC conjugated prodrugs will be developed through solid phase peptide synthesis, purified through HPLC, and characterized using NMR and LC-MS. Through this semester's project, we hope to expand upon this library of DTC conjugated prodrugs by optimizing the synthesis and characterizing the copper binding of both the glutathione (GSH) and gamma glutamate (GGT) targeting prostate cancer prodrugs.

Physics 10am-11am

Xiaochen Du

HybriD3 Materials Database

Faculty Mentor: Volker Blum, Mechanical Engineering and Materials Science

In recent years, a class of hybrid organic-inorganic materials, based on the perovskite crystal structure, has attracted the attention of researchers for its enormous potential in energy applications, such as in solar cells and LEDs. However, the research community lacks a curated, dedicated repository to catalogue and systematically access the growing body of research data related to organic-inorganic perovskites. This project, associated with a NSF-funded collaboration across Duke, UNC and NCSU, aims to create such a database, intended to help accelerate the pace of materials discovery and research. Currently, the database has the following features: an overview page containing a snapshot of the different properties for each material, a page listing multiple entries for each material property, pages for authenticated users to contribute to the database, and a search page that allows users to search by multiple parameters. Current data types include crystal structures, synthesis procedures, photoluminescence data, and electron band structures, which are the physical quantity underlying the electronic properties of a material. Additional entry types can be easily added to the database in the future. The database is built using open-source components: Django framework hosted on an Apache2 server, with a RHEL7 OS, and MariaDB. The database is available at materials.hybrid3.duke.edu. In the future, the group plans to 1) implement a rating system to show the top/most-trusted entries on the overview page 2) integrate with existing community materials databases, and 3) establish an API for users to download large datasets based on their search parameters.

Physics 10am-11am

Matias Horst

Synthesis of chelating polymers and their applications in the study of inorganic mechanochemistry

Faculty Mentor: Katherine Franz, Chemistry

Polymers with specialty organic architectures have emerged as platforms to investigate mechanophores, moieties that have reaction manifolds exhibiting force-malleable potential energy surfaces. These mechanophores can be activated when loads are translated intramolecularly along the polymer mainchain. While this approach has enabled many organic mechanophores to be better understood, systematic studies of inorganic mechanochemistry have lagged behind their organic counterparts. Understanding how force coupling and activation thresholds change as a function of better-understood properties of inorganic species would advance fundamental physical inorganic chemistry, leading to potential applications in smart materials, selective drugs, and externally controllable catalysts. Here, we report the synthesis of chelating polymers bearing nonintegral mainchain metal-ligand bonds and preliminary investigations into the mechanochemistry of coordination complexes using this macromolecular architecture. Single molecule force spectroscopy (SMFS) was chosen as a characterization technique for its capacity to simultaneously apply force and quantitatively relate it to a readout of molecular state, the contour length of a polymer. Polymeric platforms for inorganic chemistry amenable to this technique require two components: unspecific metal-binding motifs that undergo contour length change upon activation and motifs that promote surface adhesion. Ruthenium-catalyzed entropy-driven ring opening metathesis polymerization of macrocyclic substrates bearing such motifs gave copolymers with random character. Work towards resolving metal-ligand bond scission in these polymers by SMFS is ongoing. Synthetic techniques developed in this study could be used to develop chelating polymers for applications as diverse as optoelectronic devices, water purification, or manipulation of biological metal homeostasis.

Physics 10am-11am

Jaewon Moon

Assessing Cu-redox properties of Î²-amyloid peptides by modulation of metal-coordination environment

Faculty Mentor: Katherine Franz, Chemistry

Amyloid-beta (AB) peptides possess an amino terminal Cu(II)- and Ni(II)- high affinity binding (ATCUN) and bis-His motif which have been observed in other peptides to hold a high binding affinity for Cu(II) and Cu(I), respectively. Consequentially, these motifs and associated activity have implicated AB in the progression of Alzheimer's disease; however, the mechanism behind this is unclear. For investigation, AB4-16 peptide and AB4-16H3A mutated peptide fragments were synthesized to exploit the ATCUN and bis-His motifs and test for copper redox properties. UV-Vis spectroscopic studies revealed that addition of ascorbate to Cu(II)-AB complex solutions resulted in the formation of a band at 360-380 nm, commonly associated with highly reactive copper-oxygen species. This activity was further strengthened with the addition of hydrogen peroxide and modified by a His-to-Ala substitution within the ATCUN motif of AB4-16. Together, these observations suggest the possibility of redox activity of Cu(II)-AB complex.

Physics 11am-12pm

Elena Puccio

Synthesis of Î²-Lactamase-Activated Prochelators Based on Cephalosporin and Clavulanic Acid Cores

Faculty Mentor: Katherine Franz, Chemistry

Numerous types of pathogenic bacteria have developed a method to resist antibiotics through beta-lactamases, which cause degradation of beta-lactam drugs through hydrolysis. Beta-lactamase inhibitors, such as clavulanic acid, can covalently bind to the active site of the enzyme and remain associated to the enzyme. This is useful in serine beta-lactamases, which use serine to hydrolyze beta-lactam rings; however, metallo-beta-lactamases use a catalytic zinc ion, which prevents covalent binding of the inhibitor. The aim of this work is to create a prodrug that is able to selectively disrupt metal homeostasis in resistant cells through the release of a chelator after activation by beta-lactamase. It is also hypothesized that the chelator may be able to inhibit metallo-beta-lactamases by chelating the catalytic zinc ion. The core of the prochelator was designed to prevent antibiotic properties in non-resistant strains by limiting binding affinity to only beta-lactamase. The chelators used were chosen based on known antibacterial properties and metallo-beta-lactamase inhibition. The specific prochelators developed in this work are PcephPT (phenylacetamido-cephem-pyrithione), PcephDPA (phenylacetamido-cephem-dipicolinic acid), and CA2DPA (Bis-clavulanic acid-dipicolinic acid).

Physics 12pm-1pm

JR Smith

The Biomechanics of Lateral Iliac Flare

Faculty Mentor: Steven Churchill, Evolutionary Anthropology

Lateral flare of the iliac blades has long been thought to be a critical anatomical feature for bipedal locomotion in hominins (humans and their ancestors). Conventional thought suggests that lateral flare plays a role in the mechanical advantage (leverage) of the gluteal abductors (gluteus minimus and gluteus medius) which stabilize the hip during the stance phase of bipedal gait. Due to the fragmentary nature of the fossil record, different researches have employed different methods of measuring lateral iliac flare in the past. Recent comparative studies show that these methods of measurement are uncorrelated, and therefore we do not know which, if any, accurately reflect the mechanical advantage of the gluteal abductors. Here we use virtual models of 30 modern human pelves and proximal femora to explore the relationship between these methods of measurement and the corresponding moment arms of the g. minimus and g. medius. Results confirm that there is poor agreement between different measures, and that only three measures - the biomechanical length of the femoral neck, the angle between the iliac blade and the auricular surface, and the ratio of pelvic inlet diameter to bi-iliac breadth - best reflect the gluteal muscles' moment arms. Restricting future studies of the mechanical advantage of the gluteal abductors to these measures should improve our understanding of bipedal kinematics throughout hominin evolution.

Physics 12pm-1pm

Aditya Sridhar

Design Automation and Microfluidic Resource Optimization of Reconfigurable Flow-Based Biochips

Faculty Mentor: Krishnendu Chakrabarty, Electrical Engineering

Digital microfluidics is an alternative technology for lab-on-a-chip systems for manipulating droplets on-chip. Microfluidic processing involves transporting, storing, mixing, reacting, and analyzing micro- and nano-scale fluids discretely using design-automated instructions. In microfluidics, single-cell screening is used to sort streams of cells into clusters based on pre-specified biomarkers, thus supporting type-driven biochemical analysis. Reconfigurable flow-based microfluidic biochips (RFBs) can be utilized to screen hundreds of heterogeneous cells within a few minutes, but they are overburdened with the control of a large number of valves. To address this problem, a pin-constrained RFB design methodology for single-cell screening is presented. The proposed design is analyzed using computational fluid dynamics simulations, mapped to an RC-lumped model, and combined with a high-level synthesis framework. Simulation results show that this algorithm significantly reduces the number of control pins and fulfills the timing requirements of single-cell screening. In addition, a focus exists on an efficient algorithm that generates design-automated control sequences for complex valve networks. This includes both architecture-dependent and architecture-independent phases, focusing primarily on crossbar valve-network designs. The algorithm implements adjacency matrices for valve-neighbor connectivity and develops a well-defined network-levelling scheme. Finally, an additional algorithm is motivated that optimizes on-chip equipment to facilitate chip-to-world interfacing. This is accomplished using control pins for valve actuation in microfluidic systems. Further, the algorithm exploits microfluidic XOR gates and linear algebraic Gauss-Jordan Elimination techniques. All the algorithmic implementations are performed in Java, COMSOL, and MATLAB. Overall, the extension of microfluidics in real-world applications leads to numerous interesting directions.

Physics 10am-11am

Visible Thinking- Abstracts

David Wang

Accurate Refolding of Experimentally Determined Protein Mechanical Unfolding Intermediates Via All-Atom Molecular Dynamics Simulations

Faculty Mentor: Piotr Marszalek, Mechanical Engineering and Materials Science

One of the major goals of all-atom molecular dynamics simulations is to recreate the trajectories of proteins as they fold into their native state. Currently, one of the main methods to validate the accuracy of these folding trajectories is to observe whether the simulated unfolded protein eventually obtains a structure similar to its native conformation. However, it is unknown whether the folding trajectories produced by simulations accurately represent the folding pathways actually undertaken by the protein. Thus, incorporating experimentally known protein intermediates into these simulations can provide a new means to verify the accuracy of these refolding trajectories. We simulated the refolding trajectories of titin I91 (I27) domain and consensus ankyrin repeat structures, NI3C, from their experimentally perturbed (partially denatured) mechanical unfolding intermediate states generated using atomic force spectroscopy and witnessed the refolding of these intermediates into their final protein structures. In doing so we show that we can accurately reproduce the experimentally-determined partial folding trajectories of proteins using molecular dynamics simulations. The creation of these trajectories then provides a new way to test the accuracy of the molecular dynamics force fields and may provide valuable information regarding the folding landscape of many proteins under investigation.

Physics 1pm-2pm

Max Xu

Assessing the Tunability of Copper-Redox Activity of Histatin-5 by Modulation of the Coordination Environment

Faculty Mentor: Katherine Franz, Chemistry

Histatin-5 (Hist-5), a member of the histatin family, is a salivary peptide that exhibits antifungal properties. However, the mechanism of its killing action has been the subject of intense debate. Hist-5 contains several metal binding motifs, including the amino-terminal Cu(II), Ni(II)-high affinity binding motif (ATCUN) and the bis-His site, composed of the seventh and eighth histidines in the peptide. These regions grant the peptide the ability to bind Cu(II) and Cu(I) respectively. The third histidine of the peptide is also purported to participate in bis-His mediated binding of Cu(I), acting as a third ligand. It has been theorized that this binding of Cu(I) to the bis-His binding site and the third histidine of Hist-5 results in a complex capable of performing redox reactions to form ROS to kill the fungi. We have determined that this redox activity appears to be conserved even when substituting the third histidine with other amino acids capable of binding to copper. We also show that the histidine moieties of the bis-His site are potentially more crucial to the reactivity than the histidine of the ATCUN motif.

Physics 10am-11am

PSYCHOLOGY- GRADUATION WITH DISTINCTION ABSTRACTS

Visible Thinking- Abstracts

Elizabeth Adler

Social Attention in Autism Spectrum Disorder

Faculty Mentor: Kim Carpenter, Psychology and Neuroscience

Autism spectrum disorder is largely defined by social deficits, language impairments, and repetitive behaviors. Attention deficits in both a social and non-social domain are largely associated with autism and play into these lager social impairments. The majority of autism research has focused on gross attention in relation to social orienting; however, our study is the first to look at social orienting at the level of eye-tracking. Ours is the first to concentrate on which disengagement and engagement variables specifically correlate to response-to-name to predict an autism diagnosis. RTN has shown to be a predictive phenotype of autism, with patterns of lack of response emerging as early as six months of age, and being a strongly predictive diagnostic tool by 24 months. Our study focused on whether differences in attentional control predicted difficulties in response-to-name in 3-6 year old children with ASD. Clinician reports of response-to-name and EGT were used to assess attention patterns among participants. Our findings corroborate that response-to-name is a strong indicator of autism (OR 2.66; 95% CI: 1.21-5.86; p=.02); however, contrary to our hypotheses, eye gaze tracking did not differ between children with and without autism. There was no interaction between response-to-name and eye gaze tracking patterns in differentiating between-groups. CS accuracy and RTN was not statistically significant ($\chi2(1) = .14$, p=.70); the interaction between RTN and CS Disengagement reaction time did not reach significance ($\chi2(1) = .18$, p=.67). Furthermore, RTN and PS disengagement accuracy did not have a statistically significant interaction ($\chi2(1) = .01$, p=.91); and RTN and EGT did not reach significance, showing that this interaction did not predict differences between-groups ($\chi2(1) = .07$, p=.79). It is possible that future studies should focus on more social, visual orienting tasks, as this appears to be strongly correlated to autism spectrum disorder.

Psychology Graduation with Distinction 12pm-1pm

Afua Ansah

When Two Worlds Collide: The association between beliefs, relationship quality, and attachment orientations in friendships and romantic relationships

Faculty Mentor: Steven Asher, Psychology and Neuroscience

This study (N = 382) aimed to assess the associations between beliefs about friendship and beliefs about romantic relationships. Additionally, the links between beliefs and relationship quality as well as beliefs and attachment orientations were examined. Participants were recruited through Amazon Mechanical Turk and reported to self-report measures via an online Qualtrics survey. Twelve different beliefs (e.g., friendships last, each romantic partner is unique) were assessed for friendships and romantic relationships. Mean scores for nine beliefs were combined to create a total maladaptive beliefs score. Results illustrated that maladaptive beliefs about friendship were positively correlated with maladaptive beliefs about romantic relationships. Second, maladaptive beliefs were associated with lower relationship quality in both friendships and romantic relationships. Third, maladaptive beliefs were associated with greater attachment-related avoidance and attachment-related anxiety in friendships and romantic relationships. Finally, maladaptive beliefs mediated the link between attachment orientations and relationship quality in both friendships and romantic relationships. Overall, results illustrate that individuals tend to conceptualize friendships and romantic relationships in similar ways and indicates the important role that these beliefs have on the quality of these relationships.

Psychology Graduation with Distinction 10am-11am

Visible Thinking- Abstracts

Chloe Banker

The Hypo-Egoic Nonentitlement Model of Humility

Faculty Mentor: Mark Leary, Psychology and Neuroscience

Compared to many other psychological constructs, the topic of humility is relatively young and unexplored, and the field lacks consensus regarding an agreed-upon conceptualization and measure of humility. This project aimed to correct both issues by advancing a new conceptualization of humility and developing a corresponding measure. The conceptualization, termed the hypo-egoic nonentitlement model of humility, proposes that humility is characterized by the belief that, no matter what one's accomplishments or positive characteristics may be, one is not entitled to special treatment by other people. Two studies were conducted; the first was an exploratory study that examined the potential of this conceptualization. Results indicated the validity of the hypo-egoic nonentitlement model as participants' belief that their accomplishments and positive characteristics entitle them to special treatment correlated negatively with scores on an existing measure of humility and were related to, but separate, from narcissism. In the second study, a new measure of humility based on the hypo-egoic nonentitlement conceptualization was developed and its validity examined. Participants' level of hypo-egoic nonentitlement correlated with other measures of humility and related constructs, but was independent of how participants compared their characteristics and accomplishments to those of other people. These findings indicate the strong potential of both the hypo-egoic nonentitlement model of humility and the newly-developed measure based on this conceptualization.

Psychology Graduation with Distinction 11am-12pm

Rachel Buchanan

Distress in Durham: Neighborhood Characteristics and Use of Police-Based Mental Health Interventions

Faculty Mentor: Nicole Schramm-Sapyta, Psychology and Neuroscience

Neighborhood characteristics, such as its socioeconomic status (SES), have been associated with residents' mental health quality, with residents in lower SES neighborhoods typically exhibiting poorer mental health. We wanted to investigate whether this relationship is reflected in an area's usage of the Durham Police Department's mental health team, the Crisis Intervention Team (CIT). We used geographically coded CIT call data and various measures of neighborhood SES to determine how CIT involvement in an area varied with neighborhood SES. We found that lower SES areas have a higher level of CIT involvement and that the three major predictors of CIT involvement in a neighborhood are the percentage of the residents in poverty, the percentage unemployed, and the percentage that has not completed high school. Furthermore, we found that the geospatial variations in poverty, unemployment, and completion of high school completely account for the geospatial variations in CIT calls. These findings could be used to inform officer positioning and resource allocation. Additionally, this information has implications for identifying areas of Durham that are in need of more mental health resources and community outreach programs.

Psychology Graduation with Distinction 12pm-1pm

Visible Thinking- Abstracts

Lucy Cao

Social class and brand prominence preferences

Faculty Mentor: Gavan Fitzsimons, Psychology and Neuroscience

Consumer brand choice and conspicuous consumption has been studied in detail, but little is known about how consumers make decisions about purchasing brand prominent goods in the context of their social class history and environment. This paper explores the relationship between consumer socio-economic status (SES) and low vs. high class environments and their effect on consumer brand prominence preferences. The results from the study suggest that SES and high class vs. low class environments do have a significant effect on brand prominence choices, but only within certain contexts. Post hoc theorizing suggests that when individuals have an expectation that they will interact with others outside the group they arrived with, they may find brand prominence signaling more important, and that individuals are more comfortable signaling with higher brand prominent goods in environments that match their SES.

Psychology Graduation with Distinction 11am-12pm

Coco Chen

The influence of positive emotions on consumer brand preference

Faculty Mentor: Gavan Fitzsimons, Psychology and Neuroscience

As consumers, we face hundreds of brands each day, ranging from well-known national brands to store-specific private-labels. How do we choose what brands to purchase? Previous studies have suggested that emotions influence people's buying behaviors, and there are different types of positive emotions. Combining those two areas, I plan to study how different positive emotions (specifically contentment, amusement and love) influence consumers' brand preferences. My hypothesis is that consumers would purchase more national brands when they feel content, because national brands offer higher security for quality. To test my hypothesis, I will group participants into the different emotion conditions. Then, they would choose between national brands and private-labels in a mock-up store environment. The results of this study will not only help companies to create more effective marketing strategies, but also help daily consumers to better understand our unconscious behaviors. [Note: this project is conducted by a junior with early graduation. Data collection will be completed this summer and next fall].

Psychology Graduation with Distinction 1pm-2pm

Aleksandra Czarkowska

Exploring Regulatory Fit and Self-Regulatory Outsourcing in Goal Pursuit

Faculty Mentor: James Shah, Psychology and Neuroscience

Whether one wishes to run a marathon, quit smoking, learn a language, get promoted, or shed those last few pounds, goals are fundamental end states that energize and direct behavior. However, in a world where we are surrounded by the direct and indirect influences of others, it becomes increasingly important to understand the impacts of personal relationships on goal pursuit. We explore goal pursuit in the context of interpersonal influence by examining the effects of regulatory fit on self-regulatory outsourcing. Participants were asked to identify a dieting goal, as well as an instrumental other that serves to help initiate goals or defend against distracting alternatives. With one week separating two surveys, participants used this time to work toward their goal while thinking about their identified person each day. Eagerness and vigilance behaviors, promotion and prevention orientations, and levels of outsourcing were analyzed in order to create a more comprehensive image of the influence close others have on goal pursuits. With an understanding of the interactions between these underlying frameworks, we can develop more effective and efficient strategies to maximize the likelihood of successful outcomes.

Psychology Graduation with Distinction 10am-11am

Jack Dolgin

Separating the Influence of Budget and Numeric Priming on Willingness to Pay

Faculty Mentor: Scott Huettel, Psychology and Neuroscience

Impulsive purchasing is pervasive, and numerous behavioral economics models propose stimuli that contribute to these choices. Our study looks at whether another stimulus, the size of one's budget, can change purchasing behavior in the same vein as, for example, a good's placement next to a more expensive item or the discounting of a price from $20 to $19.99. Seventy-one participants mostly from the Duke community were incentivized to buy goods at different budgets, and we found they were indeed significantly more likely to purchase an item when their budget was $40 rather than $20 or $10—even if they could afford the good in all three cases. Our study also employed eye-tracking data, which led us to analyze attentional patterns correlated with this form of impulsive choice. Finally, we are currently running a follow-up study, in which 50 of 60 participants' data have been collected, that measures the extent that the larger budget affected behavior due to priming—that just by seeing a larger number on the screen regardless of its meaning, participants were more likely to buy an item. Our results shed light on both a stimulus that contributes to impulsive choice and the ongoing debate regarding irrelevant information's effect on decision-making.

Psychology Graduation with Distinction 10am-11am

Jacqueline Emerson

Sensory Over-Responsivity is Associated with Restricted, Repetitive Behavior in Children with Autism Spectrum Disorder

Faculty Mentor: Dr. Kimberly Carpenter, Psychology and Neuroscience

Restricted, repetitive behaviors (RRBs), behaviors that are high in frequency, stereotyped, restrictive to change, and considered inappropriate in display (hand flapping, spinning, rocking, restricted interests, insistence on sameness) decline after age 4 in typically developing children but persist and are often impairing in children with Autism Spectrum Disorder (ASD). Although RRBs are one of the two diagnostic features that characterize individuals with ASD, the role of sensory challenges in these behaviors has only recently been recognized in the DSM-V. Individuals with ASD have higher rates of sensory sensitivities, of which the neurobiological mechanism is unknown, than their typically developing peers. We aimed to quantify levels of sensory gating, an information filtering and inhibitory mechanism potentially underlying the development of sensory over-responsivity (SOR), through the analysis of the P100 ERP from the paired auditory click paradigm in children with and without ASD. We hypothesized a potential pathway from decreased sensory gating to increased SOR to increased levels of RRBs in children with ASD. We did not find any significant differences in level of P100 sensory gating between children with ASD and typically developing children. While we also did not find any significant correlations between level of sensory gating and SOR, importantly, we found a significant positive correlation between level of SOR and level of RRBs. This correlation was primarily driven by higher order RRBs: sameness, compulsive, and ritualistic behaviors. These data suggest that approaching higher order RRBs from a sensory perspective may provide impactful implications for therapies for children with ASD.

Psychology Graduation with Distinction 11am-12pm

Aquinnah Fox

Why Some Co-Ruminative Friendships Are More Damaging than Others: Associations Among Co-Rumination, Friendship Quality, and Internalizing Problems

Faculty Mentor: Steven Asher, Psychology and Neuroscience

Co-Rumination, the tendency to excessively discuss and speculate about problems with a close friend, has been linked with high quality friendships, as well as with depression and anxiety. The present study (n= 387 participants ages 18-29, 52% men) examined whether gender differences in and correlations among co-rumination, depression, anxiety, positive friendship quality, and negative friendship quality would replicate within a young adult sample. It further investigated whether positive friendship quality, negative friendship quality, and particular negative friendship features would moderate associations among co-rumination and internalizing problems. The study additionally broke new ground in examining the links between negative friendship quality and other adjustment outcomes, including friendship satisfaction and perceived friendship cost. Finally, the study explored whether co-rumination strengthens relationships between exposure to interpersonal stress and internalizing problems. Participants responded to questionnaires online measuring emotional assessment and aspects of their closest same sex friendship. Results indicated that co-rumination was significantly linked with positive friendship quality, negative friendship quality, and depression, and that gender marginally moderated the association between co-rumination and depression. Results further revealed that neither negative friendship quality nor the specific negative friendship features hypothesized moderated associations between co-rumination and depression, but that positive friendship quality strengthened the relationship between co-rumination and anxiety. Co-rumination did not moderate the link between exposure to interpersonal stress and internalizing problems. Overall, the results offer a deeper understanding of the particular qualities of co-ruminative friendships, which will aid researchers and therapists in diminishing the risks and heightening the benefits associated with participating in these friendships.

Psychology Graduation with Distinction 10am-11am

Madison Heath

Effects of exercise type and intensity on depression in a non-sedentary population

Faculty Mentor:, Nancy Zucker, Psychology and Neuroscience

This study examines the impact of exercise type and intensity on levels of depression in order to determine which moderator improves outcome the most. Duke Physical Education (PE) students were surveyed at the beginning of a school semester, at the end of the semester, and three times in the middle of the semester to examine changes in depression over time based on physical activity level, type of exercise engaged in and perceived intensity of PE workouts. In the non-sedentary, non-clinical sample of college students, exercise had no impact on level of depression, regardless of type or intensity. However, pretest depression level significantly predicted change in depression, indicating high levels of depression may be necessary to show substantial improvement. Additionally, mood was improved immediately after each PE class. In healthy college students, PE classes provide short-term mood benefits but are not useful as a long-term solution for distress or symptoms of depression. Future studies should examine moderators of exercise in a non-sedentary, clinically depressed population.

Psychology Graduation with Distinction 10am-11am

Ehi Ihionkhan

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

Faculty Mentor: Christina Meade, Psychiatry

More than 37 million people globally have been diagnosed with HIV, and Hepatitis C/ HIV coinfection is as high as 30% within the US. The effects of HIV on cognitive function have been well documented, but the effects of Hep C on cognitive function are highly debated. My research focuses on comparing the neuropsychological performance of HIV mono-infected individuals with Hep C monoinfected individuals, coinfected individuals and healthy controls. We are analyzing the scores of different groups, while controlling for demographic differences and confounding variables. The results would help clarify whether or not Hepatitis C contributes to any cognitive deficits seen in these participants.

Psychology Graduation with Distinction 1pm-2pm

Taylor Ikner

Alternative Displays for Medical Information: Consequences for Cognition & Action

Faculty Mentor: Ruth Day, Psychology and Neuroscience

Anaphylaxis is a life-threatening allergic reaction to an antigen (such as a bee sting) for people who are hypersensitive to the antigen. Epinephrine is typically used as the first line of defense for treating anaphylaxis and must be injected immediately. Therefore, it is provided in an autoinjector resembling a pen for easy access and use. Although this medical device can save lives, many people, including professionals, often do not use it correctly. This research determined what aspects of the written information pose problems for comprehension and tested whether an enhanced version of the instructions can increase comprehension and correct use of the device. The original instructions were enhanced using cognitive principles such as chunking, labeling, and spatial layout of text. During the Study Phase, participants read directions for using the auto-injector, either in its Original or Enhanced version. During the Cognitive Test Phase, they participated in a series of tasks (e.g., free recall, cued recall, recognition) to test their knowledge about the instructions. During the Simulated Use Task, participants received a training device (an auto-injector shell, with no needle or drug inside) and demonstrated how to use it. The results showed that the Enhanced Group outperformed the Original group across tasks. This research demonstrates how using certain cognitive principles in medical information can enhance comprehension and correct use – where incorrect usage can have disastrous consequences. It also suggests how to develop instructions for any type of medical device, so patients, medical professionals, and other caregivers can use them correctly.

Psychology Graduation with Distinction 1pm-2pm

Sarah Jackson

Like Mother, Like Child? The Role of Maternal Depression on Future Child Internalizing Symptoms

Faculty Mentor: Timothy Strauman, Psychology and Neuroscience

One in nine mothers experience depression either during or after pregnancy. This study examined the effect of maternal depression during the prenatal period, postnatal period, and years following the postnatal period on child internalizing symptoms. In a study of 342 mother-child dyads recruited through the Wisconsin Study for Families and Work, I predicted that postnatal depression would be related to increases in child internalizing symptoms. First, case-controlled analyses tested for significant differences in child internalizing symptoms between those whose mothers met the criteria for clinical depression and those whose mothers did not meet the criteria during the three time periods. Clinical depression during each period was associated with higher child internalizing symptoms in the third and fifth grades. Then, hierarchical regression analyses were performed to isolate the relative effects of the depression from the prenatal, postnatal, and later periods in a stepwise fashion while controlling for relevant stressors. Main effects of postnatal and later episodes of depression were revealed, and there was a trending effect of the interaction between postnatal and later depression. These findings elucidate the role of maternal depression on child internalizing outcomes, encouraging mothers to seek the help they need for both themselves and their children. Furthermore, these results establish a precedent for mental health professionals to utilize resources for those experiencing severe depression in the postnatal periods and in the years following the postnatal period.

Psychology Graduation with Distinction 1pm-2pm

Nona Kiknadze
Comfort Zone Orientation
Faculty Mentor: Mark Leary, Psychology and Neuroscience

The comfort zone is a concept that helps conceptualize people's relationships to approach-avoidance conflicts. Although people colloquially talk about certain behaviors or activities being "inside" or "outside" their comfort zone, no research in psychology has examined factors that influence where people draw this line. The psychological experience of feeling hesitant, threatened, or afraid is actually a continuum of avoidance, yet people make a distinction between things that are in versus out of their comfort zone, indicating that they are making a dichotomous judgment about what they believe they can handle. Study 1 investigated differences in how people conceptualize behaviors or activities that lie along this approach-avoidance gradient. Study 2 explored personality variables that are associated with comfort zones, and validates a new measure that assesses attitudes toward the importance of pushing oneself out of the comfort zone. Study 3 tested the malleability of comfort zones by testing the hypothesis that performing a challenging task that is inside one's discomfort zone (a task that people say they can do though they might feel uncomfortable) increases one's ability to perform a task that is outside one's comfort zone (a task that people say they would have difficulty doing) by increasing confidence in one's abilities to handle risk.

Psychology Graduation with Distinction 1pm-2pm

Mikaela Kovach-Galton

Gender differences in displays of stress within cross-race interactions

Faculty Mentor: Sarah Gaither, Psychology and Neuroscience

Cross-race interactions are known to be anxiety provoking, but the role that gender plays within such encounters remains underexplored. Study 1 (N = 128) examined gender differences for White individuals within an interracial interaction with a same-gender Black confederate after being primed to think about either their race or gender identity. Nonverbal behavior coding from the video-taped interactions showed that White men smile less, act less enthusiastically, show less comfort and interest, and are less physically engaged compared to White women. Additionally, White men self-reported feeling less energetic, engaged, friendly, and happy, but more threatened, defensive, tense, frustrated, and bothered compared to White women. Only White women primed with their gender identity showed more positive interaction outcomes, whereas a gender prime showed no effect for men. Study 2 (N = 34) investigated gendered responses to stress for biracial individuals who had their racial identity denied by an other-race experimenter. Results from nonverbal behavior and audio coding reveal that people overall are audibly more upset (p < .05) and marginally more engaged (p = .066) after being denied racial identity versus the control condition. Interestingly, it should be noted that an interaction analysis revealed marginal significance in the audibly upset variable (p = .053), such that biracial men are more audibly upset than biracial women after being denied racial identity versus a control condition, a pattern opposite that of biracial women. We suspect the interaction had marginal significance when split out because of small Ns. Additionally, another marginal interaction effect was found such that biracial men are more angry (p = .085) as compared to biracial women after being denied racial identity versus a control condition. Overall, these results suggest that men are more likely to express both nonverbal (study 1 and 2) and verbal (study 2) displays kinds of stress more obviously than women in interracial interactions. Furthermore, Study 1 pinpoints a possible pathway for mitigating stressful interracial outcomes, but one that may only affect women. Thus, future research should explore what other common identities may impact cross-race experiences and the unique role that masculinity may play in cross-race encounters.

Psychology Graduation with Distinction 10am-11am

Chris Lea

How Health and Religion Interact: An Interplay between PTSD, Pain, and Religious Involvement in Veterans

Faculty Mentor: Timothy Strauman, Psychology and Neuroscience

Close to 80% of war veterans with posttraumatic stress disorder (PTSD) also report experiencing chronic pain. Previous studies in the veteran population have demonstrated how social factors like social support moderate, or change, the relationship between PTSD and pain. Religious involvement is another social factor that may influence health outcomes, so this study examines if and how religious involvement moderates the relationship between PTSD symptoms and perceptions of pain. Veterans (N = 84) experiencing symptoms of PTSD completed a questionnaire capturing the three variables of interest: PTSD, pain, and religious involvement. PTSD symptoms were measured using the PTSD Checklist, and pain was assessed using a single-item self-report scale. The Belief into Action Scale captured both intrinsic and extrinsic factors of religious involvement. Results showed that PTSD and pain were significantly and positively correlated, r = .35, p < .01. PTSD symptoms were still a reliable predictor of pain after controlling for significant demographic variables. Religious involvement did not moderate the relationship between PTSD symptoms and perceptions of pain, F (2, 81) = 1.15, p > .05. Meaning, one's level of religious involvement did not reduce or increase the strength of the positive relationship between PTSD and pain. Future studies should examine the relationship between PTSD and pain in a longitudinal fashion, and also new studies need larger sample sizes in order to detect a moderation effect of religious involvement.

Psychology Graduation with Distinction 10am-11am

Visible Thinking- Abstracts

Savannah Grace Lynn

Internet Usage & Mental Health of Transgender Adolescents: An Exploratory Study

Faculty Mentor: Makeba Wilbourn, Psychology and Neuroscience

Transgender youth are known to experience dramatic disparities in mental health and well-being. Previous research has shown that Internet community has been beneficial for the identity formation and mental health of lesbian, bisexual, and gay individuals, but such findings have heretofore not been replicated with specifically transgender populations. The present study investigates a possible relationship between Internet usage and mental health for transgender adolescents in the Southern United States.

Psychology Graduation with Distinction 12pm-1pm

Samantha Neal

Cross-Cultural Examinations of Children's Perceptions of Ambiguous Race Asian/White Faces

Faculty Mentor: Sarah Gaither, Psychology and Neuroscience

Race is a salient social category that influences how people interact, but less is known about how individuals of mixed race heritage are viewed because they belong to multiple racial in-groups. Previous research on perceptions of biracial individuals has focused on those of mixed Black/White heritage, so comparatively less is known about how others perceive people of mixed Asian/White heritage. Additionally, this work has yet to be extended cross-culturally which would give the field insight into the degree of universality of these perceptions. This study examined how children aged 3-7 in Durham, NC, and Taichung, Taiwan, perceived ambiguous race Asian/White faces through a forced-choice categorization task and coloring activity to assess skin tone biases. White American children were significantly more likely to categorize the Asian/White faces as appearing more Asian while Asian American and Taiwanese children did not demonstrate any biases. Additionally, American children were more likely to select darker crayons than Taiwanese children in the coloring task, indicating an effect of cultural context on skin tone biases. Within Asian American children, South Asian children used significantly darker crayons than East Asian children, a comparison not commonly explored in research. There was also a negative correlation between age and degree of skin tone bias regardless of race, demonstrating that children's views of race become more holistic in this age range. By using of faces of real biracial people as stimuli, this study produced significant findings with greater external validity and extended them to an understudied subset of the biracial population

Psychology Graduation with Distinction 1pm-2pm

Erik Savereide

Exploring Body Image in the Context of Gender Dysphoria & Hormone Replacement Therapy

Faculty Mentor: Nancy Zucker, Psychology and Neuroscience

Body image disturbances have been found to underlie and contribute to the experience of gender dysphoria (GD) and generally improve over the course of hormone replacement therapy. To date, no published studies have examined the role of various components of body image in GD and how these may change over the course of hormone replacement therapy. The present study measured interoception, proprioception, executive function, and self-reported experiences in a sample of adolescents with GD (n = 18) undergoing or about to begin hormone replacement therapy. A subset of the sample (n = 7) was assessed again after at least four months. Interoceptive accuracy was significantly lower than a theoretical score cutoff observed in nonclinical samples and significantly improved during treatment, while proprioception did not significantly change. Intelligence and executive functioning were above average. Correlations were found between many variables, including interoception, proprioception, body competence, and attention shifting, suggesting a possible model of broad improvements to processes involved in self-awareness and self-acceptance during hormone replacement therapy. Though preliminary and limited by a small sample size, the results of this study can inform feasibility of study design and may have clinical implications if replicated in a larger sample. Future studies should further explore mechanistic pathways through which body image disturbances manifest in GD and can be resolved.

Psychology Graduation with Distinction 12pm-1pm

Christine Townsley

If at First You Don't Succeed, Reconsider: Attainability Cues and Adaptive Disengagement

Faculty Mentor: Rick Hoyle, Psychology and Neuroscience

Individuals' decisions to persist or disengage from a goal are essential to successful self-regulation. When individuals encounter unattainable goals, persistence can cause psychological and physical distress. Little is known about the traits and mechanisms underlying these differences. The present study hypothesizes that variation in task persistence (an individual's decisions to continue in a particular task or behavior) is due in part to individuals' evaluations of the task's attainability. In a within subjects design, participants were given two sets of challenging cognitive puzzles with several unsolvable items. The first set of puzzles had no cue about attainability, but the second set included an answer option indicating that the correct answer was not present. As predicted, the attainability manipulation had a significant effect on persistence, with participants spending less time on puzzles when they were cued that they might be unattainable. Most significantly, participants high in self-control spent less time on impossible puzzles in the un-cued condition, an effect opposite our prediction and the literature consensus.

Psychology Graduation with Distinction 1pm-2pm

Sarah Walker

Speaking the Language of Your Body: Distorted Interoceptive Awareness in Anorexia Nervosa

Faculty Mentor: Nancy Zucker, Psychology and Neuroscience

Anorexia Nervosa (AN) is a deeply troubling disorder in which individuals restrict caloric intake to the point of physical starvation. Previous research has found that individuals suffering from AN develop an all-consuming desire to lose weight, leaving them virtually impervious to the pains of hunger and ignorant of their physical deterioration. Although body image disturbance is accepted as a core feature of AN, little is understood regarding the experiential component of this construct—the differential way in which individuals experience physical sensations in their bodies. Emerging evidence does suggest, however, that AN may be motivated, at least in part, by a desire to blunt aversive hypersensitivity to visceral sensations, as acute starvation produces said effect. The current study explores the relationship between the somatic and cognitive components of AN symptomatology, so as to shed light upon why certain individuals seek to maintain a state of severe nutritional deficiency. To achieve this end, we compared individuals with (n = 18) and without (n = 22) a history of AN on their interoceptive accuracy, their tendency to exhibit fear-based reactions to bodily sensations, and their ability to appropriately interpret the messages conveyed by their visceral signaling pathways. While the only statistically significant finding lends support to the notion that individuals with a history of AN experience heightened fear-based reactions to bodily sensations, the data do offer preliminary support for the visceral hypersensitivity hypothesis. Given these findings, it may prove fruitful to implement acceptance-based approaches to interventions for AN, both preventatively and post-morbidly.

Psychology Graduation with Distinction 12pm-1pm

Madeline Wilkerson

Associations Between Positive Body Image, Exercise Type, and Eating Disorder Symptoms

Faculty Mentor: Nancy Zucker, Psychology and Neuroscience

Eating disorders are a prevalent mental illness, affecting as many as 10 million Americans. However, treatment options are often expensive, and up to 50% of those with severe eating disorders do not receive treatment. Although exercise can be harmful to those with eating disorders, structured exercise programs have had promising results. Therefore, this study looks at type of exercise as well as body image to see what impacts the two have on eating disorder symptoms. A sample of Duke University Physical Education students (n = 303) was given an in-person questionnaire examining eating disorder symptomology, type and frequency of exercise, and body image. Through a hierarchical multiple regression and an ANOVA, it was found that type of exercise and positive body image measures both significantly predicted eating disorder symptoms, while mindfulness and demographic measures did not. This implies that having a high positive body image may be a protective factor against eating disorders as well as that type of exercise might differentially impact eating disorder symptomology. Further randomized controlled trials should be conducted in order to confirm this association.

Psychology Graduation with Distinction 10am-11am

Grace Williams

Mental Health of NCAA Division One Student Athletes

Faculty Mentor: Timothy Strauman, Psychology and Neuroscience

In recent years, the prevalence of mental illness has expanded rapidly. Issues generally arise in the late teens to early twenties, making the transition to college extremely difficult for many people. But, for student athletes, these same stressors are compounded by pressures to perform well in sports and live up to expectations from coaches, teammates, professors, and fans. In this study, 120 current and former student athletes completed an online survey that was designed to assess the prevalence of symptoms of depression, anxiety, and eating disorders in this population. It was hypothesized that there would be higher levels of depression and anxiety in current athletes than former athletes, and there would be a higher incidence of mental health symptoms in recruited athletes than walk-on athletes. Furthermore, a positive correlation between symptoms of anxiety and depression and the amount of scholarship money the student athlete receives is expected. Lastly, we hypothesize an increase in eating disorder symptoms in female sports than male sports.

Psychology Graduation with Distinction 11am-12pm

Catherine Yang

What's the Story? A Qualitative Analysis of Birth Stories Across Race

Faculty Mentor: Makeba Wilbourn, Psychology and Neuroscience

Childbirth is a memorable experience for many women, but negative subjective experiences can result in negative psychological outcomes in mothers. Previous research on mothers' birth stories studies nearly exclusively white, middle-class mothers. To generalize those findings to mothers of other backgrounds would problematically minimize the effect that race has on the lived experiences of non-white women. In this study, we examine black and white mothers' birth stories to characterize similarities and differences. Researchers hypothesized that black and white mothers would mention particular themes, such as Medical Facts, at different rates. Black and white mothers' stories about the day their infant was born ("Could you please tell us about the day that [BABY] was born") were video-recorded and transcribed. The stories were coded with themes developed using Grounded Theory. No statistically significant differences were found in the frequencies at which themes appeared. However, we found that black mother' stories were significantly shorter than white mothers' stories. The themes also clustered differently in black and white mothers' stories. These results suggest that black mothers may be less comfortable discussing their birth in a research setting and that black and white mothers may think about childbirth and motherhood differently.

Psychology Graduation with Distinction 12pm-1pm

Idil Yazgan

Cumulative early childhood stressors and later antisocial behavior: The potential mediating role of neurocognitive functioning

Faculty Mentor: Kenneth Dodge, Psychology and Neuroscience

Unfortunately, early childhood adversity is very common in the U.S. 26% of children will have experienced a traumatic event by the age of 4. Clear from previous research that negative events during childhood can have deleterious effects later on. Early childhood adversity has been found to be a predictor of later antisocial behavior. However, the mechanisms that play into this relationship are unclear. Neurocognitive functioning is a good candidate as a mediator for this pathway. In this study, we explored the potential mediating role of neurocognitive functioning for the pathway between cumulative early childhood adversity and later antisocial behavior using the Child Development Project longitudinal data set consisting of 585 participants. Through our analyses, we concluded that cumulative early childhood adversity increased later antisocial behavior and lowered neurocognitive functioning in adolescence. And poor neurocognitive functioning predicted later antisocial behavior. Mediation analyses showed that neurocognitive functioning was a significant mediator for the relation between cumulative early childhood adversity and later antisocial behavior. This research has implications on understanding the development of later antisocial behavior and pinpoints to a potential pathway for intervention within the pathway from cumulative early childhood adversity to later antisocial behavior.

Psychology Graduation with Distinction 1pm-2pm

Karen Young

How to Speak without saying a word: A Comparison of Infants Responses to Three Nonverbal Cues

Faculty Mentor: Makeba Wilbourn, Psychology and Neuroscience

Human eyes have a uniquely large ratio of exposed white sclera, which may have evolved to facilitate cooperation. Here, we test whether pointing, another joint attentional skill, is equally important in the development of cooperative behavior by examining how infants follow head turns (H), eye gaze (E), and pointing gestures (P). We tested 12- and 18-month-olds' (n=48) ability to follow an experimenter's nonverbal cues directed towards novel objects. Six combinations of cues were used (H, E, P, HE, HP, EP). Each test trial had 3 iterations of a cue. We also included control trials with all 3 communicative cues combined (HEP). Infants followed the combined cue of eye gaze and pointing gesture more often than pointing gesture alone (p = .002). Eighteen-month-olds followed eye gaze + pointing gesture more often than head turn + eye gaze (p < .001). Across ages, infants looked more quickly to the target object in response to a pointing gesture compared to a head turn (p < .001) or eye gaze (p < .001). Furthermore, infants looked in response to eye gaze + pointing gesture significantly faster than head turn + eye gaze (p < .001). Thus, eye gaze and pointing are most effective at directing infants' attention. These findings contribute to our understanding of joint attention by exploring how pointing gestures influence gaze-following at different developmental time-points. This study is the first to compare the effectiveness of each of these social cues, and therefore pinpoint the unique contribution of each to infants' cue-following capabilities.

Psychology Graduation with Distinction 12pm-1pm

SOCIAL SCIENCES ABSTRACTS

Blaine Elias

To Seek or Not to Seek: Examining Health-Seeking Behaviors among Ethiopian Immigrants in the United States

Faculty Mentor: Jay Pearson, Public Policy

Existing literature suggests that immigrants underutilize U.S. health care. Care utilization is associated with poor health for both patients and those around them. Current health care research lacks data specific to Ethiopian immigrants' behaviors. Such research is necessary, as the Trump Administration has made recent efforts in reforming health care and immigration policies. The goal of this research was to investigate the reasons why Ethiopian immigrants choose and choose not to seek American health care. Past studies have identified (1) language differences with providers and (2) perceived discrimination from providers as barriers and (1) existing insurance coverage and (2) positive testimonials from social networks as facilitators to health care use for immigrants. These identified factors served as the hypotheses. Five focus groups were conducted with a total of 26 Ethiopian patients of "Learn and Live Wholestic Health Services", a public clinic located in Northern Virginia, during Summer 2017. The group discussions highlighted both hypothesized and emerging themes. Language was not a barrier to health care for participants, but there was variation on characterizing discrimination as a barrier. Public insurance was a facilitator and private insurance was a barrier. Positive testimonials were strongly regarded as facilitators. Considering emerging themes, one's attachment to Ethiopian traditionalism arose as a barrier, while professionalism of U.S. health care was a facilitator. This research has the following policy implications: implementation of health advertisements in Ethiopian communities, development of tools to solicit Ethiopian ideas, improvement of language services in health facilities, and further health research on Ethiopians.

Social Sciences 10am-11am

Chelsea Liu

Rehabilitation Provider Type Influences Functional Outcome and Mortality of Acute Ischemic Stroke Patients with Severe Neurological Deficits: Findings from the China National Stroke Registry II

Faculty Mentor: Janet Prvu Bettger, Orthopedic Surgery

Background: Task-shifting rehabilitative care from rehabilitation therapists to physicians, nurses, and relatives may supplement the shortage of specialized rehabilitation personnel in China. However, it is unknown how this practice affects patient outcomes. This study examined the association of rehabilitation provider type with functional dependence and mortality among patients with acute ischemic stroke (AIS) in China. Methods: Patients with AIS hospitalized at participating China National Stroke Registry II hospitals were eligible if they had no pre-stroke disability (modified Rankin score [mrs]=0-2), had moderate to severe neurological deficits at admission (NIHSS>4), and returned home after hospital discharge. Using multivariable logistic and Cox regression models, we compared rehabilitation care provided by therapists versus physicians, nurses, or relatives on functional dependence (mRS=3-6) and mortality at 3, 6, and 12 months after discharge, adjusting for patient characteristics. Results: A total of 3741 patients received in-hospital rehabilitation, 56.21% from rehabilitation therapists and 43.79% from others. Among patients with NIHSS=5-9 and NIHSS=10-14, there were no differences between groups for any of the outcomes (Table 1). However, for severe stroke patients (NIHSS>14), non-therapist care was associated with higher odds of mortality at 3-months follow-up (HR=2.13, 95%CI 1.11-4.07, P=0.02) and 12-months follow-up (HR=1.88, 95%CI 1.17-3.01, P=0.01). Hospital-level analysis showed that it was more common for nonteaching hospitals to be without rehabilitation therapists. Conclusions: This study suggests a lower mortality risk for patients with severe stroke when treated by a rehabilitation therapist versus others. Future studies should explore the dose, frequency and focus of acute stroke rehabilitation by different providers to better delineate the mechanisms for improving patient outcomes.

Social Sciences 1pm-2pm

Joshua Lovett

Exploring Identity Dissonance Among First-generation Students at Highly Selective Institutions

Faculty Mentor: Jennifer Hill, Education

It is clear that first-generation students experience many barriers as they enter and persist through college. Past research has hinted that many first-generation students struggle with growing and maintaining two identities, especially at highly-selective institutions, but research has yet to explore how these two identities change, diverge, and even reintegrate as first-generation students' progress through college. Using a novel conceptual framework, the current study qualitatively explores the idea of identity dissonance in relation to the types of barriers first-generation students encounter while in college. Ten first-generation students participated in semi-structured interviews. It was found that first-generation college students reported experiencing a variety of academic, social, cultural, and familial challenges. Notably, it was also found that many participants did report experiencing identity dissonance. This research indicates that first-generation college students may be particularly susceptible to experiencing divergent identity development while in college. Future research should focus on further exploring the specific psychosocial mechanisms underlying identity dissonance among first-generation students.

Social Sciences 10am- 11am

Attyat Mayans

Chinese students studying abroad at Duke Kunshan University: Examining the implications of the Chinese study-abroad movement at an International Branch Campus

Faculty Mentor: Eileen Chow, Asian and Middle Eastern Studies

This ethnographic case study explores the relationship between the Chinese study abroad issue and Duke Kunshan University (DKU), in Kunshan, Jiangsu Province, China. DKU is one of 39 International Branch Campuses (IBCs) currently operating in China. Through interviews with 15 students and participant observation on campus in Spring 2017, I examined if and how IBCs served to supplement the traditional study abroad experience. Duke Kunshan University clearly emerged as a trial run for students wishing to study abroad, as they were able to experience what they defined as American-style education and judge whether or not they would wish to attend graduate school in an English-speaking country. Students also indicated more systemic reasons for their educational choice, namely the omnipresence of the American imaginary, discontent with traditional Chinese education, achieving personal goals, and the high cost of studying abroad. Although IBCs have already been both heralded and critiqued for branding the educational practices of their parent universities in order to tap into a market in other countries, their role in the Chinese study abroad movement, which is already over 520,000 students strong across the globe, has largely been overlooked.

Social Sciences 10am-11am

Adair Necalli

Color, Class, and Language Ideology: Loving a Language Without Those Who Speak It

Faculty Mentor: Gareth Price, Linguistics

This preliminary research isolates the trends in language ideology held by citizens in the greater Cholula area, in the state of Puebla, Mexico, who regularly come into contact with Nahuatl, Mexico's most widely spoken indigenous language. The decline in speakers of Nahuatl since the 1980's is heavily affected by the community's language ideologies – the system of values, feelings, and beliefs an individual or community assigns to specific languages. These language ideologies are affected by environmental factors, such as experiences of linguistic, economic, and racial discrimination, and policies (both official and unofficial) in place in schools, workplaces, and the home related to bilingualism (or lack thereof) and linguistic identity. These factors are typically analyzed individually in academia to attempt to understand the process of language revitalization and language death. However, when comprehended as parts of a whole as systems of language ideologies held by different groups of people who interact with Nahuatl speakers, one can better understand the state in which the Nahuatl language exists. In the greater Cholula area in the state of Puebla, the language ideologies held by today's adult generations affect that of the next generation of children in contact with Nahuatl. This will likely affect the future of the Nahuatl language in the area and the rate at which it is spoken, which is still dropping rapidly.

Social Sciences 10am- 11am

Gino Nuzzolillo

Addressing Mass Incarceration in Cook County, Illinois

Faculty Mentor: Alma Blount, Public Policy

My research assesses mass incarceration in the United States through the lens of the Cook County Jail in Chicago, Illinois. The American criminal justice system currently incarcerates approximately 2.3 million people, of which a disproportionate number are low-income men of color. It is both a violent disruption to communities across the country, trapping marginalized communities in cycles of poverty and incarceration, and a system inconsistent with the principles of human rights that the United States rests upon. The programs and policies taking place in Cook County Jail under the leadership of Sheriff Tom Dart, including bail reform and substantive mental healthcare, are an analytically-rich source to understand the challenges preventing creative criminal justice reform. A human-centered approach to criminal justice reform, as opposed to considerations of economic efficiency or taxpayer savings, is essential to fundamentally reimagining the role of criminal justice in our society.

Social Sciences 12pm-1pm

Raichel Perper

Labor Attrition between South Africa's Public and Private Health Sectors: A Mixed-Methods Case Study of KwaZulu-Natal Dietitians

Faculty Mentor: Sherryl Broverman, Global Health

The South African health care system has a highly inequitable distribution of human and financial resources. The private sector only serves 28-38% of the population but has 59% of medical specialists. Applying the concept of job satisfaction as a mediator of labor attrition, the aims of this study were to (1) evaluate the factors influencing choice of workplace amongst clinical dietitians, and (2) analyze the policy implications for improving labor retention. This cross-sectional study employed mixed-methods, including job satisfaction surveys (N=66) and semi-structured interviews (N=7). The sample included public and private clinical dietitians in KwaZulu-Natal, South Africa. Data were analyzed using regression modeling and thematic content analysis. The regression analysis revealed private dietitians to be 12.43 points happier than public dietitians on a 12-question job satisfaction survey (95% CI: 6.73, 18.13), after controlling for salary, degree, job setting, time in current job, university, and specialty. The private sector offers perceived advantages in physical workplace, workday flexibility, and salary level. Government dietitians expressed more favorable professional relationships with dietetic and non-dietetic colleagues, feelings of value, and salary stability. Private dietitians were dissatisfied with income insecurity, colleague competitiveness, and marketing one's dietetic services. Public dietitians noted poor physical working conditions and limited promotion opportunities. These findings suggest that retention strategies should target public sector staffing shortages, career pathing, and contract flexibility. Further research is needed to evaluate these findings on a national scale and assess the comparative feasibility, favorability, and impact of private contracting models across other allied health professions.

Social Sciences 10am- 11am

Elizabeth Speed

Women's Underrepresentation in United States Elective Office: Why Women are Less Likely to Run and How This Imbalance Can be Addressed

Faculty Mentor: Alma Blount, Public Policy

While women have held elective office in the United States for the past century, a large gender gap in political representation still persists. Despite this, it has been found that women and men win elections nationwide at about the same rate. The difference in representation therefore stems from fewer women running for office in the first place. Understanding that when women run, they do win, this project utilized a literature review and a practitioner interview to identify why women are nevertheless less likely to be on the ballot than men are. A policy memo and adaptive analysis leadership strategy were then created to address these findings.

Social Sciences 10am- 11am