19th Annual Celebration of Undergraduate Research at UNC Chapel-Hill

Poster Sessions - Frank Porter Graham Student Union

Session I: 1:15 – 2:15 PM

1. Aditi Adhikari (Public Policy), *Promoting Engagement in a Healthy Masculinity Program for Boys in Rural Nicaragua*
Track: Health & Well-Being
Advisor: Edwin Fisher (Health Behavior and Health Education - School of Public Health)
Undergraduate Co-Authors: Rishika Reddy

Abstract: Machismo is the Latin American attitude and acceptance that men are inherently superior to women, which often results in negative consequences for women's health and encourages interpersonal violence. The primary focuses of this project revolved around creating a forum for discussion on the both significance and consequences of Mach??smo culture in Nicaragua, while also increasing general awareness and knowledge of laws related to gender equity by 50%. The interactive program consisted of a combination of informative games and charlas, or informal lessons, that discussed three main topics: interpersonal violence, active fatherhood, and conceptions of masculinity. There were 43 participants in grades four through six across three locations: La Virgen, El Ascentamiento, and El Higueral. Quantitative and qualitative data collected from schools that were visited have shown significant increases in the awareness of gender equity laws and conceptions of masculinity in surrounding communities. Participants at three sites showed an increase of at least 100% in awareness based on pre and post tests on all three topics. Though the study period was brief and the information itself may have only been retained for a short period of time, the quantitative data shows that the young, school-aged males were engaged in the program. Lessons learned from this intervention shed light on how future healthy masculinity education programs may be approached, especially in rural, resource-poor areas.

3. Aneesh Agarwal (Undecided), *Tumor Texture Feature Extraction as a Predictor for Survival in Patients with Melanoma Brain Metastases*
Track: Health & Well-Being
Advisor: Yueh Lee (Neuroradiology)

Abstract: Quantitative imaging is of growing interest for the assessment and treatment of brain lesions. We sought to explore the relationship between magnetic resonance (MR) tumor texture parameters of melanoma brain metastases and patient survival. METHODS Anonymized MR sequences including fluid-attenuated inversion recovery (FLAIR), susceptibility-weighted imaging (SWI), apparent diffusion coefficient (ADC), T1-weighted, and T2-weighted imaging were analyzed. Second-order texture statistics were extracted from tumor and edema regions of image series. The correlation of statistical parameters was estimated as a function of patient survival from brain metastases diagnosis. T-tests for significance of a correlation coefficient were performed to interpret correlations between parameters and survival. RESULTS MR imaging studies from 10 patients were selected for analysis. On FLAIR images, a correlation of 0.4 across 3 parameters was noted. Highest correlations were found in SWI images, ranging from 0.44 to 0.59 across 16 parameters with the highest having significance at $P<0.037$. These results suggest that SWI, and to a lesser extent FLAIR images may offer additional

diagnostic information about melanoma brain metastases. CONCLUSION We found that higher secondary statistics of SWI and to a lesser extent FLAIR imaging are consistent with longer patient survival. Further work is ongoing to increase the study size and explore biological mechanisms for the improved survival.

5. Rawan Ajeen (Nutrition), *Electrophysiological and Behavioral Response of Restrained and Unrestrained Eating Behaviors in Response to Emotional Images*
Track: Health & Well-Being
Advisor: Alana Campbell (Psychiatry), Aysenil Belger (Psychiatry)

Abstract: The boundary model (Herman & Polivy, 1984) characterize restraint in eating as an increased tolerance and control over hunger as well as more cognitive control, related to decreased responses to food stimuli.. This experiment sought to explore behavioral and electrophysiological responses to food stimuli as they relate to the boundary model. Participants (n = 23) had their brainwaves recorded while viewing 35 positive, negative, neutral and food images selected from the International Affective Picture System (IAPS). Participants then rated the valence and arousal, on a 1-9 likert scale for the images. Preliminary analysis of the behavioral data showed mean valence and arousal showed that the restrained (n=17) eaters reported higher valence (6.95) than the unrestrained (n=6) eater's reported mean valence (6.56) and the IAPS mean valence (6.61). Both groups in this experiment reported a higher mean arousal (6.15 Restrained, 5.56 Unrestrained) towards the food IAPS images, than the IAPS mean arousal (4.86). ERP data was collected and is currently being analyzed to include in the poster session. These data suggest that restrained eaters, despite having a higher tolerance to hunger and satiety, as a result are more sensitive to external food stimuli, which confirms Herman and Polivy's assumption under the boundary model.

7. Samuel Aldous (Chemistry), *Characterization of Myosin X Localization and Activity due to SH3 and PH Domain Deletions in Various Cell Lines*
Track: Health & Well-Being
Advisor: Richard Cheney (Cell Biology and Physiology)
Graduate Student Contributors: Ernest Heimseth, Sara Francis

Abstract: Myosin X is a key component to cell motility and cancer cell metastasis, yet the biochemical methods in which this protein is localized to the tips of filopodia in the cell is relatively unknown, as well as the regulation behind its activation. It was previously believed that the protein Phosphatidylinositol (3,4,5)-trisphosphate attached to one of the 3 PH domains that existed in Myosin X to then direct the protein to the basal side of polarized epithelial cells. Furthermore, Myosin X's SH3 domain has been shown to play a major role in its dimerization, and subsequent activation. By performing deletions for one of the three PH domains and the SH3 domain, the localization and activity of Myosin X was investigated. This revealed that PIP3 binding to and localization for Myosin X was maintained due to the remaining PH domains being sufficient for PIP3 binding, as noted by the localization change when all PH domains were removed. The SH3 domain deletion also created qualitative differences in filopodia behavior.

9. Anita Amin (Health Policy & Management), *The Role of MMP-9 in Neuroinflammation and HIV Neuropathogenesis*
Track: Health & Well-Being
Advisor: Rick Meeker (Neurology)
Graduate Student Contributors: Lauren Allen
Faculty/Postdoc Contributors: Laura Herring, Emily Wilkerson, Rick Meeker

Abstract: Activation of macrophages and microglia in the central nervous system by HIV plays a pivotal role in the progressive development of neural damage and cognitive deficits. However, the precise mechanisms of pathogenesis are not well understood, and no current treatments are available that effectively target the inflammatory response and reduce neural damage. An antibody based assay revealed robust secretion of matrix metalloprotease-9 (MMP-9) by macrophages in response to HIV virions. We consequently evaluated the potential contribution of MMP-9 to neurotoxicity by adding 1-20 ng/ml MMP-9 to cortical/hippocampal neuron cultures and assessing calcium and cytoskeletal dysregulation. A proteomic analysis was also conducted to identify proteins cleaved by MMP-9 in high-density neuronal cultures. A gradual rise in intracellular calcium was seen over 66 min in the presence of added MMP-9. Neuronal sensitivity to glutamate was enhanced with individual cells showing an increased frequency of calcium spikes that were prevented by co-incubation with the NMDA receptor antagonist AP5. The initial proteomic analysis revealed significant upregulation and downregulation of important calcium-binding proteins, ion channels, and cytoskeleton proteins in MMP-9-treated cultures. These results indicate that MMP-9 may play a role in neural dysfunction in response to inflammation by enhancing NMDA receptor activity and promoting dysregulation of proteins that maintain normal neural function.

11. Keerthi Anand (Biomedical Engineering), *Implementation of Pulse-Inversion Super Harmonic Contrast Enhanced Ultrasound Imaging in 3D Space*
Track: Health & Well-Being
Advisor: Paul Dayton (Biomedical Engineering)
Graduate Student Contributors: Thomas Montgomery Kierski, Sandeep Kasoji
Faculty/Postdoc Contributors: Paul Dayton

Abstract: While ultrasound is useful for making diagnoses based on morphology, it faces obstacles of a limited resolution at depth, poor tissue specificity, and inaccurate 3D reconstruction. Scanners noninvasively image tissues by transmitting pressure waves with a center frequency from 1-20 MHz, detecting echoes from tissues within a transducer-specific-bandwidth, and reconstructing the anatomy. Injectable microbubble contrasts have helped to increase tissue specificity as they respond non-linearly to pressure waves, and echo the pulses at frequencies outside of the range of the tissues. As signals from the microbubbles are limited to regions of blood vessels, they may be used to track migration of markers with blood flow, resolve vasculature, measure perfusion, or target particular cells. It was hypothesized that implementing a dual-transducer setup would select for contrast and increase contrast tissue ratio. The signal from contrast may be isolated with a pulse inversion technique, which negates linear echoes from tissues. To test the hypothesis, a tissue mimicking phantom was injected with contrast, interrogated with a low frequency pulse-inversed signal from one transducer, and the harmonic response of the was detected by another high contrast frequency probe. It was also hypothesized that developing a platform for 3D ultrasound image acquisition would help to map tissue distribution. This study analyzes the improvement to CTR when combining the aforementioned imaging methods.

13. Abby Bergman (Biology), *Defining the Role of Nectins in Secondary Palatogenesis*
Track: Health & Well-Being
Advisor: Scott Williams (Pathology and Laboratory Medicine)
Faculty Contributors: Scott E Williams, PhD
Undergraduate Contributors: Danielle C Spitzer
Graduate Student Contributors: Kendall J Lough

Abstract: Cleft palate is one of the most common birth defects in the US, and is the result of the palatal shelves failing to fuse. The formation of the secondary palate occurs during embryonic development and is well modeled in mice. After emerging from the maxillary prominences, the palatal shelves undergo a period of vertical down-growth toward the floor of the mouth, followed by rapid elevation and horizontal growth over the tongue. Secondary palatogenesis concludes as the medial edge epithelia of each shelf make contact and adhere to one another, forming the medial epithelial seam (MES). The MES is then cleared by several mechanisms to form a contiguous palatal roof, defining the boundary between the oral and nasal cavities. Previous studies have linked various mutations in the cell adhesion molecule nectin 1 to cases of both syndromic and non-syndromic cleft palate. Utilizing gene expression editing techniques, we have demonstrated that loss of either nectin 1 or its family member nectin 4 can result in cleft palate in mice with variable penetrance. Furthermore, it has been previously demonstrated that adherens junction components are important in establishing mitotic spindle orientation via recruitment of polarity molecules and/or direct linking to the spindle machinery. Our data suggest that nectin 1 is not required for normal division orientation, preliminary nectin 4 data suggest it may be necessary for maintenance of division orientation.

15. Mackenzie Bogiages (Mathematical Decision Science), *Effect of Education on Diabetes Rates in the United States*
Track: Health & Well-Being
Advisor: David Guilkey (Economics)

Abstract: Increasing diabetes rates are a problem of growing concern in the United States and worldwide. The health complications caused by diabetes are complicated, costly, and can be deadly. Rising healthcare costs in the United States have encouraged many healthcare organizations (HCOs) to begin promoting "preventative care", taking measures to prevent diseases instead of waiting for diseases to develop and treating them, in order to avoid these preventable and costly diseases. In addition to reducing costs, preventative care has also been shown to reduce mortality rates and produce overall healthier patients. Over 30 million people in the United States have been diagnosed with diabetes, and over 90 percent of that group has the largely preventable type 2 diabetes. Additionally, 84 million other Americans have prediabetes, a condition that can develop into type 2 diabetes if untreated. In order to thwart the disease that costs the US $245 billion a year, the populations that are most susceptible to diabetes need to be identified and educated. Relevant literature frequently cites education to be statistically significant when analyzing diabetes rates. Using data from the Medical Expenditure Panel Survey, education and several other casual factors of diabetes have been identified and their relationships with diabetes have been analyzed through regression analysis in order to target at risk populations and outline tactics to educate those in dire need of preventative care.

17. Adrienne Bonar (Psychology & Neuroscience), *Believing Your Body: Beliefs About the Value, Regulation, and Intensity of Body Signals Matter for Interoceptive and Emotional Awareness*
Track: Health & Well-Being
Advisor: Kristen Lindquist (Psychology and Neuroscience)
Graduate Student Contributors: Jennifer K. MacCormack
Faculty/Postdoc Contributors: Dr. Kristen A. Lindquist

Abstract: The body plays an important role in one's experience of emotion, yet little work examines beliefs about the value, regulation, and intensity of bodily signals (e.g., a racing heart) and how such beliefs predict emotional outcomes. We developed a 12-item questions measure assessing beliefs about bodily signals' value (e.g., My body is a source of wisdom), intensity (e.g., My body is an intense place), and regulation (e.g., It's important to control my bodily urges). 105 undergraduates completed a

heartbeat detection task measuring interoception and a series of questionnaires assessing their body signal beliefs, interoceptive awareness, and emotional awareness. Participants who believed their body signals were misleading were more interoceptively accurate and alexithymic, but also reported reduced body awareness and emotional clarity. People who believed their bodies ought to be regulated were more alexithymic with less emotional clarity and body awareness. People who believed their bodies were intense had greater interoceptive ability, alexithymia, somatization tendencies, and less emotional clarity. These findings provide early evidence that beliefs about one's internal sensations could play an important role in interoceptive and emotional awareness.

19. Ryan Booth (Chemistry), *Profiling the Expression of Progesterone Receptor and Serum Response Factor Pathway Members in Female Reproductive Tract*
Track: Health & Well-Being
Advisor: San-pin Wu (NIEHS - Reproductive and Developmental Biology)

Abstract: The primary functions of the myometrium are to maintain uterine structural integrity and provide contractile force during parturition. The dysfunction of the myometrium may result in uterine leiomyoma, dystocia, and preterm birth. Genome-wide progesterone receptor (PGR) cistrome analyses reveal enriched binding motif of the serum response factor (SRF) in PGR occupying sites of the myometrium. Given that SRF is a master regulator of vascular smooth muscle, we hypothesize that SRF is also expressed in the uterine smooth muscle and may serve a pivotal role in myometrial adaptation to pregnancy. Methodology: Tissue sectioning of mouse uteri in one day increments from day 0.5-9.5 was executed. IHC staining of the sectioned tissue samples was performed with antibodies against PGR, SRF and MKL2 to identify gene expression throughout different phases of the mouse pregnancy. Results: SRF stained tissue were positive for gene expression through each gestation day. The MKL2 antibody yielded similar results, with fluctuations in gene expression in the same tissue regions. Sections stained with PGR displayed uniform expression throughout the stroma. Epithelial cells showed strong expression patterns for days 0.5-2.5, decreased expression for days 3.5-5.5, no expression for days 6.5-7.5, and moderate expression for days 8.5-9.5. Discussion: Expression patterns between SRF pathway genes and PGR unveil the potential targeting of SRF pathways in the treatment of myometrial patholo**.

21. Anna Brodmerkel (Environmental Studies), *Homeowner Perceptions of North Carolina Sea Level Rise Policy*
Track: Environment
Advisor: Charles Peterson (Marine Sciences, Biology, and Ecology)
Graduate Student Contributors: Carter Smith, UNC PhD candidate
Faculty/Postdoc Contributors: Rachel Gittman, PhD, Scyphers, PhD

Abstract: North Carolina provides an interesting case study in sea level rise policy because the state faces various threats such as erosion, increasing pressure from booming coastal populations, and frequency of major storm events. Enacted in 2012, the North Carolina Act to 'Study and Modify Certain Coastal Management Policies' does not allow for any guidelines to define a rate of sea level rise for regulatory purposes and mandates that the Coastal Resource Commission (CRC) Science Panel must update the report every five years but may only use historical models to determine future rates of sea level rise for up to 30 years. This analysis sought to address if NC waterfront homeowners and statewide residents were aware of the bill, their opinions of HB819, and what factors were most likely to predict awareness and acceptance of HB819. Surveys were sent to out via Qualtrics to waterfront homeowners and statewide residents. Waterfront residents were more aware of the bill and demonstrated a stronger opinion of the bill. Ultimately, factors affecting perceptions of the bill shared a

common polarizing theme, those who believe in global warming or believe they will be most harmed by SLR were more likely to oppose the bill. Policy-makers should consider all concerns of NC residents when creating SLR policy, with a particular focus on coastal residents who will be most harmed.

23. Emily Browning (Health Environmental Sciences & Engineering), *Rainfall Effects on Water Quality in a Tropical Semi Arid Island Environment*
Track: Environment
Advisor: Diego Riveros-Iregui (Geography)

Abstract: Anecdotally, it has been suggested that when it rains more on the island of San Cristóbal in the Galápagos more people are in the hospital due to gastrointestinal issues. This is the first study to evaluate whether rainfall has a predictive effect on microbial water quality on the island. Over the course of 2 years, microbial data was taken from 11 sites on the island. Statistical analysis was done to evaluate whether microbial data can be predicted with varying amounts of rainfall. Analysis was also done to evaluate whether a site's relative position on the island or in the water distribution system changes with varying amounts of rainfall. Overall, there were relatively few instances where the findings suggested an association between the data and rainfall. However, consistent with previous research, the data used in this study did find statistically significant associations between some of the site's microbial data and cumulative rainfall 24 and 48 hours before water collection. This study focuses on addressing two questions cited as important for future methods to control and predict water quality for the island of San Cristóbal. First, how does temporal variations in rainfall affect the coliform and E. coli in the water samples? Second, how does rainfall affect the presence of coliform and E. coli in different parts of the water distribution system?

25. Constance Chen (Biology), *Exploration of a Key Mechanism Causing Chronic Pain and PTS In Women Following Trauma Exposure*
Track: Health & Well-Being
Advisor: Sarah Linnstaedt (Anesthesiology)
Undergraduate Contributors: Shan Yu
Graduate Student Contributors: Yue Pan
Faculty/Postdoc Contributors: Dr. Sarah Linnstaedt

Abstract: Women experience increased incidence and severity of post-traumatic outcomes such as chronic posttraumatic pain (CPTP) and posttraumatic stress (PTS) as compared to men. One key difference is the presence of X chromosome inactivation in women to silence the extra X chromosome. Silencing, occurs randomly by methylation, accounts for equal gene expression between the sexes. X-inactive specific transcript (XIST) is a known major regulator of X chromosome inactivation and is responsible in regulating gene expression from one of the X chromosomes. Thus, pathogenesis regarding XIST mechanism would lead to imbalances in gene expression in women and would provide insight to differences in post-traumatic outcomes. Project cohort consisted of 96 women enrolled in a longitudinal study of adverse outcome development following one of the most common traumatic experiences, motor vehicle collision. Preliminary findings show that XIST RNA expression levels predict CPTP and PTS. For both outcomes, higher XIST RNA expression was associated with increased risk of adverse outcomes in women. Specific mRNA and microRNA were identified to escape X chromosome inactivation due to altered levels of XIST RNA. Each were also significantly correlated with XIST suggesting an interaction at play. These biomarkers can act as a predictive tool to prevent or halt the development of post-traumatic outcomes in women following motor vehicle collision.

27. Elizabeth Chen (Exercise & Sport Science), *Orientalist Misconception of Harems: A Reality of Women's Power in Fatima Mernissi's Dreams of Trespass*
Track: Diversity & Equity
Advisor: Claudia Yaghoobi (Asian Studies)
Undergraduate Co-Authors: Sundus Alfe, Divia Kallattil, Zaynab Nasif, Alice Donut

Abstract: Traditionally, harems have been studied through the lens of Western scholars or tourists who have reproduced Orientalist ideas of exoticized, Middle Eastern women that lived primarily in imperial harems. The Orientalist agenda imagines, distorts, and exaggerates the differences between people of the Middle East and the West, specifically portraying Middle Eastern culture as uncivilized, erotic, and exotic. Despite the exoticized Western misconception of the harem as a sexual space, in reality harems were complex institutions that existed in both imperial and non-imperial contexts and represented a microcosm of society. Harems were nuanced spaces, exhibiting social hierarchies and varying aspirations, whether they related to modernity or tradition. This differentiation is made by Fatima Mernissi in Dreams of Trespass where she discusses Western misperceptions of harems, contrasting this view with her lived experiences in the harem she shared with her extended family and the experiences of her maternal grandmother, who was raised in a desert harem. Separate from the harems with which she had personal ties, there also exists the imperial harem. The imperial harem is formally defined as a space comprised of wives, male and female servants, female relatives of the sultan, and concubines. The fantasization of harem women, both of high and low classes, served as caricatures for Western audiences to further depict and Orientalize. However, Mernissi exhibits that women within the hare**.

29. Sofia Corella (Psychology & Neuroscience), *Crescerin: Growing the Ciliome and the Understanding of Primary Cilia*
Track: Health & Well-Being
Advisor: Kevin Slep (Biology)
Graduate Student Contributors: Rebecca Adikes

Abstract: Eukaryotic primary cilia are cell-surface projections critical for sensing the extracellular environment. Defects in primary cilia structure and function result in a broad range of developmental and sensory disorders, termed ciliopathies. Mechanisms that regulate the microtubule (MT)-based scaffold forming the cilia core are poorly understood. TOG domain array???containing proteins ch-TOG and CLASP regulate cytoplasmic MTs. Whether TOG domain array proteins also regulate ciliary MTs is unknown. However, Crescerin has been identified as a cilia-specific TOG array-containing protein that regulates ciliary MTs. To understand how TOG domains and TOG domain arrays of proteins regulate ciliary MTs, we set out to solve the structure of Crescerin1 TOG 4. It was hypothesized that Crescerin1 contains four TOG domains, that TOG 4 is a canonical TOG domain with conserved tubulin-binding determinants, and that the tubulin-binding activity of Crescerin1 TOG 4 regulates MT dynamics differently than Crescerin1 TOG 2 by promoting MT polymerization through the stabilization of the tubular structure. Using DNA cloning and protein expression, purification and crystallization techniques, we have obtained starburst-like crystals and are close to optimizing crystal morphology for X-ray crystallography and solving the structure of Crescerin1 TOG 4.

31. Benjamin Creekmore (Chemistry), *Mouse Gut Microbiome-Encoded beta-Glucuronidases Identified using MAPS, Metagenome Analysis by Protein Structure*
Track: Health & Well-Being
Advisor: Matthew Redinbo (Chemistry)

Undergraduate Contributors: Josh Gray

Abstract: Gut microbial glucuronidase (GUS) enzymes are important in drug efficacy and toxicity, intestinal carcinogenesis, and mammalian-microbial symbiosis. A catalog of gut microbiome-encoded GUS enzymes was provided for the Human Microbiome Project stool sample database. Because mice are a model organism used to examine healthy and diseased mammalian states, we sought to provide an analogous catalog of mouse intestinal microbial GUS proteins. We identified 338 unique GUS proteins by using MAPS and organized the mouse proteins into six categories based on active site features. GUS enzymes were encoded by the major gut microbial phyla, including Firmicutes (67%) and Bacteroidetes (24%). No differences in gut microbial gus gene composition were observed for mice based on location housed or provider. Mice of the Swiss-Webster strain exhibited a different phylogeny of gut microbes encoding gus genes and distinct fractions of GUS proteins based on active-site features. Mice on a low-fat diet contained 22 GUS proteins unique to the low-fat diet group. Our results show GUS in mice and humans differ at the individual protein level and show that gus gene composition in the murine GI tract differ in mice on low fat vs. high fat diets. These data provide a basis for understanding the gut microbial GUS enzymes present in laboratory mice commonly used as organisms to model mammalian health and disease.

33. Conrad Czejdo (Computer Science), *Deep Learning Based Macromolecule Conformation Prediction and Quality Estimation*
Track: Health & Well-Being
Advisor: Leonard McMillan (Computer Science)
Faculty/Postdoc Contributors: Leonard McMillan

Abstract: A grand challenge in the field of structural bioinformatics is a fast, accurate method of critiquing the likelihood of macromolecular conformations within a provided set that has been generated by servers. We present and perform a comparative analysis of a set of novel deep-learning based structural prediction and quality assessment algorithms. These include the wasserstein generative adversarial network for unsupervised learning of contact maps, direct generation of contact maps from peptide sequences using deep convolutional networks, and potential estimation from local areas of the structure using deep networks designed for molecular energy estimation. We demonstrate the viability of our approaches by training on protein structures available before the international CASP 12 protein folding competition and testing on the protein conformations solved during the competition itself. We demonstrate state-of-the-art results for single model protein evaluation, achieving a mean GDT_TS loss significantly lower than the next single-model competitor.

35. Clara Davison (English & Comparative Literature), *Mothers' Stories of Postpartum Depression: Coming to Voice and Healing the Self*
Track: Health & Well-Being
Advisor: Jane Danielewicz (English)

Abstract: The Center for Disease Control and Prevention states that 1 in 9 mothers experience postpartum depression. If we extrapolate to the number of births annually, then an astonishing 900,000 women are affected by this illness every year. This study highlights the importance of stories in the field of medicine; no definition or description of symptoms could have as much impact as the personal accounts of those who suffered from this illness. Personal accounts also introduce new ideas that may not be obvious from scientific reports. Through memoirs, women confronted the stigma surrounding post-partum-depression and voiced their support for those currently suffering. Studies in the Health

Humanities highlight the importance of individual stories and personal experience as a way to understand and treat diseases like postpartum depression.

37. Ashley Dibbert (Exercise & Sport Science), *Associations Between Quadriceps Function and Gait Biomechanics in Individuals With Anterior Cruciate Ligament Reconstruction*
Track: Health & Well-Being
Advisor: Troy Blackburn (Exercise & Sport Science)
Undergraduate Co-Authors: Nathan Guskiewicz, Heather Lavin, Jevon Morris
Graduate Student Contributors: Chris Johnston

Abstract: Anterior cruciate ligament (ACL) injury and surgical reconstruction (ACLR) increase the risk of knee osteoarthritis (OA). Quadriceps dysfunction is common following ACLR and may be associated with changes in gait biomechanics that may contribute to knee OA risk. The purpose of this study was to evaluate relationships between multiple indices of quadriceps function and a battery of gait biomechanics outcomes in 53 individuals with ACLR. Subjects performed maximal voluntary isometric quadriceps contractions from which peak torque (i.e. strength) and rate of torque development (RTD) were calculated. Three-dimensional kinematics and kinetics were sampled as subjects walked across force plates embedded in the floor. Gait biomechanics outcomes included the peak vertical ground reaction force (vGRF) and its instantaneous loading rate, as well as the internal knee flexion and valgus moments and knee flexion displacement. No significant correlations were observed between quadriceps function and gait biomechanics. These results suggest that factors other than quadriceps function likely contribute to aberrant gait biomechanics following ACLR, particularly in subjects such as ours who were on average, more than 2 years removed from ACLR. Future research is necessary to determine the role that quadriceps dysfunction plays in knee OA risk.

39. Sarah Dishman (Chemistry), *The Development of Small Molecule Inhibitors for the Methyl-Lysine Reader Protein, 53BP1, Using Fragment Based Screening*
Track: Health & Well-Being
Advisor: Stephen Frye (ESOP: Center for Integrative Chemical Biology and Drug Discovery (CICBDD))
Graduate Student Contributors: Kelsey Lamb, Beatrice Chiew
Faculty/Postdoc Contributors: Juliana The, Menachem Gunzburg, Bradley Doak, Jacqueline Norris-Drouin, Stephanie Cholensky, Peter Brown, Cheryl Arrowsmith, Stephen Headey, Lindsey I. James, Stephen V. Frye

Abstract: The methyl-lysine reader protein, 53BP1, has implications in DNA double stranded break repair, where its main function is to bind to H4K20me2 and H2A.XK115ub epigenetic marks and signal a cascade of downstream activity. While the cell has multiple mechanisms for DNA DSB repair, homologous recombination (HR) is considered the most reliable, but this pathway is compromised in BRCA1-mutated cancers. In this context, 53BP1 overrides the choice for HR, and leads the cell through non-homologous end joining (NHEJ) DNA damage repair. NHEJ is much more error-prone, often leading to mutations in the DNA which can lead to tumorigenesis. However, studies have shown that mice with null mutations for both Brca1 and 53bp1 have low occurrences of tumor formation. A small-molecule inhibitor for 53BP1 would further interrogate the biological role that this protein plays in DNA repair and cancer development. Validation of this target could lead to drug discovery applications for the inhibition of 53BP1 in BRCA1-mutated patients, and potentially serve as a prophylactic cancer treatment for women known to have mutant BRCA1. Here we report on the development of a small molecule inhibitor for 53BP1 using a fragment based screening approach and subsequent x-ray crystallography and rational-based ligand design. These efforts have thus far resulted

in a small molecule inhibitor with low micromolar affinity for 53BP1, and multiple vectors have been identified for continued optimization.

41. Supritha Dugyala (Biology), *Investigating the Relationship Between Maternal Immune Activated (MIA) Ferret Behavior and Gut Microbiome*
Track: Health & Well-Being
Advisor: Flavio Frohlich (Psychiatry)

Abstract: Studies of schizophrenia have indicated that exposure to the influenza virus during the second trimester of pregnancy may increase the offspring???s risk for developing schizophrenia in adulthood. Administration of healthy bacteria in the form of probiotic treatment to juvenile mice with this condition, called Maternal Immune Activation (MIA), restores a disparity of gut microbiota found between MIA mice and healthy mice. This condition is induced in animals during pregnancy with an injection of Poly I:C, an immunostimulant which mimics a virus and signals for an immune response. Probiotic treatment also rescues several behavioral phenotypes typical of disorders like Autism Spectrum Disorder and schizophrenia. We hypothesize that a similar intervention in an adult animal of a different species will have the same effect. In this study, 20 adult male MIA ferrets have been treated with the probiotic VSL #3, a combination of eight different lactobacteria, and evaluated for differences before and after treatment in their gut microbiome and social behavior. The results of the microbiome sequencing are not significant but do indicate a diversity difference between those ferrets with the MIA condition and those without after probiotic administration. The behavioral tests do not show any trend between behaviors before and after treatment but a manual analysis and coding of the assessments is being performed to clarify the results. In conclusion, further analysis is required to determine

43. Agnes Ezekwesili (Nutrition), *Investigating a Role for H4K16 in Double Strand Break Repair*
Track: Health & Well-Being
Advisor: Robert Duronio (Biology and Genetics)
Graduate Student Contributors: Robin Armstrong

Abstract: DNA constantly experiences damage, making the ability of a cell to protect the integrity of its genetic information a major determinant of its survival. To preserve DNA, cells utilize repair mechanisms such as homologous recombination (HR) and nonhomologous end joining (NHEJ). All of these mechanisms initiate with access to damaged DNA. Chromatin structure and histone (the protein component of chromatin) modification can either "open" or "close" DNA. The acetylation of H4K16 (H4K16ac), a specific histone modification, "opens" access to DNA. Studies have shown that H4K16ac enhances the ability of DNA double strand breaks (DSB), a particularly harmful lesion, to be repaired. To investigate how H4K16ac functions in DSB repair, we mutated H4K16 such that it can no longer be modified with an acetyl group(H4K16R). Using two agents known to induce DSBs, I performed DNA damage sensitivity assays on Drosophila melanogaster with wild-type and mutant genotypes. I found that H4K16R mutants did not demonstrate sensitivity to DSBs compared to controls. We hypothesize that H4K16 is involved in one of the two major DSB repair pathways (NHEJ) and that with the H4K16R mutation present the backup pathway (HR) takes over DSB repair. To address this hypothesis, I will repeat sensitivity assays with H4K16R mutants in a HR-deficient background. We hypothesize that only when both major pathways are disabled will DSB sensitivity be observed as a result to exposure to genotoxic agents.

45. Abigail Gancz (Anthropology), *Statistical Analysis of the Old Chapel Hill Cemetery: Age, Occupation, and Gender as Correlated to Social Rank and Spatial Placement*

Track: Health & Well-Being
Advisor: Dale Hutchinson (Anthropology)

Abstract: Cemeteries are deliberately constructed sources of material evidence that reflect dynamic transformations within societies. The Old Chapel Hill Cemetery, in particular, serves as an excellent reservoir of cultural and historical information associated with the University of North Carolina, including over 1600 graves, with the earliest recorded burial dating back to 1798 and the most recent dating to the 20th century. The individuals interred include African American slaves, University students, and professors, as well as almost "anybody who was key to the growth of [the UNC] community." By interpreting the physical and ethnographic information associated with these burials, this project renders it possible to understand how such factors such as age, race, gender, wealth, and occupation were associated with social status and monument construction during the 19th and 20th centuries.

47. Saumya Goel (Chemistry), *Investigating cAMP Regulated Transcription Coactivators (CRTCs) in HPV-Positive and HPV-Negative HNSCC*
Track: Health & Well-Being
Advisor: Antonio Amelio (Cancer Cell Biology)
Faculty/Postdoc Contributors: Dr. Miranda Carper

Abstract: HNSCCs are the 6th most common cancer worldwide. Aberrant activation of signaling pathways, such as the cAMP/PKA pathway, induces CREB transcriptional activity and promotes cell cycle and survival. Since little is known about the role of CREB and their co-regulators in HNSCCs, this study investigates the CREB/CRTC pathway. RNA was isolated and real-time qPCR was used to determine the copy number of CRTC1-3 in HNSCC and oral keratinocyte cell lines. Luciferase assays were used to measure endogenous CRTC activity in UMSCC11A (HPV-) and VU147T (HPV+). Cells were treated with DMSO, forskolin (FSK) and/or 3-isobutyl-1-methylxanthine (IBMX) to stimulate cAMP pathway and induce CRTC activation. Western blot analysis was used to examine change in localization, cytosolic vs. nuclear, of CRTC2 following treatment. In both the UMSCC11A and VU147T cell lines, we observed increased CRTC/CREB induced transcriptional activity. FSK or IBMX/FSK treatment in both UMSCC11A and VU147T increased CRTC2 localization in the nucleus and decreased CRTC2 phosphorylation indicative of CRTC2 activation. However, western blot revealed a possible phosphorylated CRTC2 band in the nucleus, which is contrary to canonical CRTC2 activation. For future analysis, we will characterize CRTC2 expression and activity in other HPV-positive and HPV-negative HNSCC cells. We will also use immunofluorescence assays to further investigate phosphorylation and localization of CRTC2 in HNSCC cells.

49. Tatiana Gonzalez-Argoti (Psychology & Neuroscience), *Examining the association between eating disorder symptoms and ADHD-specific medication misuse in college students*
Track: Health & Well-Being
Advisor: Jessica Baker (Psychiatry)
Faculty/Postdoc Contributors: Dr. Melissa Munn-Chernoff

Abstract: College students are at increased risk for developing eating disorders (ED) and substance use disorder. Illicit prescription drug use, including ADHD-specific medication (e.g., Adderall, Ritalin), is prevalent among undergraduate students due to the perceived cognitive benefits and appetite suppressing effects. Misuse of these drugs is especially critical for individuals exhibiting ED symptoms because they could exacerbate these ED symptoms. This study examined differences in ED symptoms between ADHD medication users and non-users. Participants included 744 undergraduate students (17-

35 years old; 61% women) who completed an online survey. ED symptoms were assessed using the Eating Pathology Symptoms Inventory; ADHD medication misuse was assessed via an illicit drug use questionnaire. T-tests were used to examine mean differences on ED symptoms between ADHD medication misusers and non-users. ADHD medication users (7.3%) had lower mean scores on Body Dissatisfaction (M=6.24, SD=6.71) than non-users (M=9.00, SD=7.10), t(725)=2.77, p<.05. Post-hoc t-tests showed that stimulant users (9%) had higher mean scores on Negative Attitudes towards Obesity (M=6.42, SD=4.95) and lower mean scores on Body Dissatisfaction (M=6.90, SD=6.88) than non-users (M=4.79, SD=4.72; M=8.98, SD=7.07), t(725)=-2.68, p<.05; t(725)=2.31, p<.05. Findings highlight the importance of assessing multiple ED symptoms in stimulant users and separating stimulant drug categories.

51. Joshua Hardin (Chemistry), *Selective Recognition of Asymmetric Dimethylarginine with a Synthetic DCC Receptor*
Track: Health & Well-Being
Advisor: Marcey Waters (Chemistry)
Graduate Student Contributors: Alexandria Mullins

Abstract: Methylation of histone lysine and arginine residues is an important regulator for gene expression; recognition of methylated peptides is most commonly performed using antibodies, but synthetic receptors are an emerging alternative tool. Currently, no receptor exists that selectively recognizes asymmetric dimethylarginine (Rme2a) over trimethyllysine (Kme3). A synthetic receptor for Rme2a was produced using dynamic combinatorial chemistry (DCC), which allows monomers to form various receptors, the concentrations of which are affected by interactions with guest compounds via Le Chatelier's Principle. Dynamic combinatorial libraries (DCLs) containing synthetic monomers G and N and different peptide guests were produced and allowed to equilibrate for 3 and 10 days, allowing the DCLs to undergo changes in equilibrium concentrations after introduction of guests. Using UV-vis HPLC, DCLs containing no peptide guest, RGGY, Rme2aGGY, and Kme3GGY were analyzed. A peak was significantly amplified solely for Rme2aGGY, indicating that the N_2G_2 DCL selectively recognized Rme2a over Kme3. nuclear Overhauser effect spectroscopy (NOESY) will indicate the conformation of N_2G_2 that best recognizes Rme2a, and this conformational analysis will guide the synthesis of a thioether-linked N_2G_2receptor.

53. Jennifer Hausler (Sociology), *Bound by the Care We've Learned to Receive: The Persistence of Adolescent Health and Dental Care Utilization Behaviors into Young Adulthood*
Track: Health & Well-Being
Advisor: Robert Hummer (Sociology)

Abstract: The transition from adolescence to young adulthood, though often considered a period of newfound independence and freedom, is characterized by worsening health and decreased health and dental care utilization, especially among males. To further understand the factors that shape health and dental care utilization during young adulthood, this study examines the socioeconomic stratification of adolescent health and dental care utilization behaviors, the impact of these behaviors during adolescence on health and dental care utilization during young adulthood, and the modifying effects of gender on utilization across the transition to young adulthood. Controlling for disparate levels of access and need, I use multivariate logistic regressions to analyze data from Waves I and IV of the National Longitudinal Study of Adolescent to Adult Health. I find that lower parental educational attainment and income are significantly associated with lower odds of care during adolescence. My results also reveal the persistence of adolescent utilization behaviors into young adulthood, but gender is not related to the

endurance of such behaviors. Among other theories, I integrate the life course perspective into the Behavioral Model of Health Services Use to explain my findings and make a call for improvements in social and health care policies to prevent the further stratification of health and dental care, as well as the persistence of poor utilization behaviors into young adulthood.

55. Kathrin Hennigan (Psychology & Neuroscience), *An Investigation of Eating Disorder Symptoms and E-Cigarette Use in College Students*
Track: Health & Well-Being
Advisor: Dr. Melissa Munn-Chernoff (Psychiatry)
Faculty/Postdoc Contributors: Dr. Jessica Baker

Abstract: College students are at high risk for eating disorders (EDs) and their symptoms. There is an increased prevalence of tobacco use in individuals with EDs, but this prevalence varies based on ED symptoms. Few studies have examined ED symptoms and e-cigarette use in college students. We examine differences in ED symptoms between college students who do and do not report ever using e-cigarettes. Subjects were 721 students (M=19.23, SD=1.65; 60.8% women) recruited from a psychology subject pool who completed an online survey. Eating disorder symptoms were assessed via the Eating Pathology Symptoms Inventory; e-cigarette use was assessed via a smoking questionnaire. T-tests and logistic regressions were used to investigate differences in ED symptoms between students who reported having ever vs. never used e-cigarettes. One hundred sixty-six individuals (23.1%) reported ever using an e-cigarette. Higher scores on muscle building were significantly associated with e-cigarette use (t(709)=-3.23; p<.0001); no other significant findings emerged. Post-hoc analyses revealed that more men (n=94, 56.6%) than women (n=72, 43.3%) reported ever using e-cigarettes. After controlling for sex, the association between muscle building and e-cigarette use was no longer significant (Odds Ratio=1.02; p>.05). Findings suggest that experimenting with e-cigarettes is common in college students, and that sex should be included when examining associations between ED symptoms and e-cigarette use.

57. Sierra Houck (Geography), *The Self-Making Process of Mapuche Students in the Chilean Higher Education System*
Track: Diversity & Equity
Advisor: Elizabeth Havice (Geography)

Abstract: This research investigation explores how mapuche indigenous youth in Chile view the Chilean education model and the purpose of education and how their education experience shapes their self-making process. Mapuches, the largest group of indigenous peoples in Chile, continue to seek to establish their identity outside of the "norm" of the Chilean nation. However, the research conducted suggests that these desires to help fight for territorial or cultural rights of one's community after studying are often stifled in the university setting (if these visions have not already been suppressed due to the continued discrimination against mapuches and the fear the discrimination creates within communities). This research was conducted in Temuco, the capital city of the Araucan, a region and Mapuche heartland of Chile, consisting of interviews with mapuche students in the various public and private universities in Temuco, professors, members of the Ministry of Education, and mapuche university graduates.

59. Lacey Hunter (History), *Defining Subjecthood in Eighteenth-Century British North America: The Life and Perspectives of Sir Guy Carleton*
Track: The US & Foreign Relations
Advisor: Wayne Lee (History)

Faculty/Postdoc Contributors: Kathleen DuVal, Department of History

Abstract: This thesis examines subjecthood in British North America during the late eighteenth century through the lens of how a British official, Sir Guy Carleton, incorporated new subjects into the British Empire. The "new subjects" discussed in my paper are French-Canadians, Indians, and ex-slaves. Through examining the course of Carleton's life, this paper argues that his efforts to smoothly bring new subjects into the empire stemmed from his background within the British imperial system, particularly the military and public office. He believed imperial control and the king's protection was in everyone's best interest, and obedient and content subjects were essential to the continuity of the growing empire. The era's tendency of ethnocentricity clashed with the reality of an increasingly heterogeneous empire. Carleton's professionalizing approach to his responsibilities in both the military and public office, however, affirmed Britain's increasingly legally inclusive notions of subjecthood. His beliefs were particularly evident when he decisively acted to ensure the safety and evacuation of 3,000 black loyalists, many of whom had been enslaved, out of the newly independent American colonies in 1783. Utilizing primary documents written both to and from Carleton, as well as other contemporary correspondence and works, this paper concludes that Carleton believed applying the law to all of His Majesty's loyal subjects, of whatever race or ethnicity, would ensure a prosperous empire.

61. Vishal Iyer (Biology), *Examining the Role of the Auto Inhibitory Tail of SRO7: Yeast Member of LGL/Tomosyn Family in Homo Oligomerization and Vesicle Tethering*
Track: Health & Well-Being
Advisor: Patrick Brennwald (cell biology)

Abstract: It was previously determined that the protein, SRO7 plays an important role in vesicle transport. The Brennwald lab has developed a novel assay for homo-oligomerization of SRO7, which will allow the lab to determine the structural elements within SRO7 that are involved in oligomerization and test their importance to the tethering process in vitro and in vivo[1]. Initially, a characterization of a set of mutants that affected tethering in vitro and in vivo gave the lab a first clue as to the significance of two regions of the protein, which are found to interact with the crystal structure of SRO7[1]. The mutations were found to disrupt an intra-molecular interaction found between a region in the C-terminus of SRO7 and the N-propeller domain[1]. We will directly test this hypothesis by generating both disrupting and compensating mutations in the proposed sites of interaction. The predicted relevance to human health is that these are fundamental processes that are important for a number of diseases such as cancer and type-2 diabetes. Cell surface trafficking events are associated with a number of problems, such as loss of synaptic function.

63. Julia Katz (Psychology & Neuroscience), *The Consequences of Moral Typecasting in Healthcare*
Track: Health & Well-Being
Advisor: Kurt Gray (Psychology and Neuroscience)

Abstract: The dyadic theory of morality proposes that moral scenarios consist of an agent, a capable doer who performs an action, and a patient, a vulnerable feeler who receives the action. Once one is typecast into one of these roles, it is difficult to consider their capacity for the opposite role. In healthcare, physicians are acting to improve the health of others, causing them to be cast as agents and medical patients as patients. Doctors are consequently perceived as having little patiency, causing neglect to their self-care and wellbeing. Study 1 asked participants to rate the perceived mind of several characters (including a man, woman, and dialysis patient), and found that physicians are perceived as significantly more agentic than the others. In Study 2, participants rated doctors and medical patients based on cultural stereotypes, and found that doctors are perceived as significantly more agentic than

patients, and patients are perceived as having significantly more patiency than physicians. Study 3 asked participants to rate the perceived minds of people based on their hobbies/interests, and rate them again after learning they are physicians or medical patients. This study found that people are perceived as significantly more agentic if they are physicians, and significantly less agentic if they are medical patients. This research allows us to better understand perceptions of physicians and medical patients, and the resulting expectations for people in these roles.

65. Elaine Kearney (Computer Science), *Data Science Rosetta Stone*
Track: Education
Advisor: Stanley Ahalt (Computer Science)

Abstract: Data Science and Machine Learning enable researchers both in academic and industrial fields to analyze data and consequently make important decisions as well as predictions. Many different programming languages are used in the pursuit of Data Science. However, it can be difficult for researchers to switch between languages or learn a new language which is often needed in working across interdisciplinary fields and when working with colleagues from diverse backgrounds. This paper discusses a resource created to demonstrate the commonalities between four different programming languages commonly used in Data Science: MATLAB, Python, R, and SAS. The work for this project came out of research completed both at the Australia New Zealand Banking Group (ANZ) headquarters in Melbourne, Australia, and at the University of North Carolina at Chapel Hill (UNC-CH). This research resulted in an online set of tutorials, which we refer to as the Data Science Rosetta Stone, which demonstrates common data science tasks in the same progression for each programming language. We demonstrate that all of these languages achieve similar results, though with different syntax and/or simplicity of code, and efficiency of execution.

67. Sol Kim (Biology), *Connectivity Patterns of Claustrum in the Fronto-parietal Circuit*
Track: Health & Well-Being
Advisor: Flavio Frohlich (Department of Psychiatry)
Graduate Student Contributors: Charles Zhou
Faculty/Postdoc Contributors: Susanne Radtke-Schuller, Flavio Frohlich

Abstract: The claustrum, a thin, sheet-like subcortical structure between insular cortex and striatum, is known to be interconnected with most cortical regions. Such extensive claustrocortical connectivity suggests that the claustrum may be responsible for integrating the information across sensory, motor and cognitive modalities, thereby facilitating attention and conscious experiences. Despite the history of claustrum literature, the claustrocortical connectivity studies are inconsistent and the assessment of anatomical connectivity between claustrum and higher-order cortical areas has been understudied. In the present study, we show the connectivity patterns of claustrum in the fronto-parietal network by injecting anterograde and retrograde tracers in frontal (FC) and posterior parietal cortex (PPC) of ferret brains, and subsequently by imaging processed tissue under widefield and confocal microscopes. We also show that individual neurons in claustrum project to both FC and PPC by means of dual-site retrograde tracing. Analysis of connectivity across the whole extent of claustrum revealed that the anterograde tracer in FC projected evenly across the rostro-caudal plane and the retrograde tracer in PPC projected mainly to dorsomedial region of claustrum. There was also a high overlap between the two tracers in the medial region of claustrum. Together, these results suggest that the claustrum acts as a relay center in the fronto-parietal circuit.

71. Emily Kupec (Journalism & Mass Communication), *Changing the Way Women Interact with Personal Finance Education Through Social Influencers*

Track: Education
Advisor: Richard Clancy (School of Media and Journalism)

Abstract: Women command upwards of $20 trillion, or 27 percent of the world's total wealth. In the United States alone, women exercise decision-making control over $11.2 trillion. And yet, 86 percent of investment advisors are men over the age of 50. This suggests conversations in the financial industry may focus on the ways that men tend to prioritize their goals and career paths. As a result, women have less financial literacy than men – a potential problem as they become financially independent, make spending decisions and marry if they choose. In 2008 the Boston Consulting Group organized a survey and found that women's depiction of their relationship with financial institutions left a detailed picture citing a lack of respect, poor advice, a one-size-fits-all approach, conflicting policies and an infinite tangle of red tape, leaving women exhausted and frustrated. According to Adweek, women prefer to interact with brands digitally. While 90 percent of women interact digitally with the beauty industry and 83 percent with the clothing industry, only one percent of women in the survey interacted with finance brands digitally. Through focus groups and surveys, this study explores explored the opportunity to alter the way that young women, ages 22 to 29, interact with their finances and, in particular, if influencers have the capability to do so.

73. Chris LaMack (Archaeology), *Recording and Preserving a Cultural Site with Structure-from-Motion Modelling Technology*
Track: Education
Advisor: R. P. Stephen, Jr. Davis (Anthropology (Research Laboratories of Archaeology))

Abstract: The object of this study is to establish a working methodology for applying Structure-from-Motion (SfM) three-dimensional modelling to document, preserve, and widen accessibility to a cultural heritage site. I argue that SfM is an ideal method for digitally recording cultural heritage sites, not only as a safeguard against loss, but also in order to make these sites more publically available ??? and available in an intuitive and interactive format ??? through internet-accessible repositories. The experience for crafting my methodology came out of my attempts to model the reconstructed Pee Dee structures of Town Creek Indian Mound, a North Carolina State Historic Site with which UNC has been extensively involved since the 1930s. Owing to the prohibitive cost, requisite qualifications, and legal issues associated with UAV-based photography, my methodology deals solely with data collection by a recorder on foot with a handheld camera. Though I found the creation of a single model of the entire site this way to be impractical, I believe that my efforts to digitally document individual structures have not only indicated the advantages of this method in capturing and representing good data, but have provided invaluable experience from which to construct a stable set of best practices. I aim to disseminate these methods in order to facilitate a more widespread adoption of SfM modelling in the conservation of and to increase public exposure to human cultural heritage and patrimony.

75. David Lauzier (Biology), *Production of Recombinant Neuropilin-2: A Potential Therapeutic Agent for Asthma*
Track: Health & Well-Being
Advisor: Timothy Moran (Pediatrics)

Abstract: The Moran laboratory studies cellular aspects of airway inflammation and asthma. My SURF project focused on the protein Neuropilin-2 (Nrp2), and it???s role in airway inflammation. I had two major findings. First, I showed that transgenic mice lacking Neuropilin-2 (Nrp2) on alveolar macrophages (LysmCre+ Nrp2 mice) have delayed resolution of airway inflammation. Second I showed that airway inflammation caused by the environmental pollutant lipopolysaccharide (LPS)

increases surface expression of Nrp2 on alveolar macrophages and additionally leads to release of soluble Nrp2 (sNrp2) from the cell surface. To follow up on these findings I will test if sNrp2 (versus surface expressed) is important in resolving airway. sNrp2 was produced by transient transfection of an Nrp2-Fc-His mammalian expression plasmid into HEK293T cells. The sNrp2 protein produced contained a signal sequence, but lacked the transmembrane region causing secretion into the culture supernatants. sNrp2 was isolated from HEK293T supernatants using Ni-affinity chromatography. Enough sNrp2 was produced for in vivo studies. Mice were selected and split into 2 groups, LysmCre+ Nrp2 + sNrp2 and LysmCre+ Nrp2 + PBS the vehicle control. The mice were challenged with 10ug LPS and airway inflammation was assessed 4 days later. These experiments are ongoing, but we hypothesize that the excess inflammation seen in LysmCre+ Nrp2 + PBS mice will be reduced by administration of recombinant sNrp2.

77. Heather Lavin (Biology), *Correlations between Methods for Assessing Somatosensory Function in Individuals with Anterior Cruciate Ligament Reconstruction*
Track: Health & Well-Being
Advisor: Troy Blackburn (Exercise and Sport Science)
Undergraduate Co-Authors: Ashley Dibbert, Nathan Guskiewicz, Jevon Morris
Graduate Student Contributors: Chris Johnson
Faculty/Postdoc Contributors: Troy Blackburn

Abstract: The risk of developing knee osteoarthritis (OA) increases greatly following anterior cruciate ligament injury and surgical reconstruction (ACLR). ACLR often results in a decline in somatosensory function which may contribute to OA risk. Somatosensory function is typically measured via joint position sense (JPS), but this assessment requires complex 3D motion analysis equipment, and is not feasible for use in the typical clinical setting. A relatively new measurement called vibratory perception threshold (VPT) is potentially clinically feasible, and may serve as a clinical proxy for JPS. The goal of this study was to evaluate correlations between JPS and VPT in individuals with ACLR. JPS and VPT were measured in 53 ACLR subjects. JPS refers to perception of the angle between two body segments, and was measured by assessing the subjects' ability to reproduce a given joint angle using 3D motion analysis. VPT refers to the lowest vibration intensity that subjects can perceive, and was measured using a biothesiometer at 5 bony prominences in the leg. JPS was not correlated with VPT at any of the testing sites. These findings suggest that VPT is not a feasible substitute for assessing JPS in the clinical setting. Future research is necessary to explore other clinical approaches for assessing somatosensory function.

79. Jamie Lebhar (Biomedical Engineering), *Optimization of Hydrogel Material for Microraft-based Cell Sorting Microarrays*
Track: Health & Well-Being
Advisor: Nancy Allbritton (Joint Department of Biomedical Engineering)

Abstract: Current cell sorting techniques are limited due to potential damage to cell morphology, cell membranes, cellular physiology, and loss of viability of the isolated cell population. The development of micromolded array technology for the growth, isolation, and imaging of single cells provides a unique approach for analysis that combats the limitations aforementioned. Once fully fabricated, the micromolded array holds detachable concave components that, in practice, will hold a single cell. Cells on microrafts can be selected, collected, and examined through dislodgment by a microneedle. Hydrogel material screenings allow for the assessment of alternative materials to serve as detachable concave components within microarray devices. Successful creation of a hydrogel microarray would lower the autofluorescence, increase cell affinity for the microraft, increase biocompatibility, offer

biodegradable benefits, and provide a means to easily alter the environment of cells. To test various hydrogel microrafts, PDMS arrays are utilized in conjugation with hydrogel raft materials: agarose, polyacrylamide, chitosan-agarose, collagen, pectin, PLGA, and hydroluronic acid. The microrafts are assessed based on height uniformity, concavity, and shape through quantification by imaging. The viability of the rafts will be evaluated based on ability to release the rafts, cell survivability, cell affinity, and stability.

81. Christina Lim (Environmental Science), *Vibrio Fischeri Strain Es114 Demonstrates Enhanced DNA Transfer Rates Under Ecologically Relevant Conditions*
Track: Environment
Advisor: Alecia Septer (Marine Sciences)
Graduate Student Contributors: Stephanie Smith

Abstract: The marine bacterium Vibrio fischeri is commonly found in a light-organ symbiosis with the Hawaiian Bobtail squid, Euprymna scolopes, and naturally in the water column. In the sea water, V. fischeri freely interacts with other microorganisms, facilitating opportunities for bacteria to horizontally acquire new genes. This allows for quick adaptations to environmental stressors that can enhance their survival or host colonization abilities. The goal of this project was to determine how calcium concentration influenced DNA transfer rates among various V. fischeri strains. To investigate this, V. fischeri strains ES114 and ES401 were co-incubated in a medium containing a calcium concentration similar to natural seawater (10 mmol) and a medium without calcium. Antibiotic selection was used to quantify DNA transfer between strains. Results showed that with calcium, ES114 had a hundred-fold increase in transfer rate compared to the non-calcium media. It was unknown if all V. fischeri strains were able to donate DNA at such high rates under this condition. To test this, incubations were conducted with seven other strains and DNA transfer rates were measured for each pairing. Results indicated that of the strains tested so far, only ES114 is able to transfer its DNA at high rates to other V. fischeri strains in a calcium media. Future research will determine if ES114 can transfer DNA to more distantly related bacteria species or if transfer is limited between V. fischeri strains.

83. Carolyn Liu (Biomedical Engineering), *Development of Custom MRI Cradle and Habituation Protocol for Functional Neuroimaging in Awake Mice*
Track: Health & Well-Being
Advisor: Yen Yu Shih (Department of Neurology)
Graduate Student Contributors: Esteban Oyarzabal

Abstract: Functional connectivity magnetic resonance imaging (fcMRI) is a whole brain neuroimaging technique that measures coherence among neurons in different brain regions. High-field MRI scanners have permitted fcMRI mapping in experimental mice models, allowing for circuit-level dissection of many neuropathological models. However, the majority of fcMRI studies published in mice are performed under anesthesia, resulting in neuronal activity suppression that make findings difficult to compare to human fcMRI data acquired in awake participants. Though attempts have been made to image conscious mice, navigating adequate head-restraining to reduce image movement and suppressing stress-induced neurocircuit alterations in these mice has been a great challenge addressed by habituating mice to the restraining and scanning conditions experienced during awake imaging. In this study we designed and tested the habituation conditions in custom awake mouse imaging cradle that prevents motion artifacts through minimally invasive surgery to implant an MR-compatible head plate and acquire blood-oxygen-level dependent (BOLD) fcMRI data using single-shot gradient echo EPI. To compare circuit level changes of stress in mice, we quantified corticosterone levels in serum by ELISA. This project has culminated in the establishment of the first awake rodent fcMRI protocol on

campus and believe its utilization will improve our ability to relate fcMRI data between rodents and humans.

85. Ewen Liu (Health Environmental Sciences & Engineering), *Determining HIV-1 Evolutionary Pathway to a Macrophage-Tropic Phenotype*
Track: Health & Well-Being
Advisor: Ronald Swanstrom (Biochemistry and Biophysics)
Faculty/Postdoc Contributors: Ean Spielvogel

Abstract: HIV-1 entry into host cells depends on the Env protein, which usually requires a high density of CD4 present on the surfaces of T-cells to gain entry. A subset of virus variants are also capable of infect cells with low densities of CD4, such as tissue macrophages/brain microglia. Macrophage-tropism appears to evolve within the central nervous system in subjects with severe disease, and may be associated with HIV-associated neurological disease (HAND). The Swanstrom Laboratory has identified several patients who have macrophage-tropic viral variants in their CSF, and compared the Env sequences with their respective plasma T cell-tropic variants. Genetic differences in the two HIV env sequences of the same subject allow us to compare the genotype to phenotype patterns necessary for entry into low-density CD4 cells. Several subject-distinct genetic mutations resulted in the same phenotype for different patients. For each patient, we synthesized multi-mutant "chimeric" viruses containing varying amino acid mutations found from their respective plasma-CSF variants using cloning and transfection methods. Phenotypic studies of these pseudotyped viruses containing mutated Env genes were performed using the Swanstrom Lab's Affinofile cell assay to determine the CD4-entry phenotype for each of the "chimeric" viruses. We were able to determine a possible evolutionary pathway from T-cell tropic to macrophage-tropic in two of our five patients so far.

87. Emily Long (English & Comparative Literature), *Constructing a Health Fair Model for Rural North Carolina*
Track: Health & Well-Being
Advisor: Jane Thrailkill (English, Health Humanities)

Abstract: Food security and healthcare access are often set at odds in rural communities, such as Ashe County, a region in the mountains of North Carolina in which 20% of residents live in poverty and 72% of residents choose between paying for food and healthcare. Therefore, the goal of my research was to use a partnership between the Ashe Sharing Center, a food assistance organization, and Ashe Memorial Hospital, the area's main healthcare provider, to integrate these opposing ideals by creating a health fair model that could be optimized for Ashe County and extended to other rural areas. I gained information on the needs of Ashe County residents by conducting pre-surveys and interviews of Sharing Center clients. I then coordinated a health fair based on demonstrated needs and administered a post survey to attendees to determine its impact and areas for improvement. Through my research, I found that 40% of clients reported difficulty receiving dental care and that their main interests were weight and diabetes management. Especially relevant findings of my study were that health fairs have a greater impact when they prioritize preventative measures and that access to dental care and specialized physicians are two of the main health-related difficulties faced by Ashe County residents. Ashe Memorial Hospital executives deemed my research significant enough to coordinate a meeting with me to discuss how my data could focus their outreach to an underserved population of Ashe County.

89. Alexander Ludwig (Biology), *Positive Selection Experimentation of Species Level Clustering*
Track: Environment
Advisor: Jeff Dangl (Biology)

Graduate Student Contributors: Isai Gonzalez

Abstract: In the last years, hundreds of bacterial genomes isolated from the rhizosphere and endophytic compartment of a variety of plants have been sequenced. These collections contain closely related genomes belonging to a same genus but without evident species boundary delimited between them. Despite the fact that the species concept is controversial in bacteria, it is well established that highly similar strains tagged with the same species assignment will exhibit highly similar phenotypes in a myriad of conditions. In this work we utilized state of the art in silico methods to group 925 plant-associated bacterial isolates into species clusters, these refined classification of the isolates will provide a valuable resource to guide future experimental or computational work dependent on using a set of homogeneous set of genomes. The importance of using highly synonymous bacterial species for future experiments is that closely related genomes have more similar genomes thus the genetic pressures will be more pronounced than using a highly diverse set of organisms. To support the validity of the reclassified bacterial species assignments the 925 genomes are pared to a highly curated set of 8829 bacterial genomes maintained by NCBI. The NCBI genomes contain taxonomic data and thus even species level information is known. We put the 925 genomes into the NCBI phylogenetic tree to support the validity of the method applied and that the species clustering was correct.

91. Zachary Lynch (Biology), *The Future of IBD Therapy: It's All About Access*
Track: Health & Well-Being
Advisor: Terry Furey (Biology)
Graduate Student Contributors: Michelle Hoffner O'Connor
Faculty/Postdoc Contributors: Dr. Shehzad Sheikh

Abstract: Crohn's disease is a chronic inflammatory disease of the intestine track that results from a loss of tolerance to the enteric microbiota. Previous studies have established interleukin(IL)-10 is an important anti-inflammatory cytokine driving lamina propria macrophage (LPM) tolerance. Within a cell, transcriptional responses are governed by the ability of transcription factors to bind accessible, nucleosome-free regions of DNA. Previously published studies have shown that marked changes in chromatin accessibility occur in LPMs isolated from colitis-prone Il10-/- mice. These changes in chromatin accessibility are stable, as the addition of ectopic IL-10 does not alter accessibility at 95% of the regions identified. We hypothesize that the stable chromatin landscape of Il10-/- macrophages may be altered using small molecule inhibitors of chromatin modifying proteins resulting in the restitution of LPM tolerance to the enteric microbiota. A high-throughput screen with a chromatin accessibility readout was used to test small molecule inhibitors of chromatin modifying enzymes in Il10-/- macrophages. Changes in chromatin accessibility were assessed using a relative chromatin inhibition (RCI) score which compares accessibility changes at two regions that are only accessible in Il10-/- macrophages and two control regions. This screen identified several bromodomain inhibitors, including (+)-JQ1, have the ability to decrease relative chromatin accessibility. Subsequent testing using (+)-JQ1 revealed that (+)-JQ1 attenuates mRNA levels of Il6 and Il12ß in lipopolysaccharide (LPS)-stimulated Il10-/- macrophages. We conclude that bromodomain inhibitors have the ability to decrease chromatin accessibility and attenuate the production of inflammatory cytokines in Il10-/-macrophages.

93. Justin Magin (Biology), *Regulation of Smooth Muscle-specific Gene Expression by the Methyltransferase, PRDM6*
Track: Health & Well-Being
Advisor: Chris Mack (Pathology/Laboratory Medicine)
Graduate Student Contributors: Dr. Kevin Mangum

Abstract: Smooth muscle cell differentiation is controlled by the serum response transcription factor and the myocardin family of SRF co-factors to activate SMC- specific genes expression. The Mack lab identified the methyltransferase, PRDM6, as a myocardin binding factor. Interestingly, PRDM6 expression in mouse and humans is highly SMC-selective. Genome wide association studies identified a locus in the PRDM6 third intron that is associated with blood pressure and intracranial aneurysm. Since this locus is also associated with differences in PRDM6 expression in human aortic samples, we hypothesize that this locus affects the activity of a regulatory element in this region. To identify in what ways the regions of the third intron regulate PRDM6 activity, I cloned regions of the 3rd intron into promoter and enhancer vectors and observed that the PRDM6 3rd intron has region-specific activation levels. To identify the genetic variations that regulate PRDM6 expression in SMC, I mutated transcription factor binding sequences in a highly conserved region of the PRDM6 3rd intron and found that these mutations decrease PRDM6 activity in SMC. Lastly, to analyze the effects that PRDM6 depletion has on SMC differentiation gene expression markers, I used siRNA-mediated knockdown of PRDM6 and analyzed the subsequent protein and RNA levels with western blots and RT PCR protocol. All together this will help us to further understand PRDM6 function and effects as they relate to cardiovascular disease.

95. Zachary Mayo (Chemistry), *Mapping and Characterization of the SETD2 Interactome*
Track: *Health & Well-Being*
Advisor: Brian Strahl (Biochemistry and biophysics)
Faculty/Postdoc Contributors: Dr. Abid Khan

Abstract: Post-translational modifications (PTMs) are at the forefront of medical science and affect a wide range of cell targets from gene expression and epigenetics to cell signaling and metabolism. SETD2, canonically characterized as the sole histone 3 lysine 36 tri-methyl transferase (H3K36me3) in humans, is known to interact with RNA polymerase 2 (RNAP) and deposit histone modifications on active gene bodies. Recently, new functions have been revealed suggesting an additional function of SETD2 as a non-histone methyltransferase. Here we use BIOID and co-immunoprecipitation to characterize two novel interactions with nuclear lamin and chromosomal maintenance protein SMC1A. Further analysis of SETD2 truncations and in vitro interaction assays suggest that SETD2 interacts with lamin through its catalytic SET domain indicating lamin as a possible methylation substrate. These results, along with global changes in repressive histone modifications, indicate that an interaction between SETD2 and lamin may be required for nuclear structure and association of highly repressed lamin associated domains (LADs) on chromatin. SETD2 is a known tumor suppressor, highly mutated and deleted among cancers, and these findings shed light on the wider effect of a loss of SETD2.

97. Landon Mays (Physics & Astronomy), *Brillouin Scattering Studies of Biological Tissue*
Track: Health & Well-Being
Advisor: Laurie McNeil (Physics & Astronomy)
Graduate Student Contributors: Britta Gorman

Abstract: Knowledge of the mechanical properties of cells that make up tissue in the human body is of paramount importance in understanding the vast array of fundamental processes in cell biology. This project studies the changes in elastic properties of the extracellular matrix (ECM) upon interactions with malignant cells. We determine the elastic moduli of Corning Matrigel Matrix samples via Brillouin spectroscopy to explore how the mechanical properties of the ECM determine the rate at which cancerous cells travel in the body. Escaping tumor cells secrete enzymes that scission the collagen in the ECM to make their passage to the vasculature easier, a process we simulate by introducing collagenase to the Matrigel Matrix for varying durations. Different exposure times to

collagenase yield different percentages of scission in the ECM proteins, resulting in alteration of the elastic moduli of samples. From observing the change in frequency shifts of Brillouin peaks in spectra, we find that the elastic constant decreases with increasing scission. By quantifying such changes in the ECM, this project aims to further integrate more rigorous mathematical and quantitative methods in cell biology, as well as establish Brillouin spectroscopy as a useful tool in analyzing biomechanical processes.

99. Carrington Merritt (Psychology & Neuroscience), *Neural Mechanisms Underlying Attributional Ambiguity: An Investigation of Cross-Race Social Feedback*
Track: Diversity & Equity
Advisor: Keely Muscatell (Psychology and Neuroscience)
Graduate Student Contributors: Arun Nagendra

Abstract: Emerging research suggests that ambiguous cross-racial interactions, such as a Black individual receiving positive feedback from a White individual, may actually create stress-provoking situations for Black individuals.[1] These findings may reflect the consequences of "attributional ambiguity," or minority individuals' uncertainty about whether to attribute positive feedback from Whites as being genuine or simply motivated by a desire to not appear prejudiced.[2] To date, the neural mechanisms underlying these counterintuitive responses are largely unknown. As such, the current study examined Black individuals' neural responses to positive social feedback from racial outgroup members (e.g. White individuals). Twenty-two African American adults (18-37) participated in a fMRI social feedback task and completed various self-report measures. It is hypothesized that racial outgroup positive feedback will produce greater activity in threat-related neural regions (e.g. amygdala and dACC), reduced activity in reward processing regions (e.g. VS and vmPFC), and greater activity in social cognitive processing regions (e.g. medial PFC). It is also expected that self-reports of suspicion of Whites' motives and perceived discrimination will be associated with the hypothesized patterns of neural activity. Data analysis is pending. Anticipated results will be the first to link neural mechanisms to cross-race positive feedback and aid in understanding why such feedback elicits negative outcomes.

101. Sarah Miller (Chemistry), *Long Noncoding RNA Cyrano in Neural Differentiation*
Track: Health & Well-Being
Advisor: Terry Magnuson (Genetics)
Faculty/Postdoc Contributors: Dr. Keriayn Smith, Dr. Terry Magnuson

Abstract: The goal of this project is to elucidate long non-coding RNA Cyrano's role in the neural differentiation pathway of embryonic stem cells (ESCs). Currently, long non-coding RNAs (lncRNAs) are known to be prolifically expressed, with nonprotein-coding transcripts consisting of the vast majority of the human transcriptome, but their functions are understudied and not well understood. The studies that have been executed show that lncRNAs are extremely impactful on gene expression and developmental processes. Further, misregulation of lncRNAs has been implicated in many diseases, including neurodegenerative disorders. It is crucial to investigate Cyrano as a key player in neural differentiation to delineate the function of a paradigmal lncRNA to build the foundation of understanding of lncRNA functions as a whole. Additionally, the implication of Cyrano in neural differentiation will further understanding of the gene expression network necessary for neural differentiation. Although further studies will be necessary, investigation of Cyrano may prove to be an imperative first step in understanding neurological diseases that result from genetic aberrations.

103. Elizabeth Monaghan (Environmental Science), *Ecology of Postpartum Female Timber Rattlesnakes (CROTALUS Horridus) in The Southern Appalachian Mountains*

Track: Environment
Advisor: Sarah Workman (Highlands Biological Station: Field Site)
Undergraduate Co-Authors: Ashley Mullikin

Abstract: Timber rattlesnakes (Crotalus horridus) are not extensively researched in the Southern Appalachian Mountains, resulting in a deficit in knowledge about their ecology. Due to differences in elevation and climate, there is an expected distinction from other populations in the United States (Northern and Western), which is the basis of our study. Here we discuss the ecology of two postpartum adults. As they moved from initial gestation site to overwintering site, the pair were monitored using a radio transmitter externally attached to the rear scales. Radio telemetry was utilized to track the snakes weekly over the course of three months. Both snakes were located, tagged, and tracked in the Warwoman Wildlife Management Area in Rabun County, Georgia between August and November 2017. The two snakes traveled down the mountainside to their primary foraging range, where they alternated between resting and hunting before migrating to an overwintering den (hibernacula). Their overwintering habitat and overall foraging range was analyzed using a minimum convex polygon. Our findings serve as a pilot study in examining the ecology of the Southern Appalachian timber rattlesnakes. The snakes moved a total of 202-292 meters, and the use of Tegaderm as an adhesive for the transmitters was successful and likely to be utilized in further studies.

105. Jevon Morris (Exercise & Sport Science), *Associations between Somatosensory Function and Gait Biomechanics*
Track: Health & Well-Being
Advisor: Troy Blackburn (Exercise and Sports Science)
Undergraduate Co-Authors: Heather Lavin, Nathan Guskiewicz, Ashley Dibbert
Graduate Student Contributors: Chris Johnston

Abstract: Suffering anterior cruciate ligament injury and surgical reconstruction (ACLR) increase the risk of developing knee osteoarthritis (OA). Individuals with ACLR demonstrate somatosensory deficits that may contribute to aberrant gait biomechanics linked to OA risk. However, the relationship between somatosensory function and gait biomechanics is unknown. The purpose of this study was to evaluate the relationship between somatosensory function and gait biomechanics linked to OA development in individuals with ACLR. Joint position sense (JPS) was assessed as the ability to reproduce a specified joint angle using 3D motion capture. Vibratory perception threshold (VPT) was assessed as the minimum detectable vibration amplitude applied to 5 bony prominences in the lower extremity. Subjects walked across force plates while 3D kinetics and kinematics were sampled. Gait biomechanics outcomes included the peak vertical ground reaction force (vGRF) and its instantaneous loading rate, knee flexion displacement, and internal knee extension and valgus moments. JPS was not correlated with any biomechanics outcome. However, greater VPT was associated with greater knee valgus moment and knee flexion displacement, and lesser vGRF loading rate. With the exception of knee valgus moment, the directions of these correlations were opposite our hypotheses. Further research is necessary to evaluate the influence of VPT on gait biomechanics and knee OA risk following ACLR.

107. Safiyyah Nawaz (Chemistry), *Dopaminergic Pathway Connectivity and Impulsivity*
Track: Health & Well-Being
Advisor: Jessica Cohen (Psychology and Neuroscience)

Abstract: Impulsivity is a key symptom that characterizes neurodevelopmental and psychiatric disorders; it is an especially important symptom of Attention-Deficit Hyperactivity Disorder (ADHD).

Studying impulsivity can provide insight into the way this specific trait characterizes ADHD symptomatology, and in order to understand the varied functions and forms of impulsivity, it is critical to establish links between neurobiological mechanisms and presentations of impulsive behavior. In present literature, some structural biomarkers have been identified in ADHD groups; additionally, investigations of dopamine dysfunction and impulsivity have been performed. However, the relationship between impulsivity and connectivity within dopamine-associated regions specifically has yet to be explored. By observing the activity of dopamine pathways specifically, the neurobiology of impulsivity and the way it manifests in ADHD symptomatology may be better understood. This study evaluates the relationship between impulsivity and both mesolimbic (ML) and nigrostriatal (NS) dopaminergic pathway connectivity by collecting self-reported questionnaires of impulsivity and resting-state and task fMRI data of participants. Using Whiteside and Lynam's UPPS Impulsivity Scale, an analysis of the different facets of impulsivity will be studied with respect to ML and NS dopamine pathways, exploring the function of these two systems as they relate to specific presentations of impulsivity.

109. Quinn Osment (Women's Studies), *The Nature of Freedom: Escaping Patriarchal State Structures in al-Shaykh's Women of Sand and Myrrh*
Track: Diversity & Equity
Advisor: Claudia Yaghoobi (Asian Studies)
Undergraduate Co-Authors: Rain Tiller
Undergraduate Contributors: Sophia Curtis
Faculty/Postdoc Contributors: David Wollensak

Abstract: In Hanan al-Shaykh's 1989 novel Women of Sand and Myrrh, the readers follow the lives of four women struggling to find meaning, intimacy, and freedom in an unnamed Middle Eastern desert state. Women of Sand and Myrrh is a stark discussion of space and gender; the women's lives are divided along the structures of their existences: their private homes, the homes of other women, the city streets, the desert beyond the buildings, and the countries beyond borders. This project focuses on the confining private sphere shifting into liberatory space due to the integration of nature in the home. In the work, "nature" includes plant life as well as animals. Nature symbolizes freedom in the novel, specifically in relation to self-expression, self-exploration, and sexual desire. Al-Shaykh draws on the Arab literary tradition of employing gardens as spaces of refuge. In the novel, the homes include extravagant gardens and pets, namely gazelles and canaries. The home gardens are integral settings for the queer intimacy developed between two characters, Nur and Suha. We aim to explore the social, sexual role of nature in the domestic space: how does nature in the home create a space through which the women can escape the restrictive heteronormative patriarchal structures they encounter in public? This project contributes to the discussion of nature as a symbolic refuge from societal and personal strife, in addition to analyzing nature as a gendered space for queer experiences.

111. Reagan Page (Exercise & Sport Science), *External Pressure Affecting Athletes' Self-Reporting of Concussions: A Review*
Track: Health & Well-Being
Advisor: Johna Register-Mihalik (Exercise and Sport Science)
Graduate Student Contributors: Melissa Kay

Abstract: Lack of visible signs and symptoms make patient self-reporting a priority for concussion diagnoses. In order to encourage athletes to self-report concussions and implement proper protocol, it is necessary to better understand what factors affect self-reporting tendencies. Previous research has found that internal factors, such as an individual's knowledge and attitudes toward concussion, do not

necessarily translate to injury reporting. These internal factors have been well established and discussed; however, external factors, such as pressure, need better understanding. The purpose of this project was to create a critically appraised topic reviewing previous literature to identify how pressure affects an athletes' concussion reporting behaviors. A literature search was conducted and resulted in five articles discussing external factors affecting self-reporting. Inclusion criteria were: articles within the last 10 years, limited to English, and investigated self-reporting. The studies found that external pressure on athletes from a variety of sources (coaches, teammates, parents, and fans), in isolation or combination, impact concussion reporting behaviors. Specifically, those with direct effect on an athletes' ability to play (such as coaches) tend to influence athletes more. By understanding the relationships between external pressure and concussion reporting, clinicians can help design and implement targeted interventions toward the removal of pressure from each source.

113. Kevin Parham (Health Policy & Management), *Exploring Stakeholder Perceptions of Safe Injection Facilities in North Carolina*
Track: Health & Well-Being
Advisor: Karl Umble (Health Policy and Management)

Abstract: Despite significant efforts to curtail the impact of the opioid epidemic, overdose deaths continue to grow exponentially across the United States. With 22 of the top 25 cities for opioid abuse in the Southeastern United States, including 4 in North Carolina alone, it is crucial to consider new and innovative interventions in the political context of the South to effectively combat the negative effects of this crisis. Safe injection facilities are a harm reduction method that have been proven to decrease the likelihood of drug overdose and connect injection drug users to reliable healthcare information in other countries, but they have yet to launch in the United States due to social and legal obstacles. Using in-depth interviews with public health officials, medical providers, and law enforcement officers across North Carolina, I explored the potential benefits and concerns that key stakeholders have concerning the potential implementation of safe injection facilities in response to the opioid crisis. Interviews were taped with consent, transcribed, and coded for thematic analysis to identify potential barriers, structural limitations, and suggestions for implementation. By using the themes and related information collected in this study, public health workers, legislators, and policy advocates can make informed decisions about how to effectively and efficiently pass policy that benefits the overall health and safety of injection drug users in North Carolina.

115. Ruby Patel (Biomedical Engineering), *Early Assessment of Tumor Response to Radiation Therapy Using Ultrasound Molecular Imaging In Vivo*
Track: Health & Well-Being
Advisor: Paul Dayton (Biomedical Engineering)
Graduate Student Contributors: Sunny Kasoji, Thomas Kierski
Faculty/Postdoc Contributors: Paul Dayton, James Tsuruta, Sha Chang

Abstract: Earlier evaluation of treatment response to radiation therapy could lead to better prognoses for cancer patients. Previous studies have shown that VEGF (vascular endothelial growth factor) plays a critical role in angiogenesis. Higher levels of VEGF expression are associated with increased angiogenesis and tumor proliferation. Since tumor microvasculature is known to be significantly affected by radiation therapy, VEGF has the potential to be biomarker for tumor response to radiation therapy. In this study, ultrasound molecular imaging was used to evaluate changes VEGF expression in a cohort of rats with fibrosarcoma tumors that were treated with broad beam radiation therapy.

117. Erin Rogers (Biomedical Engineering), *Understanding the Temporal Dynamics of CENP-A Incorporation in Quiescent Cells Re-entering the Cell Cycle*
Track: Health & Well-Being
Advisor: Paul Maddox (Biology)
Undergraduate Contributors: Saurin Kantesaria
Graduate Student Contributors: Lydia Smith, Matthew Disalvo
Faculty/Postdoc Contributors: Paul Maddox, Nancy Allbritton

Abstract: CENtromere Protein A (CENP-A) is a histone variant and is the epigenetic mark that determines where centromeres are within a chromosome; thus it is critical to life. Here we report the temporal dynamics of a CENP-A incorporation in quiescent cells as they re-enter the cell cycle. We are able to study quiescent cells naturally in C. elegans, because after C. elegans??? embryos hatch, their cells stay in a quiescent state until they find food, which prompts the cells to re-enter the cell cycle. We used light microscopy to image and quantify the protein levels of CENP-A within cells in a quiescent state and compare them to C. elegans with cells that have re-entered the cell cycle. Using these methods, we discovered that there is a statistically significant increase in CENP-A levels after the cells exit the quiescent state and re-enter the cell cycle. From this data we have determined that the majority of the CENP-A incorporated in the cells is loaded once the cells begin proliferating. In the future, to increase the temporal resolution of CENP-A incorporation and to better understand when CENP-A is incorporated into the cell, we plan to use microfabrication and microfluidics to more precisely control the feeding, and consistently image multiple worms in parallel.

119. Halle Ronk (Biology), *Characterizing the Role of Canoe as a Cell Junction-cytoskeletal Linker Protein During Drosophila Morphogenesis*
Track: Health & Well-Being
Advisor: Mark Peifer (Biology)
Faculty/Postdoc Contributors: Dr. Lathiena Manning

Abstract: Adherens junctions (AJs) connect epithelial cells to one another and connect the plasma membrane to the actomyosin cytoskeleton; this organization translates contractility to neighboring cells and preserves tissue integrity during morphogenesis. It is not known exactly how the AJs are organized. The current model postulates that actin cables bind directly to unknown linker proteins, which bind to -catenin, which binds to -catenin, which binds to the transmembrane cadherin. We examined whether Canoe acts as a junction linker protein by testing its role in maintaining epithelial integrity, which is an indicator of junctional integrity. We used immunofluorescence and confocal microscopy to examine Drosophila melanogaster embryos during dorsal closure. In wild-type embryos, Canoe is enriched at the leading-edge epidermis and at tricellular junctions along the lateral epidermis, aligning closely with actin cables and myosin II heavy chain. We used RNA interference and the Gal4-UAS system to reduce canoe function. Loss of canoe caused cells along the lateral epidermis to become highly variable in shape. Furthermore, the number and regularity of puncta of Enabled, an actin assembly and elongation factor usually enriched at AJs, decreased across the leading edge. These results support the hypothesis that Canoe acts as a cytoskeletal-junction linker protein. Understanding this complex system can provide insight into the mechanisms of wound healing and neural tube closure in humans.

121. Allison Ruvidich (English & Comparative Literature), *Elizabeth Green and the Early Carolina Playmakers*
Track: Fine Arts
Advisor: James Leloudis (History)

Graduate Student Contributors: Dr. Cecelia Moore

Abstract: Elizabeth Lay Green (1897-1989) is best remembered as the wife of Paul Green, a UNC faculty member and eventual winner of the Pulitzer Prize. This legacy, however, fails to take into account the significant influence Elizabeth had both on her husband's work and on UNC's history. My research focuses primarily on her letters, which vividly narrate her experience as one of fewer than thirty female students, call co-eds, at UNC after World War I. Elizabeth's letters describe her relationships with prominent figures from UNC history, such as Professor Frederick Koch, Dr. Edwin A. Greenlaw, Frank Porter Graham, Thomas Wolfe, and her future husband, Paul Green. Elizabeth's letters capture the formation and growth of the Carolina Playmakers, as well as the significant role she played in their success: her play, When Witches Ride, was chosen to be the first play performed by the Carolina Playmakers in 1918. Elizabeth's contribution to the literature of North Carolina did not end when she graduated. Newly married to her college sweetheart, Paul Green, Elizabeth served as his secretary, editor, and financial supporter while he struggled to establish his place in literature. Despite explicitly having written significant portions of plays such as The Lost Colony, which is still performed in Manteo, North Carolina, Elizabeth is uncredited for her work. My research on Elizabeth Lay Green illuminates the early history of UNC while revealing a pillar of NC's artistic history.

123. Brittany Smith (Chemistry), *Synthesis of Fluorinated Polymers and Their 19F MRI Utility*
Track: Health & Well-Being
Advisor: Frank Leibfarth (Chemistry)
Faculty/Postdoc Contributors: Dr. Aaron Teater

Abstract: In proton MRI, contrast agents are typically used to enhance and improve the image. However, Fluorine MRI offers the chance to further improve images due to the absence of fluorine in the body. Using a fluorine-based imaging agent would allow for better images since it would only highlight those areas with the MRI agent. Beyond this, fluorine MRI agents also offer the potential to measure tumor oxygen concentration which would be beneficial to determining the best possible treatment options and a better understanding of the tumor. 19F MRI agents have been previously developed, but those imaging agents exhibited high chemical shift dispersion, poor molecular mobility, and low fluorine content. This research looks at synthesizing a fluorinated polymer with high fluorine content and exploring its ability to measure partial oxygen concentration. A hexa-fluorinated epoxide monomer was successfully prepared using a Mistunobu reaction. This monomer was subsequently polymerized by monomer activated anionic polymerization. An optimization study was done on this polymerization which allowed us to target molecular weights and achieve low polydispersities. To determine its 19F MRI utility, a 19F NMR study was done to analyze the relationship between solution oxygen concentration and the polymer.

125. Mary Smith (Psychology & Neuroscience), *Parent and Teacher Expectations Predict GPA and College Search Behaviors in African-American Adolescents*
Track: Education
Advisor: Beth Kurtz-Costes (Psychology and Neuroscience)

Abstract: Research has found that parent and teacher expectations for a student's educational attainment positively relate to academic outcomes. More can be learned, however, about how expectations held in earlier grade levels predict student outcomes years later. In this study, I examined how parent and teacher educational expectations relate to the student's academic performance and college preparation behaviors later on. Data from 563 African-American students and their parents and teachers were analyzed in this work. Data came from surveys collected in Grades 5 and 12 as part of a

longitudinal study of the development of factors related to academic success for African-American youth. Results indicated that teacher educational expectations at Grade 5 were a significant predictor of Grade 12 GPA and college search behaviors. Parent educational expectations predicted Grade 12 college search behaviors but not Grade 12 GPA. These findings supplement previous research on the external, social factors related to academic performance and attainment for minority students. Although parent expectations for their child's educational attainment did not significantly predict later academic performance, they may still influence behaviors a student completes while progressing toward college matriculation. Furthermore, teacher expectations prove to be an accurate predictor of academic performance and activities related to higher education attainment even years after teaching a particular student.

127. Claire Stark (Psychology & Neuroscience), *The Relative Effects of Anxiety Sensitivity and Distress Tolerance on Behavioral Approach and Peak Distress Following Treatment for Spider Phobia*
Track: Health & Well-Being
Advisor: Jonathan Abramowitz (Clinical Psychology)
Graduate Student Contributors: Shannon M. Blakey
Faculty/Postdoc Contributors: Jonathan S. Abramowitz

Abstract: Previous research documents the importance of anxiety sensitivity (AS) and distress tolerance (DT) in the development and maintenance of anxiety. The current study was designed to test the hypothesis that greater pre-treatment AS and lower pre-treatment DT would predict (a) poorer behavioral approach and (b) greater distress when faced with a live tarantula in a sample of adults receiving treatment for spider phobia, even after controlling for pre-treatment levels of these outcomes. Adults with spider phobia (N=55) completed four sessions of exposure-based therapy for spider phobia. Participants completed self-report measures of AS and DT at pre-treatment as well as a 13-step spider behavioral approach task (BAT) at pre- and post-treatment. Linear regression models showed that although AS and DT jointly accounted for a 37.5% of post-treatment BAT completion variance ($p < .001$), only AS emerged as a significant unique predictor (?? = -.30, $p = .032$). Conversely, although AS and DT jointly accounted for 25.2% of variance in peak distress during the post-treatment BAT ($p = .007$), only DT emerged as a significant unique predictor (?? = -.29, $p = .047$). Results did not support hypotheses and suggest that although DT more significantly relates to one???s distress intensity when encountering a feared stimulus, AS is a more important factor in how one behaves despite elevated distress. Potential explanations, study limitations and future directions, will be discussed.

129. Bailey Tadlock (Exercise & Sport Science), *Descriptive Epidemiology of Knee Internal Derangement Injuries in High School Girls' Lacrosse, 2008/09-2016/17 School Years*
Track: Health & Well-Being
Advisor: Zachary Kerr (Exercise and Sport Science)

Abstract: Knee internal derangement (KID) injuries are common in high school sports. However, research related to girls' lacrosse is needed to identify sport-specific risk factors. PURPOSE: Describe the epidemiology of KID injuries in high school girls' lacrosse in the 2008/09-2016/17 school years. METHODS: Athletic trainers (ATs) collected injury and athlete-exposure (AE) data via the High School Report Information Online System. Injury was defined as: 1) occurring during an organized practice or competition; 2) requiring medical attention; and 3) resulting in time loss for ≥1 days beyond the day of injury. KID injuries were those to the anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial collateral ligament (MCL), lateral collateral ligament (LCL), and menisci. Injury rates per 10,000AE and injury rate ratios (IRR) with 95% confidence intervals (CI) were reported. Linear regression assessed injury rate time trends. RESULTS: ATs reported 106 KID injury

events (injury rate=1.4/10,000AE), most of which included ACL injuries (65%). The injury rate was higher in competition than practice (IRR=8.5; 95%CI: 5.3-13.6). Most injuries were reported mid-season in April (56%) and were due to rotation around planted foot/inversion (57%). The ACL injury rate increased over time (P=0.002). CONCLUSION: ACL injuries were common among KID injury events. The increase in ACL injury rates highlights the need to develop and refine lacrosse-specific injury prevention programs.

131. Nicole Thomas (Exercise & Sport Science), *Impact of Knee Osteoarthritis Severity on Walking Biomechanics*
Track: Health & Well-Being
Advisor: Brian Pietrosimone (Exercise and sport science)
Graduate Student Contributors: Hope Davis

Abstract: Determine the impact of knee osteoarthritis (KOA) severity on knee flexion excursion, vertical ground reaction force (vGRF), and walking speed. Methods: Radiographic KOA severity in the involved limb was rated for 88 adults (57% female, age: 62.1 ± 7.4, BMI: 28.8 ± 3.8) using a Kellgren-Lawrence (KL) grade of 2-4 (KL2: n=25, KL3: n=48, KL4: n=15). Gait trials were collected by placing 39 retroreflective markers on participants' feet, legs and sacrum as participants walked at a self-selected pace across a 6-meter walkway with three embedded force plates and 10 motion capture cameras. Knee flexion excursion, vGRF normalized to body weight (BW), and walking speed were compared using a one-way analysis of variance with KL grade (2,3, or 4) as the factor variable. Tukey post-hoc multiple comparison tests were conducted in the presence of a significant interaction. Results: Knee flexion excursion was significantly greater for individuals with KL grade 2 (12.08±3.8°) compared to KL grade 3 (9.3±4.3°; p=0.018) and KL grade 4 (7.9±3.9°, p=0.007). Individuals with KL grade 2 (1.2±0.2 m/s) walked faster than those with KL grade 4 (1.0±0.2 m/s; p=0.002). Peak vGRF was significantly lower for KL grade 4 (1.0±0.1 BW) compared to KL grade 2 (1.1±0.1 BW, p=0.017) . Conclusion: Individuals with severe KOA (KL 4) demonstrated aberrant walking biomechanics compared to those with mild KOA (KL 2). This could be due to pain or other factors not determined in this study.

133. Nicole Trupiano (Business Administration), *Relationship Among Bed-Sharing, Method of Feeding, and Risky Nighttime Behaviors for Infants*
Track: Health & Well-Being
Advisor: Cathi Propper (Psychology - Center for Developmental Science)
Graduate Student Contributors: Melissa Grimes

Abstract: Objectives Prior research has shown a positive relationship between breastfeeding and bed-sharing (Simon et al., 2015), but also between bed-sharing and nighttime risk (Shaefer, 2012). However, the research does not address how feeding method may contribute to risky nighttime behavior for those who choose to bed-share. The current study aims to examine the relationship among bed-sharing, feeding method, and risky nighttime behaviors. Methods The current study utilizes data from the Neonatal and Pediatric Sleep (NAPS) Study, a prospective and longitudinal study of 82 African-American infants and their caregivers. Infant sleep behaviors were video recorded throughout the nighttime period for one night at 3 months of age. Variables of interest include whether the infant shared a bed with his/her parent(s), the method of feeding (bottle-feed versus breastfeed), and risk behaviors (stomach sleeping, bottle propping, blanket covering face). Results Preliminary findings indicate that 70.73% of the sample bed-shared at some point throughout the nighttime period. Of those that engaged in bed-sharing, 39.66% breastfed, 39.66% bottle-fed, 6.90% did both, and 13.79% did not feed at all. Proportion of the nighttime period spent engaging in risky behaviors ranged from 0-97.42%

for stomach sleeping, 0-3.44% for bottle propping, and 0-27.67% for a blanket over the face. Future analyses will investigate the difference in risk behaviors for bed-sharing infants by feeding method.

135. Yifei Wang (Chemistry), *Building a BLT-Humanized Mouse Model on the Clade C HIV-1 Infection*
Track: Health & Well-Being
Advisor: Martina Kovarova (UNC Division of Infectious Diseases)

Abstract: 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.

137. Lynde Wangler (Psychology & Neuroscience), *The Roles of the Subicula of the Hippocampus in Producing Heroin-Induced Conditioned Immunosuppression*
Track: Health & Well-Being
Advisor: Donald Lysle (Psychology & Neuroscience)
Graduate Student Contributors: Christina Lebonville

Abstract: Infection vulnerability in people with SADs may be mediated by a conditioned immune response. Previously, our lab has investigated aspects of conditioned immune functioning to characterize neural circuitry and immune response in rats. Presently, we are interested in the neuronal outputs from the dorsal and ventral subicula, which are areas of the hippocampus that interact with regions that are critical for context encoding. It is unknown if these areas are involved in producing a conditioned immune response to a context. To investigate this circuit, male Lewis rats were conditioned to associate heroin, which is immunosuppressive, with a specific context over five 60-minute sessions. Previous work has shown that after conditioning in this manner, subsequent exposure to the context without heroin is sufficient to produce immunosuppression. We used DREADDs, a chemo-genetic tool, to inhibit the function of dorsal (Study 1) and ventral (Study 2) subicula of the hippocampus before re-exposure. The rats were injected with LPS (an immune challenge) immediately after the 60-minute re-exposure session and sacrificed six hours later. Measures of immune component nitric oxide were assessed using qPCR (to detect iNOS, an NO precursor), nitrate assay (to assess levels of nitrate/nitrite, a product of NO) and ELISAs. The current preliminary data support the notion that the dorsal, but not the ventral, subiculum is important for expression of conditioned immunosuppression.

139. Shannon Williams (Biology), *Gram Negative Bacilli in Critically Ill Burn Patients*

Track: Health & Well-Being
Advisor: Anne Lachiewicz (Infectious Diseases)

Abstract: Background: Among critically ill burn patients, the ability of surveillance screening to predict clinical gram-negative bacilli (GNB) infections is unknown. In this study, isolates identified by surveillance screening using vancomycin-amphotericin-ceftazidime-clindamycin (VACC) agars are compared to clinical isolates. Methods: Consented adult ICU patients with >20% burn or inhalation injury were screened from admission until ICU discharge (range, 1-29 weeks) with once weekly wound and perirectal swabs and twice weekly tracheal aspirates if intubated. Surveillance samples were incubated overnight in tryptic soy broth and inoculated to VACC agar. VACC agars select for extended-spectrum -lactamase producing-Enterobacteriaceae but allow breakthrough of glucose nonfermenting GNB. GNB isolated in 48 hours were identified and tested for antibiotic resistance using Kirby-Bauer methods with CLSI breakpoints. Clinical cultures were tested by routine methods in the clinical laboratory. Results: Of 654 screened patients, 66 were eligible and 52 enrolled (Figure 1). 90% consented to screening with 62% screened at all 3 sites. 450 GNB isolates were obtained from 1059 surveillance samples. 119 clinical GNB isolates were obtained. P. aeruginosa composed 40% of surveillance and 34% of clinical isolates. Figure 2 shows the wide variety of GNB that were detected. 31% of GNB clinical isolates were multidrug resistant (MDR) (Table 1).

141. Charles Wright (Psychology & Neuroscience), Intimate Self-disclosure as a Central Node in Adolescent Well-being: A Graph-theoretical Network Analysis
Track: Health & Well-Being
Advisor: Eva Telzer (Psychology and Neuroscience)
Graduate Student Contributors: Paul Sharp

Abstract: Decades of research investigating the act of self-disclosure have established its wide range of benefits, with the most studied being its capacity to promote intimate relationships, particularly if the nature of the disclosure is intimate. Self-disclosure has also been linked to healthy expression, social facilitation, and identity development - areas where competence is of critical importance during adolescence. For the purpose of assessing intimate self-disclosure's role in adolescent well-being in its entirety, this study performed graph theory analyses to determine the nature of intimate self-disclosure's centrality within a network of constructs which have been found to be either risk or protective factors in adolescent mental, emotional, and behavioral disorders. Data was drawn from daily diary questionnaires which were administered to 328 adolescents (mean age = 14.4, 57.9% females) to be completed over the course of a two-week period. Our findings show that tendency to intimately self-disclose possesses a high degree of centrality within this network, but displays a weak, negative node strength, suggesting that it is associated, albeit weakly, with negative outcomes. A major limitation of the study was the short span of time captured by our diary data.

143. Siqing Xu (Computer Science), *High-quality 3D Reconstruction of Texture-less Objects in Confined Space Using Stereo Vision and Structured Light*
Track: Health & Well-Being
Advisor: Jan-Michael Frahm (Computer Science)

Abstract: This thesis presents the research in gaining high quality 3D reconstruction of confined, texture-less environments such as human cavities. The research intends to provide high quality 3D data of human cavities to the surgeons who conduct laparoscopic surgeries in order to improve efficiency and reduce errors in surgeries. Supporting with experiments, the thesis proposes to add multiple refining algorithms and structured light assistance to increase the reconstruction quality. Based on the

results, remaining artifacts in reconstructions are analyzed and solutions to them are suggested which will be researched in later progress.

145. Shan Yu (Biology), *OPRM1 Gene Expression Differentially Predicts Posttraumatic Chronic Pain in Women and Men*
Track: Health & Well-Being
Advisor: Sarah Linnstaedt (Anesthesiology)
Graduate Student Contributors: Yue Pan

Abstract: Results of previous studies suggest that the expression of endogenous opioids in response to traumatic stress, and/or the influence of endogenous opioids on musculoskeletal pain (MSP) outcomes after traumatic stress exposure may differ in women vs. men. In the current study, we evaluated for sex differences in: 1) peritraumatic OPRM1 expression in response to motor vehicle collision (MVC), and 2) the association between peritraumatic OPRM1 expression level and chronic MSP outcomes following MVC. African American (AA) age 18 to 65 present in the emergency departments (EDs) after MVC were enrolled, and blood was collected. MSP severity was assessed 6 weeks following MVC. The association between OPRM1 mRNA expression and post-MVC chronic MSP development was assessed using general linear models. A significant interaction between OPRM1 mRNA expression levels and sex was observed. In men, high expression levels of OPRM1 mRNA were significantly associated with increased MSP severity 6 weeks following MVC. In women, OPRM1 expression levels were not a significant predictor of 6-week post-MVC MSP levels. Of note, this difference in expression was independent of the well-studied A118G genetic variant in OPRM1, as all individuals examined had two copies of the major allele (due to low MAF in AA). Further studies are needed to better understand sex differences in the role of endogenous vs. exogenous opioids in predicting chronic MSP development following traumatic stress exposure.

147. Adelaide Zhao (Psychology & Neuroscience), *Changes in the Biological Stress Response Through Adolescence*
Track: Health & Well-Being
Advisor: Aysenil Belger (Psychiatry)

Abstract: A heightened physiological stress response can cause cell damage and an aberrant alteration of the neural circuits involved. These effects are partly caused by overexposure to cortisol, a hormone released during stress. If the biological stress response indeed increases as a child ages into adolescence, the teenage brain may be more vulnerable to developing atypical stress regulation, which is related to depression, anxiety, and PTSD. This research may help explain why there are increased rates of psychiatric disorders during mid to late adolescence. The extent of the body's stress response can be measured using heart rate variability (HRV), which is the variation of time intervals between heartbeats. The Trier Social Stress Test for Children (TSST), which reliably induces a stress response, was used in this study with 23 participants (ages 9-16). TSST requires participants to perform a public speaking task to a panel and then complete mental arithmetic under time pressure. Continuous electrocardiogram (ECG) data was acquired for participants before, during, and after the TSST. HRV data was extracted from ECGs using our CardioEdit software and pipeline. The Pearson correlations indicate a moderate positive relationship found between age and extent of HRV change. As age increases, the extent of HRV change in response to stress increases as well. A greater physiological stress response could mean a greater impact on the maturation of brain structure and function during this time.

Session II: 2:30 – 3:30 PM

4. Hope Allen (Biology), *Identifying Components of the 1-aminocyclopropane-1-carboxylic acid (ACC) Signaling Pathway in Arabidopsis Thaliana*
Track: Environment
Advisor: Joseph Kieber (Biology)
Faculty/Postdoc Contributors: Joanna Polko

Abstract: The gaseous plant hormone ethylene has been extensively studied as it regulates fruit and leaf abscission, leaf senescence, and the triple response mechanism. Much is known about the biosynthesis and ethylene signaling pathways. 1-aminocyclopropane-1-carboxylic acid (ACC) is the precursor to ethylene in the ethylene biosynthesis pathway. Several studies suggest that ACC plays a role outside of the ethylene biosynthesis pathway, specifically when observing the response of the ethylene insensitive mutant ein2-5 to ACC. The ethylene insensitive mutant ein2 has been shown to respond to high concentrations of ACC, which is manifested by short roots when grown on ACC-containing media. In order to elucidate components of the novel ACC signaling pathway, a forward genetic screen is being conducted. 100,000 ein2-5 Arabidopsis thaliana seeds were EMS-mutagenized, and the candidate lines that displayed the long root phenotype in presence of ACC were selected and propagated. 14 ACC resistant (acr) mutants, were selected from the M2 population and then backcrossed to the parental ein2-5 mutant to create a mapping population. Bulk-segregant mapping by sequencing will be performed on the wild-type and mutant DNA pools in order to determine the causative mutation conferring ACC insensitivity. Follow up studies will be performed on the gene identified by sequencing in order to continue to elucidate the ACC signaling pathway.

6. Emilee Armstrong (Physics & Astronomy), *Investigation of Energy Transfer in Photon Harvesting Pendant Assemblies within Solvents of Differing Viscosities Using Coarse-Grained Modeling*
Track: Environment
Advisor: Alfred Kleinhammes (Physics)
Graduate Student Contributors: Leah M. R. Bowers
Faculty/Postdoc Contributors: John M. Papanikolas

Abstract: The study of energy transfer within photon harvesting assemblies is essential to building more efficient photovoltaics. Polyfluorene (PF) RuOs is a photon harvesting pendant assembly with an exceptionally high energy transfer efficiency given its low packing density. Through this study, the impact of the polymer backbone's flexibility on energy transfer is studied to determine why the assembly attains such a high efficiency. Using coarse-grained modeling in Materials Studio, PF-RuOs is modeled in three solvents of varying viscosities: acetonitrile, dimethylacetamide, and benzenesulfonamide. The position of the assembly's pendants, where energy transfer occurs, is recorded over a 200ns trajectory and used to generate kinetics for each model. These kinetics will be investigated to determine how the energy transfer rate and efficiency compare among solvents, which will aid in generating a better understanding of energy transfer within the assembly.

8. Kathleen Arney (Sociology), *Understanding Student Opinions on Race, Meritocracy, and Diversity in a Race-Conscious Age*
Track: Diversity & Equity
Advisor: Karolyn Tyson (Sociology)

Abstract: This study, modeled after a 2012 study by Natasha Warikoo at Harvard, Brown, Cambridge,

and Oxford Universities, examines student opinions on race, meritocracy, and diversity through the lens of affirmative action. It will focus on opinions of students at a Southern flagship university to illuminate the cultural frames students use to navigate racial issues and provide an understanding of current racial attitudes. "Opinions on affirmative action policy" was chosen as the proxy for student attitudes on race, meritocracy, and diversity because of student awareness, relevance to student life, and the opportunity to examine how students understand meritocracy and diversity when systematic inequality seemingly places the two at odds. This study attempts explorational understanding of how students navigate racial issues on campus, which will be used to develop existing knowledge on Southern, college-educated, student opinions. Data on student opinions was collected through an online survey, with approximately 600 student respondents and 20 in-depth interviews. The survey gathered information on student demographics as well as general attitudes on issues of race, meritocracy, and diversity on campus. The interview questions launched deeper discussion on the same topics with open-ended questions aimed at better understanding how students form opinions about race. Both sources of data were then analyzed according to four racial frames: color-blindness, culture of poverty, diversity,

10. Andrea Barnes (Public Policy), *GEAR UP Evaluation*
Track: Education
Advisor: Cassandra Davis (Public Policy)
Undergraduate Contributors: Andrea Barnes
Graduate Student Contributors: Stefany Yolanda Ramos

Abstract: Study conducted on the impact of GEAR UP in North Carolina schools. Findings suggest that North Carolina high school graduatesagree that college is usefulbut not necessaryforattaining successin life. Participants currently enrolled in college described mentorshipas themechanism for helping them attend and persist through post-secondary school. Unsurprisingly, students who were not enrolled in college werelesslikely toidentify a mentor as compared to the students who were enrolled. Additionally, preliminary findingsfrom the NCCKI reveals that22% of surveyed high school studentsindicated that theirpost-high school aspirations are either receiving a Bachelor's degree or getting a job.

12. Caroline Beasley (Biology), *Deconvolution of Crohn's Disease RNA-seq Data*
Track: Health & Well-Being
Advisor: Terry Furey (Biology)

Abstract: Crohn's Disease (CD) research frequently utilizes cells from colon or ileum tissue samples as sources of genetic data to undergo sequencing. In colon samples there are various cell types present in varying concentrations. The main four cell types present in colon samples are intestinal B-cells, T-cells, macrophages, and epithelial cells. These cell types are not clearly distinguishable in RNA-seq data generated from colon tissue samples. This is because the expression levels are generally averaged together in the RNA-seq output and therefore show aggregate expression of the sample. Our lab seeks to perform a deconvolution on RNA-seq data obtained from colon tissue samples. The deconvolution aims to approximate the relative proportions of the major cell types present in the sample based on RNA-seq output. This will be accomplished by first evaluating average expression levels in each of the colon's four major cell types, and then creating a deconvolution algorithm to estimate cell type proportions within samples. The purpose of this project is to create an algorithm that enables our lab to approximate cellular proportions in a sample after performing RNA-seq to foster a greater depth of knowledge about the sample itself.

14. Alison Bonner (Biology), *Characterizing the Role of Crk in Central Nervous System Development in Drosophila*
Track: Health & Well-Being
Advisor: Mark Peifer (Biology)
Faculty/Postdoc Contributors: Dr. Andrew Spracklen

Abstract: Coordinated cell adhesion and actin remodeling are required for normal development and tissue homeostasis. Crk family proteins, including Crk and Crk-like (Crk-L), are a well-conserved family of small adaptor proteins that play a role in cell adhesion, migration, and other biological processes during normal development. Crk also plays a role in various cancers, including invasive bladder cancer, and Crk-L is a key mediator of oncogenic forms of Abelson tyrosine kinase (Abl), a highly conserved developmental regulator, in Leukemia. Previous research showed that Abl has well-defined roles in central nervous system (CNS) patterning, so it was hypothesized that Crk is required for proper CNS patterning. To test this hypothesis, RNAi was used to deplete Crk, both maternally and zygotically, and the effects on embryonic viability and CNS patterning were examined. Crk depletion resulted in higher lethality in embryos, most of which had disrupted CNS patterning. Similar CNS patterning disruption had been observed in abl maternal/zygotic mutants. Additionally, zygotic loss of crk results in partially penetrant CNS patterning defects. Characterizing Crk's role in CNS development and other morphogenic processes can help to gain a better understanding of Crk's role in cancer and other disease states in which developmental regulatory programs and cell behaviors are misregulated.

16. Joshua Boone (Exercise & Sport Science), *The Effect of a Helmet on a Head Impact Sensor's Accuracy to Measure Peak Rotational Acceleration During Laboratory Controlled Drops to a Cadaver Head*
Track: Health & Well-Being
Advisor: Jason Mihalik (Exercise and Sport Science)
Graduate Student Contributors: Kody Campbell

Abstract: The xPatch is a head impact sensor worn behind the ear and measures head impact kinematics in helmeted (H) and un-helmeted (UH) sports relevant to concussion injury mechanics. It is unclear how the xpatch???s accuracy at measuring impact kinematics, i.e. peak angular acceleration (PAA), changes from H to UH conditions. Our study determined how a helmet effected the xpatch???s accuracy on measuring PAA compared to gold standard gyroscopes mounted to a cadaver head. We dropped 2 UH heads from 2, 6, and 14cm and 2 H heads from 8, 50, and 90cm onto a stiff plate. Heads were dropped on 6 locations: frontal (FR), frontal oblique right (FB), occipital (OC), parietal left (PL), parietal right (PR), and vertex (VT). We calculated the normalized absolute percent error (NAPE) between the PAA measured by the xpatch to the gold standard gyroscope for each location. T-tests for each location compared the NAPE between H and UH drops. Heads were dropped 144 times for each helmet condition, but PAAs were significantly different between UH and H drops at FB, PL, and PR locations ($p < 0.05$). We limited the analysis to the FR, OC, and VT locations. The NAPE from UH drops were 169 percent points less than the H drops at the OC location ($p < 0.05$), but did not significantly differ at the FR and VT locations ($p > 0.05$). The xpatch performed poorly with NAPES ranging from 18% to 340% at across locations for both UH and H drops. Xpatch accuracy must improve to provide accurate kinematics from the field.

18. Coleman Breen (Statistics and Analytics), *Analyzing Contractile Ring Dynamics Using Wavelets*
Track: Health & Well-Being
Advisor: Amy Maddox (Biology)

Faculty/Postdoc Contributors: Dr. Michael Werner

Abstract: During cytokinesis, a contractile ring made up of actin fibers, myosin motor ensembles, and cross linkers contracts to cleave one cell into two. A master regulator of ring formation and reassembly, RhoA promotes actin polymerization and myosin activation???both vital to the contraction of the cytoskeletal ring. It is however not clear how the cytokinetic ring is remodeled during ingression. To study the dynamics of ring closure, we measured closure speed using 4 dimensional imaging and quantitative image analysis. This analysis revealed several traits of the cytokinetic ring: (1) The ring undergoes periodic speed oscillations. (2) The ring does not behave as a single contractile unit but rather as the assembly of many contractile units. (3) The fastest segment of the ring travels circumferentially around the ring during constriction. To better characterize these behaviors we analyzed the speed oscillations of individual ring segments using wavelet analysis. We also performed neighbor correlation to determine if travel of the fastest segment and speed oscillations are linked. Initial results suggest that: (1) oscillation frequency is non-uniform around the ring and changes with ingression. (2) These behaviors are significantly altered when we deplete vital ring components. (3) The oscillatory behavior of neighbor segments is more correlated in the direction of circumferential travel. We are confident that further analysis will reveal how changes in ring dynamics drive closure.

20. Melissa Burroughs (Psychology & Neuroscience), *The Mediating Role of Cortisol in the Relationship Between Daily Peer Exclusion and School Functioning in Adolescents*
Track: Health & Well-Being
Advisor: Eva Telzer (Psychology and Neuroscience)
Faculty/Postdoc Contributors: Jorien van Hoorn, PhD

Abstract: Nearly 40% of adolescents in the U.S. report recent exclusion or victimization by their peers, often with detrimental effects for school performance. Cortisol, a stress hormone, may play a key role in the relation between peer exclusion and poor school performance. As such, the present study aimed to examine whether cortisol mediates the relationship between daily peer exclusion and school functioning. Participants (N = 421, ages 12-18) completed daily diaries, short checklists that assess events and feelings for the day, including experiences of exclusion and negative school events, such as bad grades and disagreements with teachers. In addition, participants provided salivary cortisol four times a day for four days. We used Hierarchical Linear Modeling to analyze these nested data. Our findings showed that daily peer exclusion was associated with worse school outcomes (B = .07, p = .045), and that peer exclusion better predicts social (B = .06, p = .042), as opposed to academic (B = .03, p = .329), outcomes at school. However, cortisol does not mediate the relationship (B = -.01, p = .854) between peer exclusion and school functioning. These findings suggest that while peer exclusion and school functioning are related, cortisol cannot explain this association. Future research should continue to probe this relationship using different perspectives, such as relying on subjective measures of stress (i.e., self-reported stress), to understand the mechanisms and outcomes.

22. Emma Choplin (Psychology & Neuroscience), *Evaluating the Creative Achievement Questionnaire in an Emerging Adulthood Population*
Track: Diversity & Equity
Advisor: Eric Youngstrom (Psychology & Neuroscience)
Undergraduate Co-Authors: Logan T. Smith
Faculty/Postdoc Contributors: Eric A. Youngstrom

Abstract: Growing attention on emerging adults calls for an accurate creative achievement self-assessment for this age group. Research suggests the CAQ may not measure creative achievement

accurately for 18-25 because they haven't reached the age of achieving high scoring items. We evaluated the factor structure of the CAQ, investigated potential issues of skewness & its use for emerging adults. Our hypothesis was the CAQ might show concerning skewness & would only measure a single factor for 18-25, instead of the prior putative 3 factor structure. N=681 students in NC & S.Korea completed a survey including the CAQ, a 10-domain rating of creative activities. We used an alternate scoring method to reduce skewness. We also imitated the traditional scoring method for analysis. We calculated the skewness of the distribution of CAQ total score using both methods. We analyzed the CAQ's factor structure as well as correlations between Carson's factors & related scores. The modified CAQ total scores M=18.03 with skewness of 2.00 & kurtosis of 7.06 despite our scoring reducing both. Parallel analysis indicated one factor, not Carson???s 3-factor model. Forcing the items into 3 factors yielded different factors than Carson. Her scales produced no significantly different correlations. The skewness of the CAQ scores & the factor analysis indicated the CAQ's ineptitude for 18-25. Future research should investigate other limitations of the CAQ to develop a creative achievement assessment for all.

24. Thomas Claffey (Biology), *An Analysis of the Changing Lake Stratification and its Impact on Muskegon Lake Ecology Using 6 Years of Time-series Observatory Data*
Track: Environment
Advisor: Bopaiah Biddanda (Grand Valley State University Robert B. Annis Water Resources Institute (AWRI))

Abstract: Freshwater lakes have been identified as important control points in Earth???s biogeochemical cycles. A warming climate will make lake surface water warmer, strengthening the stratification and creating a steeper thermocline resulting in habitat disruption for organisms relying on the normal seasonal changes in strata. These effects were analyzed using six years of time-series data from the Biddanda Lab???s buoy in Muskegon Lake, a drowned river mouth of Lake Michigan www.gvsu.edu/wri/buoy/ . By comparing the yearly changing structure of the strata with dissolved oxygen concentration, chlorophyll concentration, and phycocyanin concentration, the ecological impact of anomalous strata dynamics was studied. These measures served to investigate hypoxia, autotrophic production, and cyanobacteria production respectively. The results suggest that increasing average air temperatures have drastic ecological impacts in mesotrophic lakes. Hypoxia at low depths was more frequent in warmer months. Total primary production increased in relation to average monthly temperature. Cyanobacterial blooms were more frequent in warmer months. As global average temperatures have increased yearly and are expected to continue increasing, these findings expose ecological concerns for an important part Earth???s biogeochemical cycles.

26. Nadia Cohen (Physics & Astronomy), *The Role of Convection in the Overturning of Ocean Circulation*
Track: Environment
Advisor: Pierre Passagia (Marine Science)
Graduate Student Contributors: Dr. Pierre Passagia

Abstract: In this experiment, we aim to develop a laboratory-sized model that mimics the properties of the oceans??? meridional overturning circulation in order to increase our understanding of the relationship between heating and cooling at the surface and the deep water cycle. Recent studies by Paparella & Young (JFM, 2002) have shown that buoyancy driven flows at the surface do not produce enough circulation to explain the ocean???s circulation. However, simulations conducted at UNC suggest otherwise. Our simulations show that a large-scale wind type forcing drives the overturning circulation. We set up the experiment using a transparent acrylic tank. Along the top of the tank are two

wells made up of two semipermeable membranes. One has fresh water continuously pumped in and out, while the other has salt water. The diffusion of the salt ions across the membranes act as the driving force, mimicking the difference in temperature between the poles and the equator at the surface of the ocean. From this procedure, we are able to measure the magnitude of the circulation using particle image velocimetry. Our first measurements are in qualitative agreement with the simulations and allow for reproducing the overturning circulation process. We will compare the results from this experiment with known theoretical predictions and the numerical simulations in order to validate our hypothesis, that heating and cooling at the surface of the ocean can sustain deep ocean circulation.

28. Madeline Cooke (Chemistry), *Identification of Novel Antimicrobial Peptides from Bacillus subtilis and Allium Sativum Using PepSAVI-MS*
Track: Health & Well-Being
Advisor: Leslie Hicks (Analytical Chemistry)
Graduate Student Contributors: Nicole Parsley, Christine Kirkpatrick

Abstract: Antibiotic resistant pathogens infect more than 2 billion people and result in 23,000 deaths each year in the United States alone. Despite the urgent need for new therapeutics, the number of new antimicrobial drugs reaching the market each year is declining. As such, researchers have begun to look towards non-traditional peptide-based therapeutics as potential leads. Antimicrobial peptides (AMPs) have recently been shown to exhibit tremendous pharmacological potential, including novel mechanisms of action capable of overcoming many limitations of currently available drugs. To target this exciting class of compounds, we have developed the PepSAVI-MS (Statistically guided bioactive peptides prioritized via mass spectrometry) pipeline to screen botanical and microbial species for novel AMPs. This pipeline employs mass spectrometry, versatile bioactivity assays, and statistical analysis to identify AMPs with promising activity against common drug-resistant pathogens. Herein, I have expanded the PepSAVI-MS pipeline to screen the bacterially-fermented products of Allium sativum for novel AMP activity.

30. Alexander Davis (Biology), *Hydrodynamics of the American Horseshoe Crab*
Track: Environment
Advisor: Laura Miller (Biology and Mathematics)

Abstract: The intertidal zone is a turbulent landscape where organisms face numerous mechanical challenges from powerful waves. A model for understanding the solutions to these physical problems, the American Horseshoe Crab (Limulus polyphemus), is a marine arthropod that mates in the intertidal zone, where it must contend with strong ambient flows to maintain its orientation during locomotion and reproduction. Strategies to maintain position include for the shell to produce negative lift, or to minimize positive lift, in flow. To quantify flow over the shell and the forces generated, the 3D shape of a horseshoe crab shell was scanned, and the resulting digital reconstruction was used to 3D-print a physical model. We then recorded the movement of tracking particles around the shell model, under flow. Our time-lapse image series were analyzed by particle image velocimetry (PIV), which allowed for experimental visualization of the flow structure for comparison to simulations. The velocity vector fields were used to validate numerical simulations performed using the immersed boundary (IB) method. We used IB to simulate fully-coupled fluid-structure interactions (FSI) to solve for the forces on the shell, as well as velocity, pressure, and vorticity around the object. IB simulations and PIV analysis of vorticity and velocity at a flow speed of 13 cm/s reveal that there is a turbulent area downstream of the joint between the carapace and the abdomen. In this area of alternating vorticity,

32. Aanini Dwivedi (Biology), *Optimization of Immunohistochemistry Staining for IL-17 and CD3 in*

the Distal Mucosa of SIV-infected Rhesus Macaque Infants
Track: Health & Well-Being
Advisor: Kristina De Paris (Microbiology and Immunology)
Faculty/Postdoc Contributors: Dr. Alan Curtis

Abstract: Each day, hundreds of infants become infected with HIV via mother-to-child transmission through breastmilk, resulting in an urgent need for a pediatric vaccine. This project investigated the frequency of IL-17+ T cells in the colon following oral (PO) and intramuscular (IM) immunization of infant macaques. Vaccines consisted of simian immunodeficiency virus (SIV) DNA encoding structural (gag), polymerase (pol), and envelope (env) genes (DNA-SIV) adjuvanted with GM-CSF or CD40L genes together with modified vaccinia Ankara SIVgag,pol,env (MVA-SIV). Two groups of 6 neonatal macaques received two DNA-SIV immunizations at weeks 0 and 3, followed by 2 boosts with MVA-SIV at weeks 6 and 9. Group A was immunized IM. Group B was immunized PO+IM and MVA-SIV was administered sublingually (SL) and IM. Control animals received PO+IM saline at weeks 0 and 3 and empty MVA vector SL+IM at weeks 6 and 9. Beginning at week 12, all infants were orally challenged once weekly with 500 TCID50 of SIVmac251 until infected. IL-17 is a pro-inflammatory cytokine that helps maintain immune responses in the gut. IL-17 and CD3 frequency were tested in colon sections using fluorescent immunohistochemistry. The high CD3 and IL-17 frequencies in Group B suggested possible IL-17+ T cell preservation. Future work should include staining for gap junctions and tight junctions to test the possibility of leaky gut and quantification of cell frequencies.

34. Danica Dy (Biology), *Characterization of Retinal Blood Vessel Phenotype of the Adrenomedulin Signaling Axis*
Track: Health & Well-Being
Advisor: Reema B. Davis (Cell Biology and Physiology)
Graduate Student Contributors: Natalie Nielsen
Faculty/Postdoc Contributors: Reema B. Davis, PhD and Kathleen M. Caron, PhD

Abstract: The Notch cell-to-cell signaling pathway is critical in the extensive organization, growth, and patterning of blood vessels. Adrenomedulin (AM) is a multifunctional peptide-ligand, which when associated with a receptor activity-modifying protein (RAMP2), transduces its signal through the calcitonin receptor-like receptor (gene: Calcrl, protein:CLR). This AM/CLR complex has been identified to play a role in vascular development, permeability, and vasodilation. Furthermore, ACKR3, a decoy receptor structurally similar to the CLR receptor, regulates ligand bioavailability by sequestering AM, preventing the formation of the AM/CLR complex, thus impacting lymphangiogensis and angiogenesis. Incongruent with most other physiological regions, the retina is a site where blood vessels can be found independent of lymphatic vasculature; making mouse retina models robust tools for in vivo angiogenesis research. In this study, we examined mice with experimental genotypes AM hi/hi, AM hi/+, ACKR3+/-, ACKR3 -/-, Calcrl+/- and Calcrl-/- compared them to wild-type (WT) genotypes AM+/+, ACKR3+/+, and Calcrl+/+ using quantitative comparison of tip cells, filopodia, growth, and branching of retinal blood vessels. Our data reveals dramatic differences in the angiogenic front of P3 pups of the experimental genotypes compared to the wild-type retinas. This study focuses on delineating the crosstalk between the AM signaling axis and the Notch pathway in regulating developmental blood angiogenesis.

36. Zhengyang Fang (Computer Science), *A Framework for the Statistical Shape Analysis using SPHARM-PDM combined with ITK Conformal Flattening Filter*
Track: Health & Well-Being
Advisor: Martin Styner (Psychiatry/Computer Science)

Graduate Student Contributors: Mahmoud Mostapha

Abstract: Shape analysis is an important and powerful method used in neuroimaging research community due to its potential to precisely locate morphological changes between healthy and pathological structures. A popular shape analysis in the neuroimaging community is based on the encoding surface locations as spherical harmonics for a representation called SPHARM-PDM. The SPHARM-PDM pipeline takes a set of brain segmentation of a single brain structure (for example, hippocampus or caudate nucleus) as input and converts them into a corresponding spherical harmonic description (SPHARM), which is then sampled into triangulated surface (SPHARM-PDM). At present, the SPHARM-PDM pipeline utilizes an area-preserving optimization of the spherical mapping based on an initial heat-equation based mapping of the surface mesh to the unit sphere. In the case of objects with complex shape, this initial mapping will suffer from a high degree of mapping distortion that cannot always be corrected by the following optimization procedure. Here we proposed the use of an alternative initialization based on the ITK Conformal Flattening filter. This method adopts a bijective angle preserving conformal flattening scheme to replace the heat equation mapping scheme as initialization for use in the SPHARM-PDM pipeline. After quantitative measures of shape calculated from various complex structures, we concluded that in most cases, the new pipeline produced dramatically better results than the old pipeline.

38. Carlynn Ferguson (Physics & Astronomy), *Classification of Dwarf Galaxies Within the Volume-Limited RESOLVE Survey*
Track: Environment
Advisor: Sheila Kannappan (Physics and Astronomy)
Undergraduate Contributors: Margie Bruff
Graduate Student Contributors: Ashley Bittner

Abstract: AGN are compact regions at the center of certain galaxies that contain a much higher than normal luminosity of most electromagnetic radiation. Numerous subclasses of AGN have been defined based on their observed characteristics. However, previous research has rarely identified AGN within dwarf galaxies and none has done so with a statistically complete sample. The more commonly used SDSS for analyzing AGN is magnitude limited and therefore unnaturally biased towards more massive and luminous objects. The RESOLVE survey which is rather a volume-limited census of galaxies shows a more accurate representation of the dwarf galaxy distribution. Using this data to reflect on AGN prominence and characteristics within dwarf galaxies is important in order to rule out ambiguity with current methods of detecting AGN in such galaxies. A large portion of RESOLVE is embedded in the much larger survey, ECO, which therefore should yield very similar results. A code using lines of ionized Nitrogen, Oxygen, and Sulfur was created to classify galaxies within the RESOLVE survey. The results obtained, however, conflicted with those obtained from ECO. Debugging is necessary to resolve this discrepancy. Once the discrepancy is resolved we will look at less biased methods of detecting AGN in dwarf galaxies such as using ionized He instead of the current metallicity-biased method mentioned above.

40. Ryan Fockler (Biomedical Engineering), *Analysis of Gait Biomechanics During Stance Phase for Subjects with a Unilateral Anterior Crucial Ligament Injury and Reconstruction Surgery*
Track: Health & Well-Being
Advisor: Brian Pietrosimone (Exercise and Sport Science)

Abstract: Individuals who have injured their anterior crucial ligament (ACL) undergo ACL reconstructions (ACLR) to restore function to the unstable knee. Using deidentified data collected from

an existing study, we are analyzing kinetic and kinematic variables of walking gait in the injured and uninjured limbs of 20 ACL patients at 6 and 12 months following ACLR. The variables will be compared throughout the entirety of the stance phase of the gait cycle between limbs at each time point. Analysis of the entire waveform of variables during the stance phase is important because it can determine whether there are intervals during which there are significant differences between affected and non-affected limbs which was previously unstudied. Initial analysis will be completed using the kinetic variable of vertical ground reaction force. Secondary analysis will include other kinetic variables of interest (sagittal and frontal knee moments, knee power) as well kinematic variables of interest (sagittal and frontal knee angles, knee flexion velocity). The importance of this study is that the analysis of the kinetic and kinematic variables during the entire stance phase, rather than at discrete points, can identify intervals of the stance phase that require further study.

42. Riley Foster (Public Policy), *Eviction Diversion*
Track: Diversity & Equity
Advisor: Anna Krome-Lukens (Public Policy)

Abstract: With nearly 1,000 eviction filings per month, Durham County has the highest per capita eviction rate of any metropolitan county in North Carolina. In recent years, eviction has become a primary focus of the affordable housing discussion, but few programs have been implemented to mitigate the direct, negative impact of court ordered eviction judgments, namely homelessness. This Honors Senior Thesis examines the potential for a newly implemented Eviction Diversion Program (ED Program) to streamline community resources to better serve the financial and legal needs of low-income renter households in an effort to prevent homelessness. This analysis synthesizes data from court records with information gathered from interviews with stakeholders in four counties that have piloted ED Programs. It is concluded that ED Programs increase efficiency in landlord-tenant court proceedings; ensure greater protections of tenants' legal rights; unite private and public entities committed to reducing homelessness; and have the capacity to assist a small percentage of evicted households in avoiding homelessness.

44. Alexander Gartland (Biology), *Leveraging Crowdsourcing to Classify Social Media Data for Medical and Patient Safety Insights*
Track: Health & Well-Being
Advisor: Alex Topshea (SOP-CBMC)
Faculty/Postdoc Contributors: Tim Casperson, Jeffery Painter, Gregory Powell

Abstract: Objective: To evaluate whether crowdsourcing can be used to accurately and efficiently classify medically relevant concepts found in social media posts. Materials and Methods: Safety experts created a reference dataset by reviewing over 15,000 de-identified social media posts for 22 topics of medical interest. A random sampling of posts from the reference dataset was published on Amazon Turk and its users (Turkers) were asked a series of questions to identify those same medical concepts. Accuracy, price elasticity, time to complete review, and plurality were evaluated. Results: Accuracy of crowdsourced curation exceeded 90% when compared to the reference dataset and was completed in about 5% of the time. There was an increase in time efficiency with higher pay, but there was no significant difference in accuracy. When compared to the reference dataset, having a social media post reviewed by more than one Turker did not offer significant improvements in terms of accuracy. Discussion: Leveraging crowdsourcing to classify medical concepts in social media was accurate and efficient. Potential uses of this capability may range from simple noise removal to creating training datasets for algorithm development. Conclusion: Crowdsourcing is an accurate and efficient

method for identifying medical concepts contained within social media posts. More research is needed, however, to fully understand the strengths and limitations of using crowdsourcing for medical insights.

46. Emily Getzen (Biomedical Engineering), *Exploring Colonization Abilities of Burkolderia Bryophila in the Presence of Other Microbes, and Analyzing Colonization-Enhancing Genes Through Mutant Fitness Profiling in Different Media*
Track: Environment
Advisor: Jeffery Dangl (Biology)
Faculty/Postdoc Contributors: Andrew P. Klein (post doctoral fellow)

Abstract: Burkolderia bryophila (further known as MF376) is a strain isolated by the Dangl Lab that has been shown to be a robust colonizer of plant roots. It is unknown if MF376 has the same effect in the presence of other microbes competing for space on the roots. It is also unknown which genes give the strain this ability to colonize. One of the major challenges in microbiology is the functional assessment of uncharacterized genes identified through genome sequencing. I want to investigate if MF376 has an advantage when it comes to root colonization in a realistic setting, and, if so, which genes might give it an advantage when it comes to colonizing. There are four main goals to my project: discover whether or not this specific strain can survive and proliferate abundantly in the presence of other microbes, run a computational pipeline and analyze Bar-Seq data from a known colonizer (Pseudomonas simiae), and conduct a Bar-Seq experiment to identify genes essential to metabolism of different types of media, and compare colonizing enhancing genes across the two strains. This research will provide valuable information with regard to gene annotation of microbes. It will assist in the efforts to genetically engineer plant growth promoting microbes to be better root colonizers.

48. Alexandra Glenn (Exercise & Sport Science), *Talar Articular Cartilage Deformity Following a Walking Based Loading Protocol*
Track: Health & Well-Being
Advisor: Erik Wikstrom (Exercise and Sports Science)

Abstract: Lateral ankle sprains are the most prevalent musculoskeletal injuries in physically active populations. Further, the recurrence rates are high leading to a large percentage of patients suffering from chronic ankle instability. Those that suffer from chronic ankle instability are then at an increased rate of post-traumatic ankle osteoarthritis. This progression of injuries significantly decreases physical activity and quality of life and may result in the necessity of surgery or a full ankle replacement. It has been noted that degenerative changes in talar cartilage are present in many patients that have had ankle sprains. However, more information is needed to truly evaluate these degenerations by first understanding the deformation of ankle cartilage in normal daily activities. Ultrasonography has been found to be a valid tool for assessing cartilage thickness and deformation in the knee and far less costly than an MRI. The purpose of this study is to quantify the amount of talar cartilage deformation following a standardized load. Ultrasonographic images of talar cartilage were taken after resting for 45 minutes and then walking a comofrtalbe selected pace for 5000 steps on a treadmill. Cartilage thickness and area were drawn and analyzed. No significant differences in thickness or area of ankle cartilage were found. It is recommended that further research be done examine the effects of the placement of ultrasound probes on the ankle on image analysis as well as the effect.

50. Grace Guo (Biology), *Testing Habit Learning Across Paradigms: A Cross-validation Study*
Track: Health & Well-Being
Advisor: Charlotte Boettiger (Psychology and Neuroscience)

Abstract: Substance use disorders and alcohol use disorders have been posited to result from maladaptive habit learning. Habitual behavior is seen in substance use populations even after discontinued drug use, implying inflexible learning. Goal-directed responses (model-based) are flexible, whereas habitual responses (model-free) can be activated by a stimulus and separated from the outcome of that cue. Current addition literature has mixed findings on goal-directed deficits versus enhanced habit formation across tasks. The purpose of this study is to cross validate two commonly used tasks that measure habit-based or model-free behavior: the HABIT task and the model-based/model-free (MBMF) task. We predicted that model-based (goal-directed) values will negatively correlate with familiar perseverative errors, whereas model-free (habitual) values will positively correlate with familiar perseverative errors across tasks. Contrary to our hypotheses, we found that the MBMF task model-free (habit) values do not significantly correlate with familiar perseverative errors of the HABIT tasks. However, we found that model-based effect estimate positively correlates with familiar perseverative errors. This suggests that the two tasks may measure different and distinct aspects of goal-directed and habitual action selection. Knowledge gained from this study will help validate the use of commonly used behavioral tasks in detecting habitual behavior and aid in developing treatment plans for addiction.

52. Nathan Guskiewicz (Biomedical Engineering), *Comparison of Somatosensory Function Between Limbs in Individuals With Anterior Cruciate Ligament Reconstruction*
Track: Health & Well-Being
Advisor: Troy Blackburn (Exercise and Sports Science)
Undergraduate Co-Authors: Heather Lavin
Undergraduate Contributors: Ashley Dibbert
Graduate Student Contributors: Chris Johnson
Faculty/Postdoc Contributors: Jevon Morris

Abstract: Surgical reconstruction of the anterior cruciate ligament (ACLR) increases the risk of developing knee osteoarthritis (OA). Deficits in somatosensory function have been identified following ACLR and may be linked linked to aberrant gait biomechanics that contribute to the degeneration of joint cartilage. These deficits in somatosensory function are believed to originate from altered or damaged mechanoreceptors in the reconstructed ACL which are important in communicating joint position and movement to the central nervous system. The purpose of this study was to compare somatosensory function between the ACLR and contralateral limbs in 53 subjects by measuring joint position sense (JPS), as well as a more clinically feasible measurement, vibratory perception threshold (VPT). JPS was measured through subjects??? ability to replicate joint angles at the knee using 3D motion analysis. VPT was measured by identifying the minimum detectable vibration intensity subjects perceived at 5 bony landmarks in the lower extremities using a biothesiometer. There were no significant difference in JPS or VPT between the ACLR and contralateral limbs. The subjects in this study were, on average, 27 months removed from ACLR. Therefore, the results suggest that somatosensory function is likely restored within two years post-ACLR. Future research is necessary to determine whether somatosensory function differs from healthy control subjects and its influence on the risk of OA following ACLR.

54. Neil Harwani (Biology), *Regulation of CENP-A Maintenance in Early Zygotes*
Track: Health & Well-Being
Advisor: Paul Maddox (Department of Biology)
Undergraduate Co-Authors: Parker McDuffie, Sanjana Rao

Graduate Student Contributors: Lydia Smith, Ethan Hughes, Cole Barnhardt
Faculty/Postdoc Contributors: Paul Maddox

Abstract: In humans, nematodes, and other eukaryotic organisms, centromeres remain crucial components of mitotic division as they are the point-of-attachment for microtubules on chromosomes. Centromeric machinery consists of the histone H3 variant of centromere protein A (CENP-A). Here we investigate whether the homologs of MgcRacGAP and mDia2 have the same effect on CENP-A density in Caenorhabditis elegans (C. elegans) as they did in humans and whether or not novel regulators of CENP-A maintenance exist. RNA interference (RNAi) was conducted via induced feeding of bacteria that targeted proteins CYK-1, CYK-4, EPI-1, ZYG-12, L-4440 (negative control), and KNL-2 (positive control). Then, healthy adult worms with CENP-A marked with GFP and the histone H2B marked with mCherry were imaged using confocal light microscopy. We found that when CYK-4 and CYK-1 are knocked down, CENP-A levels decrease; however, the magnitude by which these CENP-A levels decreased in C. elegans is much lower than the magnitude by which CENP-A levels decreased in HeLa cells. Based on collected data, there is not sufficient grounds to label ZYG-12 and EPI-1 as novel regulators of CENP-A maintenance. Further experimentation will be conducted to determine the other mechanisms that may have been affected by knocking down ZYG-12 and EPI-1. Once novel regulators of CENP-A maintenance are identified, if any, similar experiments using HeLa cells will be carried out to extrapolate results found when using C. elegans.

56. Kaya Hedt (Mathematics), *University-Donor Relationships Examined Through Survival Analysis Modeling*
Track: Education
Advisor: Jonathan Jensen (Exercise and Sport Science)

Abstract: Survival analysis modeling is a statistical methodology used to understand how the probability of an event of interest occurring may change over time. It is often used in the academic fields of biostatistics and public health, but increasingly it is being applied to research questions in other fields such as education, economics, and in this case sport marketing. This project applies the method of survival analysis to data from a university's donor database, which consists of 18,866 individuals (105,147 observations), from 2009 to 2017. The analysis aims to determine how likely donors are to end their relationship with the university as the number of years of their involvement increases, and explores which donor characteristics affect the length of their donor relationship. Results demonstrate donors are most likely to end their relationship with the university after their first year, and that the likelihood that they end their donor relationship decreases for every year that they continue donating. This result is important as it suggests that the first few years of a relationship are the most critical in determining whether the donor relationship will be long-lasting. While the results may not be generalizable across other institutions, this university should focus on fostering strong relationships with their donors during the donors' first few years, rather than focusing on maintaining their relationships with long-standing donors.

58. Lilian Heil (Chemistry), *Identification of Antimicrobial Peptides from S. lycopersicum*
Track: Health & Well-Being
Advisor: Leslie Hicks (Chemistry)
Graduate Student Contributors: Tessa Bartges, Christine Kirkpatrick

Abstract: Reliance on a small number of antibiotic therapeutics has provoked increasing microbial resistance, and the need for new antimicrobial agents is now more urgent than ever. Peptides are a source of novel antimicrobial agents with the potential to be highly selective and effective. Our

laboratory has developed the PepSAVI-MS pipeline to facilitate the discovery and characterization of novel antimicrobial peptides. In this pipeline, aqueous extracts are fractionated to produce peptide libraries that are screened against pathogens in bioactivity assays and analyzed via LC-MS/MS to determine relative peptide abundance in each fraction. Statistical modeling is used to determine contributors to the observed bioactive region, and peptide targets are prioritized for characterization. PepSAVI-MS is highly versatile and can be modified to identify both constitutive and inducible peptides. Abiotic stress response pathways are linked to pathogen response and have been shown to alter peptide expression. Herein, we exposed Solanum lycopersicum to elevated salt levels to diversify our peptide library. We established a hydroponic system in which salt stress conditions can be applied simultaneously to many plants, facilitating the collection of large quantities of aerial tissue for analysis. The PepSAVI-MS pipeline was used to investigate tissue of S. lycopersicum grown in a liquid medium with elevated salt levels to identify antimicrobial peptides expressed under conditions of abiotic stress.

60. Hannah Inman (Biostatistics), *The 2017-2018 Flu Season: An Early Warning Model*
Track: Health & Well-Being
Advisor: Jane Monaco (Biostatistics)

Abstract: The 2017-2018 flu season has been particularly detrimental to public health. With more than 700,000 hospitalizations and more than 50,000 deaths, the Centers for Disease Control (CDC) confirms that it is the worst flu season in a decade, far more widespread and intense than in recent years. Since 1997, the CDC has collected data on positive flu specimens in each state and made those data available on the Internet on a weekly basis to monitor the incidence of the flu across the nation. The question is: Using weekly flu test data, at what point could this year's flu prevalence have been predicted to reach the current peak? How soon could we have known how bad it would get? What statistical method best predicts the sustained intensity? Considering population and other differences in states and regions, which states best predict the national trend? This project uses five months of CDC weekly data from the 2017-2018 season. Statistical models include linear regression, exponential regression, and time series (with a lag) models using SAS. A MACRO was developed to iteratively identify the earliest week for which each state could have predicted the national peak of infection. Data visualization was done using an open framework based on d3.js. This project serves as an initial inquiry into the idea of an "early warning system" to evaluate future severe flu seasons.

62. Sanjna Iyengar (Biomedical Engineering), *Validation of CRISPR/Cas9 for Investigating Genetic Basis of Gastrointestinal Neuroendocrine Tumors*
Track: Health & Well-Being
Advisor: Scott Magness (Biomedical Engineering)

Abstract: Gastrointestinal neuroendocrine tumors (GI-NET) are thought to arise from abnormal proliferation of neuroendocrine cells, yet direct evidence for this is lacking. My project at the Magness Lab addresses the hypothesis that quiescent secretory progenitor reserve stem cells in intestinal crypts can develop oncogenic mutations that lead to GI-NET formation. The proposed experimental method is to utilize CRISPR/Cas9 technology to insert mutations into murine intestinal stem cells (ISC) to disrupt genes that are likely to induce GI-NET formation, and then observe the cells for increased proliferation and other GI-NET characteristics. I am first validating that CRISPR/Cas9 is able to cut the DNA at the desired locations. To accomplish this, I have used PCR, gel electrophoresis, tissue culture, and DNA extraction/purification methods to develop a vector containing components for CRISPR/Cas9 targeting that will be introduced into ISC. The vector was transfected into NIH-3T3 cells, and the cells??? genomic DNA was extracted and PCR amplified at the target regions. The PCR product was digested with T7 endonuclease since the enzyme detects heteroduplexes formed by indels at regions where the

DNA is cut. From gel electrophoresis, I expect to find two bands for each target site, indicating the presence of a heteroduplex and thus successful validation of the CRISPR/Cas9 method. Next, I will introduce mutations into ISC and screen them for increased proliferation and the GI-NET marker ChgA.

64. Niveditha Jagadesh (Psychology & Neuroscience), *Functional Connectivity During Reward Processing in First-Degree Relatives of Individuals with Schizophrenia*
Track: Health & Well-Being
Advisor: Jessica Cohen (Psychology and Neuroscience)
Graduate Student Contributors: Dr. Teague R. Henry

Abstract: Researchers examined whether there were functional brain connectivity differences between healthy controls and first-degree relatives of individuals with schizophrenia in three networks: the default mode network (DMN), the salience network, and the dopaminergic reward network. 61 healthy participants aged 8-30 and 16 adolescent first-degree relatives aged 8-16 performed a probabilistic learning task under fMRI. Participants classified abstract stimuli into one of two categories and were given feedback. Since tasks are efficiently accomplished when brain areas communicate effectively with one another, researchers hypothesized that first-degree relatives would show decreased segregation between the brain networks and higher global efficiency values during stimulus and feedback when processing rewards. When stimulus global efficiency was predicted, age was a significant predictor while the participant grouping variable was marginally significant. When DMN and subcortical region connectivity during stimulus presentation was predicted, age and participant grouping were both significant predictors. Participant grouping was a significant predictor of overall network connectivity during both stimulus presentation and feedback. Results suggest that first-degree relatives have more diffuse functional connectivity than healthy controls, which suggests their ability to process information quickly and with targeted intent is less efficient. Keywords: Schizophrenia, reward processing.

66. Yichen Jiang (Computer Science), *Generative Adversarial Network for Image Captioning*
Track: Education
Advisor: Mohit Bansal (Computer Science)

Abstract: Most of the image captioning models are trained with maximum likelihood or reinforcement learning with metric scores as rewards. Traditional teacher-forcing models suffered from exposure bias and the lack of supervised data. Reinforced models, on the other hand, use human-crafted metrics scores as the reward function, hence require more human intervention. In this paper, we propose a framework based on Conditional Generative Adversarial Network (CGAN), which jointly trains a a generator that produces captions conditioned on the image, and a discriminator that evaluates the probability of the caption being generated or not. By optimizing the generator via policy gradient, we overcome the bottlenecks of teacher-forcing models. And by approximating the reward function with the discriminator, we avoid using human-crafted metric scores during training. We present a series of experiments to show that our CGAN-based model consistently and significantly outperforms strong baseline trained with maximum likelihood, which is not achieved by previous work that adopted a similar approach.

68. Simran Khadka (Health Environmental Sciences & Engineering), *Prevalence and Risks of Contaminants in Private Well Water*
Track: Environment
Advisor: Jacqueline MacDonald Gibson (Environmental Sciences and Engineering)

Abstract: Private well water quality is not regulated by the Environmental Protection Agency (EPA), and there are approximately 58,000 people in Gaston County and 136,000 people in Wake County who depend on these wells. The study conducted an environmental risk assessment to characterize the health risks of contaminants detected from private wells in Wake and Gaston County. The methods included determining contaminants above the maximum contaminant level (MCL), finding the reference doses or cancer slope factors for each contaminant, and performing a Monte Carlo simulation to quantify the overall risk. The expected annual individual risk of private well water consumption is 7.1×10^{-6}. The contaminants above the primary MCLs in Wake County were arsenic, cadmium, chromium, lead, mercury, selenium, and tetrachloroethylene (PCE). The contaminants above MCLs in Gaston County were arsenic and lead. The study is applicable towards public health interventions on water quality education for well owners and policy-making towards regulating private wells.

70. Amina Khan (Exercise & Sport Science), *Movement Efficiency in Chronic Ankle Instability Patients: Examining the Individual Movement Errors in Fusionetics and the LESS*
Track: Health & Well-Being
Advisor: Erik Wikstrom (Exercise and Sports Science)

Abstract: Chronic ankle instability is a condition that has multiple risk factors but no formal screening tool to measure them. It results as a continuation of untreated lateral ankle sprains and various functional and mechanical changes that ultimately cause instability. The use of functional tasks has been put forward as a means to differentiate movement patterns in individuals with diagnosed CAI. In a clinical setting, the Fusionetics and the LESS are two screening tools that are used to determine movement quality in the upper and lower extremities. Research has been performed to examine the overall scores of each platform to see if there is a significant difference in movers with and without CAI. This study proved inconclusive; however, recent thought has shifted toward breaking down each functional task and looking at the individual errors for trends in each group. The objective of this case control study is to examine the presence and/or absence of individual errors from two screening tools for movement quality, the LESS and Fusionetics, and determine if these errors show trends in movement patterns in those individuals with chronic ankle instability when compared to controls. We hypothesize that the percentages of errors made in the experimental (CAI) group will be higher, indicating poorer movement quality, and more common in both screening platforms when compared to the control group.

72. Padam Kumar (Nutrition), *Perinatal Vitamin D Status Influences Stress Hormone Levels in CC026 Female Mice*
Track: Health & Well-Being
Advisor: Lisa Tarantino (Psychiatry/Genetics)
Graduate Student Contributors: Sarah Schoenrock, Christiann Hill
Faculty/Postdoc Contributors: Joe Farrington, Ken Walsh

Abstract: Vitamin D deficiency (VDD) is a global problem that is linked to adverse outcomes in humans. Human famine studies have found that VDD during the perinatal period leads to an increased risk of neuropsychiatric disorders. These disorders can both stem from, and lead to dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis. A previous study in our lab utilized the Collaborative Cross (CC) mouse panel to analyze the effects of perinatal dietary deficiencies on HPA axis function. In this study, we created F1 reciprocal offspring of these CC lines (called CC-RIX). This study highlighted a specific RIX, CC-RIX 06/26, as a phenotypic outlier for basal corticosterone (CORT) levels. Interestingly, exposure to perinatal VDD normalized this extreme CORT phenotype. In the

present study, we measured basal CORT levels of CC-RIX 06/26 parental strains and found that CC026 exhibits significantly higher basal CORT levels than CC-RIX 06/26. Following this, we measured CORT levels in adult CC026 mice exposed to perinatal VDD. In these mice, we found significant effects of sex, diet, and sex by diet on basal CORT levels. Finally, we examined the effect of vitamin D status in adolescence on CORT levels in adulthood. This experiment found no significant effect of diet on CORT levels. These data provide insight into the biological effects of vitamin D status on stress hormone levels while illustrating the utility of CC026 in future studies of HPA axis function.

74. Jack Lawton (Nutrition), *Characterizing Autophagy Inhibition in Metastatic Triple Negative Breast Cancer: Stress and Starvation*
Track: Health & Well-Being
Advisor: Stephen Hursting (Department of Nutrition, Gillings School of Public Health)
Faculty/Postdoc Contributors: Dr. Ciara O' Flanagan

Abstract: Triple Negative Breast Cancer (TNBC) is highly metastatic and recurrent cancer subtype, but lacks effective non-cytotoxic treatments, consequently generating a need for novel treatment strategies. Autophagy, a self-degradative pathway, has been implicated in supporting cancer progression towards metastasis and has found to be required and utilized more actively as cancer progresses further. In order to characterize autophagy deficient metastatic TNBC in vitro, Atg5, an essential autophagy protein, was knocked out using a CRISPR/Cas 9 construct in a phenotypically metastatic mouse derived TNBC cell line. Experiments using this line assayed cancer invasiveness, energy generation, growth, response to stress (chemotherapeutics and nutrient starvation), and potential mechanisms underlying autophagy inhibition???s wide-reaching effects. Relative to their autophagy competent counterparts, Atg5-/- cells showed altered metabolism, Warburg Effect exacerbation, and inability to induce an antioxidant response (NRF2). Autophagy deficiency resulted in impaired long-term growth and decreased invasiveness, exhibiting reversion of the epithelial to mesenchymal transition (a necessary progression for metastasis). Growth and metabolic effects appeared synergistic with exogenous stress. These findings suggest that autophagy inhibition induces a broad reprogramming that strengthens other treatment effects and highlights potential for targeting autophagy in metastasis.

76. Sterlin Louis (Chemistry), *Reversal Pharmacological Effect of Allopregnanolone on Cocaine*
Track: Health & Well-Being
Advisor: Donita Robinson (Department of Psychiatry Bowles Center for Alcohol Studies)
Faculty/Postdoc Contributors: Giovana Macedo, Alexander Gomez-A, Donita Robinson

Abstract: The modulation of the concentration of dopamine (DA) released from dopaminergic neurons of the ventral tegmental area in the NAc can play a major role in drug addiction. Different drugs affect brain chemistry differently, so understanding how certain drugs work can help us find a better way to treat addiction. Cocaine is a strong stimulant that people often use for recreational purposes. Unlike other classes of drugs that bind to excitatory receptors on dopaminergic neurons and increase the release of dopamine into the synapse, cocaine acts differently. Instead, cocaine binds and blocks the dopamine transporter, whose role is to transport dopamine back into the terminal so it can be reused later[1]. This causes an accumulation of extracellular dopamine, which amplifies the signal to the receiving neurons. Based on the literature, cocaine increases the concentration of DA released in the NAc. Currently there is no drug approved to treat cocaine addiction. Using fast scan cyclic voltammetry (FSCV) in anesthetized rats, the change in the concentration of dopamine induced by cocaine will be monitored and also the effect of another drug called allopregnanolone (Allo) will be under study. Allo is a neurosteroid that can bind to specific GABA receptors[2]. We hypothesize that allo

will reverse the pharmacological effect of cocaine by reducing the concentration of dopamine in the NAc. If our hypothesis is correct then allo, may be a good candidate for the treatment of cocaine addiction.

78. Jeremy Low (Physics & Astronomy), *Silicon Nanowire as Next-generation Diodes*
Track: Environment
Advisor: James Cahoon (Chemistry)
Graduate Student Contributors: Jimmy P Custer

Abstract: High frequency silicon nanowire diodes are being developed in the hopes of creating novel, more efficient solar cells as well as other applications. Silicon nanowires are made into geometric diodes by controlling the geometry of boundaries and exploiting the fact that the mean free path of electrons are comparable to the wire's dimensions. An electron ratcheting effect, essentially a one-directional funneling of electrons, is achieved with a sawtooth geometry, allowing current to flow more easily in one direction versus the other. Sawtooth geometries are defined by three parameters, length, inner diameter, and outer diameter, and all impact the overall resistance, I-V characteristics and frequency dependence. These parameters are controlled through the growth, dopant encoding via a vapor-liquid-solid mechanism, and subsequent etching of the nanowire. With tuning of these parameters a device with desired diode-like properties and frequency response can be developed. To maximize the operating frequency of the diodes we develop devices with a minimized resistance, therefore minimized RC time constant. To maximize the effectiveness of the diodes we maximize their asymmetries, defined as current at a voltage V divided by the current at a voltage -V. Therefore the geometry dependence of both properties are characterized to create diodes effective in high frequency regimes.

80. Alex Martin (Psychology & Neuroscience), *Religious Cognition and Moral Cognition*
Track: Environment
Advisor: Kurt Gray (Psychology & Neuroscience)
Graduate Student Contributors: Joshua Jackson

Abstract: Previous research has shown differences between religious and non-religious people on a number of factors; primarily as it pertains to moral reasoning and behavior. Various studies, for example, look at how religious people tend to be more rule-based in their moral beliefs, making them less likely to justify transgressions like lying regardless of context; non-religious people, on the other hand, tend to be more consequentialist in their moral thinking and therefore look to the outcomes of actions to determine if it was justifiable. Another line of research aims to understand whether religious people behave more morally than non-religious people; religious people are often found to be more prosocial towards others. The current project uses these lines of research to look at how religious and non-religious people view the morality of different transgressions. We ask participants to rate how immoral an action is on a scale of 0-100 (like spanking a child or using a racial slur); following that, we ask them about their religious beliefs and identification (among other measures). Preliminary results suggest that seeing religion as a pre-requisite for morality positively predicts how immoral you rate moral transgressions to be. Further analysis will include a greater focus on religious identity's impact on moral beliefs as well as socialization factors (such as education or income), to control for possible covariates. Implications of this research are also discussed.

82. John Martin (Physics & Astronomy), *Skynet's Suite of Processing Algorithms for Single-Dish Radio Telescopes*

Track: Education
Advisor: Daniel Reichart (Physics and Astronomy)
Undergraduate Co-Authors: Dylan Dutton
Faculty/Postdoc Contributors: Daniel Reichart, PhD

Abstract: Skynet is an international network of over two dozen optical robotic telescopes operated out of the University of North Carolina at Chapel Hill. Having recently acquired privileges to the 20-meter radio telescope located at Green Bank Observatory, our team of programmers have worked to develop Radio Cartographer, a new radio data cleaning and mapping software. Here, we outline its major processing procedures and highlight the heavy influence and use of robust Chavuenet rejection (RCR) as a procedure to statistically identify and remove various forms of radio contaminants. Implementing RCR into Radio Cartographer allows us to consistently extract both accurate and precise flux values from distributions comprised of as high as 85-percent contaminated data. Combining this procedure with weighted modeling and other processing tools, we produce both cleaned and photometrically viable radio images for professional use.

84. Megan Mathes (Exercise & Sport Science), *Comparison of Training Load Between Injured and Uninjured Adolescent Female Soccer Athletes*
Track: Health & Well-Being
Advisor: Darin Padua (Exercise and Sport Science)
Faculty/Postdoc Contributors: Barnett Frank

Abstract: Background: Training load, as measured by rate of perceived exertion (RPE) values, has been repeatedly associated with injury in adult elite athletes. To our knowledge, there is no previous research that has examined the relationship between load exposure and injury in adolescent female athletes, a population at highest risk for injury during sport participation. Purpose: The purpose of this study was to compare training load measures betwteen adolescent female soccer athletes who did and did not sustain a time-loss injury during a soccer season. Methods: A total of 43 female soccer atheltes were recruited to participate from the under-17 (n=22) and under-19 (n=21) teams of a local elite level soccer club. Each day after practice the athletes logged their training duration, type of training, and the session RPE value (0-10) through a customized smartphone application. At the end of the season the athletes completed an electronic survey concerning self-reported injury throughout the season. They were asked whether or not they expereinced a time-loss injury, the location of the injury, and duration of time lost from sport participation due to the injury. Cumulative training load over the season will be calculated and compared between those who do and do not suffer a time-loss injury. We hypothesize that players who sustain a time-loss injury will demonstrate increased cucumulative training load compared to those who do not suffer injury.

86. Parker McDuffie (Biology), *CENP-A Regulators in C. elegans*
Track: Health & Well-Being
Advisor: Paul Maddox (Biology)
Undergraduate Co-Authors: Neil Harwani, Sanjana Rao
Graduate Student Contributors: Lydia Smith

Abstract: C. elegans is a holocentric organism, meaning microtubules attach all along the length of the chromosomes rather than attaching to one central location. They do so by attaching to a kinetochore, which at its foundation is a centromeric protein that is referred to as CENP-A in humans and is often referred to by the same name in C. elegans and for our purposes. CYK-1 and CYK-4 are both proteins primarily involved in the facilitating cytokinesis in mitotic divisions. CENP-A continually increases in

the cell in humans during the G1 phase of mitosis, followed by a sharp increase in MgcRacGAP(CYK-4 in worms) and mDia2(CYK-1) that maintains CENP-A levels. We wanted to see if either of these had an effect on the maintenance dynamics of CENP-A in either or both pronuclei. To do so, we placed nematodes on different RNAi plates to knockdown proteins of interest. CENP-A was tagged with GFP and mCherry was tagged to a histone that showed the relative amounts of chromatin. Worms were then sliced open and embryos were mounted on slides and analyzed with fluorescence microscopy. After characterizing many control embryos, and graphing the levels of CENP-A and overall chromatin as it approached anaphase, and comparing this with CYK-4 and CYK-1 depleted embryos, our data suggests that both CYK-4 and CYK-1 could be maintainers of CENP-A, much like the analogous protein MgcRacGAP and mDia2 in humans.

88. Dhalia Mohamed (Sociology), *Modernity Versus Tradition in Fatima Mernissi's Dreams of Trespass*
Track: Diversity & Equity
Advisor: Claudia Yaghoobi (Asian Studies)
Undergraduate Co-Authors: Stephanie Cales, Michael Myers, Gregory Sanders, Jessica Glass

Abstract: 1940s and 50s Morocco was faced with the difficulties transitioning from colonialism to modernism, which had significant social impacts that were felt even on an individual level. Culturally, the shift to adulthood in this transitioning Morocco was changing. Fatima Mernissi, author of Dreams of Trespass: Tales of a Harem Girlhood, writes her fictive memoir detailing her life in harems during this rather underrepresented time with economic and political consequences. This project examines the multiple layers of impacts these transitions had on women in harems during this historical time. When combined with analysis of the nature of harems, societal structures of gender, cultural concepts of balancing truth and convenience in everyday lives, and the imposition of colonialism, Mernissi's artistic rendering of a new and profound perspective on personal desires of freedom and community become reflected in the clashes of modernity with tradition in Middle Eastern culture when contrasted with the necessity to stay rooted in a rich, historical tradition. While we inspect in parallel the powers imposed on these women through colonial and patriarchal structures, we aim to press deepest upon the gender structures that carry the most significant impact within this novel.

90. Corey Ochs (Romance Languages), *Performance Analysis of National Basketball Association Players after Sustaining a Concussion*
Track: Health & Well-Being
Advisor: Johna Register-Mihalik (Exercise and Sports Science)
Graduate Student Contributors: Melissa Kay

Abstract: Due to the fast-paced and physical nature of basketball, National Basketball Association (NBA) players are susceptible to concussive injuries. Post-concussion performance can indicate whether NBA players are returning to the court as recommended or if there are lingering effects of injury. The purpose of this study was to compare NBA player performance in the 3 games before and after concussion, describing the effect of concussions on performance. Specifically, analyses used the player impact estimate (PIE) and efficiency rating (ER) statistics, which are measures of individual contribution to the game. Publicly available databases were searched for injury reports and player statistics. 53 concussions were found over the past 5 seasons (x =10.6 4.22 per season), 10 of which were removed from analyses due to incomplete data (n=43). The mean number of games missed due to concussion was 3.34 2.95. The data collected show little change in performance post-concussion using both PIE (0.09 0.10 vs. 0.08 0.09) and ER (10.4 8.81 vs. 9.77 8.22). These findings suggest that a player???s contribution to their team does not appear to be affected by concussive injury. This may

indicate proper management of concussion or relatively low levels of contribution per individual regardless of injury status. PIE and ER are overarching statistics for performance; therefore, more research needs to be done to determine whether or not there are nuanced performance deficits not visible using PIE and ER.

92. Megan Ogorchock (Chemistry), *A Kinetic Study of in-situ Derivatization Reactions in the Microdroplet via Nano-Electrospray Ionization Mass Spectrometry*
Track: Health & Well-Being
Advisor: Gary Glish (Chemistry)
Graduate Student Contributors: Tavleen Kochar
Faculty/Postdoc Contributors: Gary Glish

Abstract: Mass spectrometry (MS) is an analytical technique that allows for the identification and quantification of analytes in a sample by measuring the mass-to-charge ratio and abundance of gas-phase ions. Electrospray ionization (ESI) is commonly used for transferring ions from the solution phase to gas phase under ambient conditions with minimal fragmentation and high sensitivity; however, samples that are not readily ionized will not be detected. Derivatization reactions have been integral for chemical analysis of samples by MS that do not readily ionize. Specific derivatization reactions can be utilized to add a permanent charge to the analyte, thus allowing for sensitive detection by MS analysis. An example where this type of reaction is observed involves using Girard's reagents. Girard's Reagent T (GirT) and Girard's Reagent P (GirP) undergo a Schiff-base mechanism with a carbonyl compound and provide the analyte with a permanent, positive charge that increases ionization efficiency for MS analysis. Typically, a derivatization reaction is run for hours at elevated temperatures to get efficient conversion to products. Recently, it has been demonstrated that reactions can be completed on a microsecond timescale by doing the reaction on-line in a microdroplet generated through nano-electrospray ionization (nESI). The goal of this research is to study the kinetics of the derivatization reaction of GirT and GirP with carbonyl compounds in the microdroplets generated by nESI.

94. Jhana Parikh (Psychology & Neuroscience), *The Effect of Transcranial Alternating Current Stimulation on the Stress-Immune Response*
Track: Health & Well-Being
Advisor: Flavio Frohlich (Psychiatry)

Abstract: Stress is evolutionarily important to survival; however, high levels can lead to adverse health outcomes. Stress responses are characterized by the activation of two pathways: the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic division of the autonomic nervous system (ANS). These pathways are regulated via a top-down mechanism, where reflexes in the brain produce physiological changes elsewhere in the body. This research sought to target these mechanisms using 10Hz bifrontal Transcranial Alternating Current Stimulation (tACS) and investigate resulting changes in cortisol (indicator of HPA axis) and alpha amylase and heart rate variability (HRV) (both indicators of ANS). 20 participants underwent 40 minutes of tACS or an active sham condition at two separate sessions in a double-blind, randomized, crossover study design. A set of surveys was administered to assess overall levels of stress and anxiety, and saliva samples and electrocardiogram were collected before and after stimulation. Results demonstrated no effect of tACS on cortisol or HRV; however, stimulation suppressed the increase in alpha amylase that individuals with higher levels of anxiety experienced during the sham condition, indicating possible anxiolytic effects of tACS in individuals prone to anxiety. This research adds to the understanding of the physiological effects of tACS, as well as provides a basis for tACS as a possible treatment for individuals with chronic stress.

96. Ellie Pearson (Biomedical Engineering), *Characterizing the Role of Furin in LPL Trafficking and Secretion*
Track: Health & Well-Being
Advisor: Saskia Neher (Biochemistry)
Graduate Student Contributors: Ben Roberts

Abstract: Lipoprotein Lipase (LPL) is the main enzyme responsible for breaking down fats in the bloodstream. LPL deficiency causes extremely elevated triglyceride levels and an increased risk of cardiovascular events. Research has shown LPL produced by cultured cells is a promising option for protein replacement therapy, but a large portion of the secreted protein is fragmented. A form of LPL with a mutation that protects it from being cleaved by the enzyme Furin was shown to increase the yield of full length protein. Because the trafficking pattern of LPL is still not entirely understood, the purpose of this study was to gain insight into the differences in the trafficking and secretion of wild type compared to the furin-resistant LPL. This project will use confocal microscopy on cells expressing fluorescently labeled LPL and organelles to visualize differences in the trafficking of the two types of LPL. Specifically, it will examine the colocalization of the wild type and furin-resistant LPL in the Golgi apparatus, lysosomes, and the Endoplasmic Reticulum. In addition to showing any differences in the trafficking between the two forms of LPL, we engineered dual-labeled LPL to understand the cellular location in which LPL is cleaved by Furin.

98. Aaron Pietraallo (Physics & Astronomy), *Machine Classification of Active Red Dwarfs in the Search for Habitable Planets*
Track: Environment
Advisor: Nick Law (Physics & Astronomy)
Graduate Student Contributors: Ward Howard

Abstract: Planets within the habitable zone of red dwarf stars are subject to high flux as the sun-like stars are capable of deadly superflares. X-ray and UV flux from stellar flare events can photo-evaporate planetary atmospheres while stellar winds from coronal mass ejections strip off atmospheric ions impacting the planets habitability. Observations of such events are possible with the Evryscope and its 5+ years of high cadence surveys. With its 8000 square-degree field of view and its giga pixel scale array, the Evryscope performs simultaneous and continuous observations of the accessible Southern sky. Within the surveyed field red dwarfs are contaminated by red giants, interfering with characterization of red dwarf activity. Machine learning algorithms provide a way to separate stellar types and examine stellar activity which would otherwise be impossible by eye. An implementation of a random forest classifier(RFC) trained with M-giant data from the LAMOST DR1 catalog and M-dwarf data from a Lepine all sky survey was validated with an accuracy of 98.7%. Similarly, an RFC was used to examine the stellar activity of target stars separating flares from non-flares, with an accuracy ranging from 86% on the most challenging flare candidates up to 96% accurate. The performance of the flare and non-flare classification will be improved through the study and implementation of Convolutional Neural Networks which have shown to be 98.35% accurate.

100. Michaela Pittman (Exercise & Sport Science), *The Use of Alternative Therapies for Increasing Joint Range of Motion*
Track: Health & Well-Being
Advisor: Meredith Petschauer (Exercise & Sports Science)
Graduate Student Contributors: Melissa Kay

Abstract: When living an active lifestyle, injuries often occur making prevention of future/further injury imperative. Therapeutic techniques can be used to help an individual recover as well as prevent future injury upon return to activity. Improving joint range of motion (ROM) is one specific way in which this prevention can be achieved. Stretching protocols are commonly used to increase ROM; however, stretching is typically a self-treatment, without professional assistance, which may lead to ineffective stretching due to improper technique. The use of alternative therapies can offer greater control and precision when administered by clinicians, resulting in a more effective treatment. Therefore, the purpose of this study was to systematically review evidence supporting the effectiveness of alternative therapies on improving ROM within an active population. These alternative therapies include: cupping, dry needling, instrument assisted soft tissue mobilization, and myofascial release techniques. Articles focused on subjects considered to be physically active and reporting an injury or participating in a sport commonly resulting in injury, such as to the neck, hamstrings, and rotator cuff. Results found that when compared to a control group, these alternative therapies displayed significant improvements in joint ROM. Alternative therapies have the ability to improve ROM and should be considered in the treatment of active individuals to prevent future injury upon return to activity.

102. McKinley Pollock (Psychology & Neuroscience), *Inclusivity in the Making (A Look into Inclusivity Amongst Campus Makerspaces)*
Track: Diversity & Equity
Advisor: Viji Sathy (Psychology)
Undergraduate Co-Authors: Neena Khindria, Emilee Kruchten, Elena Preston, Morgan Darrow, Hannah Godat, Anna Tucker, Miranda Foster, Kat Andre, Valeria Infante-Hoyos, Margarita Rodriguez, Bahja Mohamud, Karen Fowler, Maria Cruz, Kayla Foster, Margaret McAllister, Celeste Ricci,
Undergraduate Contributors: (continued Undergraduate Co-Authors): Trinity Johnson, Britanny Alligood, Lauren Casey, Briana Saunders, Kate Scheyer El-Sharkawy, Alex Martin, Taylor Fricano, Reem Ahmed
Graduate Student Contributors: Tate Halverson

Abstract: Our research team had the opportunity to participate in a CURE class at the University of North Carolina at Chapel Hill and develop skills while answering a question for the university. Our research team consisted of 25 undergraduate students, a graduate student, and our professor. As a class, we researched inclusivity of Makerspaces at UNC and determined barriers to using the Makerspaces. We have three Makerspaces on UNC???s campus, where students come to design and create projects with technology such as 3D printers, laser and vinyl cutters, and wood shops. Throughout the research process, we were in 5 groups to divide tasks, which included: survey design, IRB proposal, website design, data analysis, and writing an academic paper. Tools and resources such as Qualtrics, SPSS, Mendeley, and Trello were utilized in order to conduct our research. Our results revealed that the most common barrier for non-users is that they don???t know what to make or they don???t know the Makerspace exists; although, more lowerclassmen knew about it than did upperclassmen, which reveals that it is becoming more well known on campus each year. Furthermore, the most common barrier for users was time constraint. This could be explained by the limited schedule the Makerspaces and students have and the belief that Makerspace projects will take a significant amount of time to complete. These results can be used to make Makerspaces more inclusive on campus by developing ways to overcome the barriers found.

104. Madison Rackear (Chemistry), *Regulation of MicroRNAs by Methylation in Breast Cancer Cell Lines*
Track: Health & Well-Being
Advisor: Scott Hammond (Cell Biology and Physiology)

Abstract: MicroRNAs are small, noncoding RNAs involved in pathways that regulate gene expression. MicroRNAs bind to mRNA targets to induce silencing or degradation, effectively turning off protein synthesis of the target gene. This pathway requires Watson-Crick base pairing between the microRNA and mRNA target species. Here, we investigate whether microRNAs are dynamically regulated by nucleotide base methylation. This is a phenomenon that has been demonstrated in other RNA species and would have dramatic effects on the ability of the microRNA to base pair and act in the mRNA silencing pathway. To study this, we isolated RNA samples from both a human breast cancer cell line and a healthy human epithelial breast cell line. Half of the RNA was treated with a demethylase enzyme while the other half was left untreated and used as a control group. Next-generation sequencing analysis allowed us to match isolated RNAs against a database of known microRNA species and compare relative rates of methylation in known microRNAs in each sample. We provide some of the first evidence that microRNA species in both cell lines are controlled via dynamic nucleotide base methylation.

106. Magdalena Rainey (Nutrition), *Calorie Restriction Alters Expression of Tumor Suppressor p21 in HER2-Overexpressing Breast Cancer*
Track: Health & Well-Being
Advisor: Stephen Hursting (Nutrition)
Graduate Student Contributors: Laura A. Smith
Faculty/Postdoc Contributors: Ciara H. O'Flanagan

Abstract: Among American women, ~25% of diagnosed breast cancers overproduce the growth-promoting tyrosine kinase receptor, HER2. This disease is associated with poorer prognosis and increased risk of recurrence, making identification of new treatment methods crucial. It is well-established that calorie restriction (CR), or chronic dietary energy restriction by ~30%, has significant tumor suppressive effects and has potential to be utilized as an adjunctive therapy. This study investigates the mechanisms by which CR decreases HER2-overexpressing BC progression. To mimic CR in vitro, murine MMTV-neu cells that overexpress HER2 were treated with medias containing reduced serum or glucose, compared to control media. MTT assays demonstrated that serum restricted medias significantly decreased cellular viability ($p<0.05$) compared to control. In MMTV-neu cells treated with serum restricted medias, there was a significant decrease in activity of tumor-suppressor protein p21. Both p21 and phos pho-21 expression was decreased with serum restriction, as well as the proportion of phospho-p21 relative to p21 ($p<0.05$). Phosphorylated p21 is localized to the cytoplasm and allows BC cells to evade apoptosis and proliferate uncontrollably. These results suggest that short-term CR is associated with decreased phosphorylation and cytoplasmic localization of p21, which may be responsible for modulating anti-proliferative activities.

108. Sanjana Rao (Environmental Science), *Spatiotemporal Localization of CYK-4 in C. Elegans*
Track: Health & Well-Being
Advisor: Lydia Smith (Curriculum for Genetics and Molecular Biology)
Undergraduate Contributors: Parker McDuffie, Neil Harwani, Cole Barnhardt, Ethan Hughes
Graduate Student Contributors: Lydia Smith
Faculty/Postdoc Contributors: Paul S. Maddox

Abstract: CYK-4 is a gene found in C. elegans that is required in the process of the formation of spindles and in cytokinesis. In cells with a mutated CYK-4 gene, embryos fail to complete cytokinesis. CYK-4 is a homologue of the human protein, MgcRacGAP, which is known to have an unrelated role regulating centromere maintenance. Specifically, it regulates CENP-A, which is a mitotic protein that establishes the centromere. Here we report the spatiotemporal localization on chromatin of CYK-4

relative to CENP-A, confirming this relationship is maintained in worms. In order to understand the temporal localization of CYK-4, we measured time-lapse images of early embryos with CYK-4 tagged with GFP and H2B tagged with mCherry. To understand its spatial localization, we performed line scans on the composite images of these embryos and analyzed the intensity of the CYK-4 signal compared to the chromatin signal. This allowed us to specify the spatial and temporal dynamics of CYK-4. Using these methods of analysis, we found that CYK-4 is shown to have a similar spatiotemporal localization as MgcRacGAP in humans, but shifted to a different part of the cell cycle in C. elegans. Additionally, its location on chromosomes is consistent with that of CENP-A, showing that it could interact with it and furthering the relationship between CENP-A and CYK-4.

110. Carolyn Reuland (Biology), *Synergistic Relationship Between Alpha-synuclein, Plasminogen Activator Inhibitor-1, and Neuroinflammation in Parkinson's Disease*
Track: Health & Well-Being
Advisor: Frank Church (Pathology (UNC School of Medicine))

Abstract: Parkinson's disease (PD) is a progressive neurodegenerative disorder that originates from the loss of dopamine-producing neurons in the substantia nigra region of the brain. The etiology of PD is still evolving; however, there is substantial evidence supporting detrimental effects of neuroinflammation, environmental toxins, numerous genetic factors, oxidative stress, innate and possibly adaptive immune systems, and advanced aging. Alpha synuclein (-syn) is the protein found to aggregate and form Lewy Body inclusions in the brains of PD patients, contributing to neuronal cell death. Plasmin, a serine protease, has been shown to cleave extracellular -syn (monomeric, oligomeric, and fibrillar forms), resulting in less aggregation and Lewy Body formation. The activation of plasmin is inhibited by PAI-1. PAI-1 expression is increased in inflammatory environments and in the presence of extracellular alpha synuclein aggregates. This suggests a pathological amplification loop: increased extracellular -syn aggregation activates microglia and astrocytes, increasing neuroinflammation and PAI-1 levels and decreasing plasmin levels. With reduced generation of plasmin, less -syn can be cleaved, and aggregation continues, sustaining the pathological process. Understanding this process could provide insight into the means by which neurodegeneration progresses in PD, and may offer possible therapeutic strategies to reduce disease progression.

112. Laura Roberson (Geography), *Condoms on Campus: A Geography-Based Approach to Sexual Health Resources on a College Campus*
Track: Health & Well-Being
Advisor: Sara Smith (Geography)

Abstract: This research uses a geography-based approach to examine how college undergraduates at UNC-Chapel obtain contraception and sexual health information. Undergraduate students completed online surveys to gather information on where students see contraceptive resources; interviews with relevant UNC-CH professionals provided prospective on how resource placements are chosen. We discuss the existing strengths and areas of improvement at UNC, placing the focus on the role of the institution to provide care for students.

114. Martina Savage (Biology), *Gene Expression in the Glycerol Pathway of Ruegeria Pomeroyi*
Track: Environment
Advisor: Scott Gifford (Marine Sciences)

Abstract: The ocean influences the flux of mass and energy on earth, including cycling and storing substantial amounts of carbon. Microbes have a key role in these ocean processes, and therefore

understanding their activities is central to understanding the ocean carbon cycle. My research focuses on how Ruegeria pomeroyi, a member of the Roseobacter clade that constitutes 20% of all oceanic bacteria, responds transcriptionally to one component of DOC, glycerol. Using BioCyc, KEGG, and IMG, I first identified the eight genes (farthest to closest to the TCA cycle: glpV, glpK, glpD, tpiA, gap-1, pgk, SPO0552, eno) in the R. pomeroyi genome involved with the glycerol metabolic pathway, and then examined if those genes are upregulated in the presence of glycerol. The goal was to identify which genes would be good transcriptional markers of glycerol presence in the environment. I hypothesized that the closer to the TCA cycle a gene in the glycerol pathway is, the less transcriptionally specific to glycerol it should be and therefore a poorer bio-indicator. To test this hypothesis, R. pomeroyi was first grown in glycerol, glucose, and combined glycerol/glucose treatments. The RNA was isolated, and Reverse Transcription (RT) PCR was used to qualitatively examine the degree of gene expression. The transcriptional specificity did decrease going inwards toward the TCA cycle, meaning that the best bio-indicators of glycerol are the genes the farthest from the TCA cycle.

116. Rachel Schomp (Computer Science), *Behavioral Biometric Security: Brainwave Authentication Methods*
Track: Health & Well-Being
Advisor: Mike Reiter (Computer Science)

Abstract: Technology continues to permeate our daily lives, and with this expansion comes increasing cyber security concerns. Simple PINs and passwords are no longer enough to limit use to only the intended user; more complex means of authentication are required, and the way this can be accomplished is through behavior based biometric security. This research project investigates the possibility of creating an authentication system based on the measurements of one of the most complex entities, the human brain. With approximately 100 billion neurons, each brain is identifiably unique in the way it reacts to and processes incoming information. It is this characteristic that can turn brainwaves into an authentication metric. Although similar to other biometric measurements such as fingerprints and iris scans, brainwaves have the distinct quality of being behavior based and able to be measured on a continual basis. This reveals the possibility of creating a continuous authentication system, which would provide a constant connection between an authorized user and the system, instead of only checking the identity at the beginning of the session. Discussed throughout this project will be an evaluation of the feasibility of brainwave authentication based on brain anatomy and behavior characteristics, conventional vs. dynamic authentication methods, biometric security concerns, and continuous authentication with machine learning models.

118. Matthew Seong (Psychology & Neuroscience), *Directional fMRI Connectivity Reveals Differences in Voluntary and Reflexive Attention*
Track: Health & Well-Being
Advisor: Joseph Hopfinger (Psychology and Neuroscience)
Graduate Student Contributors: Jake Bowling

Abstract: Endogenous (voluntary) attention is a top-down, effortful process while exogenous (reflexive) attention is triggered by a bottom-up capture to a salient stimulus. Previous fMRI results suggest that activation is similar in the dorsal frontoparietal network for both attention types, while single-unit recordings in macaques suggest temporal differences in activity between these attention types. In the current fMRI study, 20 healthy college students completed 3 different tasks that engaged either endogenous or exogenous attention or a combination of both. Dynamic Causal Modeling is a method that analyzes directed connectivity between brain regions of interest. Here, we identified 4

regions in the dorsal frontoparietal network: the bilateral frontal eye fields (FEF) and intraparietal sulci (IPS). After defining 9 competing models of connectivity differing in intrinsic connections for each condition, a Bayesian model selection function determined the best model. Different models were supported for endogenous and exogenous attention, supporting previous single-unit work. As a further advance, we found asymmetry across the hemispheres. In the left hemisphere, exogenous attention had unidirectional connectivity from the IPS to the FEF, while endogenous attention had bidirectional connectivity. In the right, connectivity did not differ across conditions. These results thus provide new evidence for the neural processes underlying voluntary and reflexive attention.

120. Dhruv Shankar (Biomedical Engineering), *Portable Apheresis Machine for Cheap & Rapid Generation of Convalescent Serum in West Africa*
Track: Health & Well-Being
Advisor: Sam Lai (UNC Eshelman School of Pharmacy)
Faculty/Postdoc Contributors: Glenn Walters, PhD

Abstract: The 2013-2016 Ebola virus outbreak in West Africa affected over 28,000 patients and claimed at least 11,000 lives. In the absence of an effective cure or vaccine, public health officials resorted to alternative strategies to treat patients infected with Ebola, such as convalescent plasma therapy (CPT). CPT involves the collection of plasma from convalescent Ebola patients with an apheresis machine. However, most apheresis devices on the market are too expensive and bulky for use in rural, impoverished areas and thus CPT was not widely utilized during the outbreak. We proposed to develop a low-cost, portable apheresis device for collecting convalescent plasma in areas with limited health infrastructure. We designed a filtration system for separating plasma from whole blood using a hollow-fiber filter instead of a centrifuge, which reduced the cost and size of the device. Three different filter designs were tested for integrity and performance at operating conditions similar to those of existing apheresis devices. Hemoglobin and ELISA assays were designed in order to test the collected plasma for hemolysis and determine its antibody content. The initial results demonstrated that all three filter designs were susceptible to rupture under normal operating conditions. Our future work will focus on implementing a new fabrication method to create more resilient apheresis filters.

122. Hristo Shimerov (Biology), *Evidence That the Cell Cycle is a Series of Uncoupled, Memoryless Phases*
Track: Health & Well-Being
Advisor: Jeremy Purvis (Genetics)
Undergraduate Contributors: Randy I. Fakhreddin
Graduate Student Contributors: Hui Xiao Chao, Jeremy E. Purvis, Rashmi J. Kumar, Gaorav P. Gupta

Abstract: The cell cycle is a series of irreversible phases of DNA replication (synthesis, or S phase) and division (mitosis, or M phase) separated by gap phases of preparation and growth (G1 and G2 phases). Various models have been proposed to describe the durations of cell cycle phases including a two-state model with a fixed S-G2-M duration and a random G1 length[1,2]; a "stretched" model in which phase durations are proportional[3]; and an inheritance model in which sister cells show similarity in phase durations[2,4]. A fundamental challenge is to understand the quantitative laws that govern cell-cycle phase durations and to reconcile the evidence supporting these different models. Here, we used time-lapse fluorescence microscopy to quantify the durations of G1, S, G2, and M phases for thousands of individual cells from three human cells lines. In the absence of external stress, we found no significant correlation between any pair of phase durations. Instead, each phase followed an Erlang distribution with a characteristic progression rate and number of steps, supporting a model in which

progress through each phase is memoryless with respect to previous phase durations. We challenged this model by perturbing the durations of specific phases through DNA damage, oncogene activation, inhibition of DNA synthesis, and reduced temperature. Though individual phase durations were altered, phase durations remained uncoupled in individual cells.

124. Divya Srinivas (Biology), *The Effect of APOE Isoforms on Myelination Levels Using the Cuprizone Model*
Track: Health & Well-Being
Advisor: Glenn Matsushima (UNC Neuroscience Center)
Faculty/Postdoc Contributors: Akhil Patel, Nagendran Muthusamy

Abstract: Multiple Sclerosis is a neurodegenerative disease with relapsing-remitting stage as the primary form that is marked by cycles of demyelination and remyelination. As part of the remyelination process, cholesterol is partly recycled from the degraded myelin during demyelination and then incorporated into newly formed myelin. This remyelination could be facilitated by APOE, a lipoprotein involved in cholesterol transport among different cell types. APOE is found in three different human isoforms with APOE3 as the most common isoform. We hypothesize that APOE recycles cholesterol to oligodendrocyte precursor cells (OPC???s). Here, we examined the functional consequences of mouse APOE and the three human APOE2, APOE3, and APOE4 during Cuprizone-induced demyelination and remyelination. Brain sections from mice with the human APOE isoforms knocked in and exposed to Cuprizone were stained for remyelination. Furthermore, an in vitro study showed the APOE protein was expressed in activated macrophages that had ingested myelin. We concluded that the APOE3 lipoprotein resulted in significantly decreased remyelination levels when compared with C57BL/6J wild type mice and APOE4 subjects.

126. Shannon Sweeney (Psychology & Neuroscience), *Cerebellar Volumes in School Age Boys with Autism Spectrum Disorder and Fragile X Syndrome*
Track: Health & Well-Being
Advisor: Heather Hazlett (Psychiatry - UNC School of Medicine)
Faculty/Postdoc Contributors: Heather Hazlett, PhD; Joseph Piven, MD; Jessica Cohen, PhD; Rachel Gimpel-Smith; Sun Hyung Kim, PhD; Martin Styner, PhD

Abstract: Background: ASD is a neurodevelopmental disorder characterized by social deficits, stereotyped and repetitive behaviors, and communication deficits while FXS is an X-linked genetic disorder that results from expansions of a CGG repeat near the promoter region of FMR1. The study at hand compares ASD and FXS using cerebellar structural data and behavioral data to determine cerebellar volumetric affects on behavioral outcomes. Methods: This study includes 70 males with ASD, FXS, and typical development between the ages of 4-12 years. Measures of development, behavior, and adaptive functioning were examined. All subjects were scanned on 3 Tesla Siemens Magnetom Tim Trio scanners. The Diedrichsen SUIT toolbox was used as a probabilistic atlas in a semi-automated segmentation procedure to calculate grey matter volumes in cerebellar anterior and posterior lobes. Results: The FXS group was observed to have a larger adjusted mean anterior lobe volume than the TYP group, but no significant differences were found between groups for cerebellar volumes. The FXS group scored significantly lower than the TYP group on the Motor Skills Domain of the Vineland Adaptive Behavior Scale ($p<0.001$). Exploratory analyses indicate that increased grey matter volumes in the anterior lobe of the cerebellum are trending toward a significant relationship ($p=0.066$) with Motor Skills Domain standard score on the Vineland when controlling for age, cognitive ability, and total cerebrum volume.

128. Divya Venkatasubramanian (Biology), *CRISPR-Cas9-mediated Disruption of Genes That Regulate Levels of 1-aminocyclopropane-1-carboxylic acid (ACC) to Study the Role of ACC Signaling in Plants*
Track: Environment
Advisor: Joseph Kieber (Biology)
Faculty/Postdoc Contributors: Joanna Polko

Abstract: Ethylene is a plant hormone that regulates many aspects of plant growth and development, including germination, nodulation, leaf and flower senescence, and response to biotic and abiotic stresses. Previous studies have implicated 1-aminocyclopropane-1-carboxylic acid (ACC), an ethylene precursor, as a hypothetical signaling molecule in a novel pathway regulating cellulose synthesis in Arabidopsis thaliana. Using CRISPR-Cas9, we aim to disrupt eight ACC synthase (ACS) and five ACC oxidase (ACO) genes, which are involved in ACC and ethylene biosynthesis respectively. We have successfully used the CRISPR-Cas9-mediated gene editing to disrupt all of the ACS and ACO genes in separate lines. The current goal of the project to create higher-order mutant lines that carry mutations in all ACS and ACO genes. We will use the obtained mutant lines to study the effect of high and low levels of ACC on cell wall perturbations. This will allow us to determine potential downstream effectors of ACC and shed light on its non-canonical role.

130. Morgan Vickers (American Studies), A Community Divided: Relationally Reconstructing the Lynching of Eugene Daniel
Track: Diversity & Equity
Advisor: Seth Kotch (American Studies)

Abstract: Lynching in America is often defined by statistics, trends, and characterizations of the mobs involved in the murder of an accused individual. But, few have studied the lives and the communities of the victims of the lynchings, and even fewer have sought to digitally recreate the circumstances in which the lynchings took place. As a result, the memory of a lynching is often defined by purported criminality, angry mobs, and an eventual death of the accused, rather than by the conditions that precipitated the lynching, the life lost during the murder, and the community condition thereafter. In this thesis, I introduce the notion of personhood in lynching victims through the case study of a single victim: Eugene Daniel from New Hope Township, North Carolina, who was murdered just six days after his sixteenth birthday in 1921. Using digital tools to reproduce a model of community relations in small towns, one can uncover what happened to relationships between local families over time, particularly the families involved in and affected by the lynchings. This thesis thus argues that one cannot separate people from the context in which they live; acts of racial violence, like lynchings, neither exist in a vacuum nor solely affect the murdered individual. I further argue that digital tools allow historians to gain a better understanding of the circumstances that perpetuated lynchings, the communities in which lynchings occurred, and the implications of historic acts of violence.

132. Walter Vozzo (History), *The Road to Jerusalem: Lessons for Daily Living from Brother Felix Fabri*
Track: Education
Advisor: Brett Whalen (History)

Abstract: My research field is pilgrimage accounts as travel writing in the late 15th century. I will draw from the The Wanderings of Brother Felix Fabri, an English translation of the pilgrimage accounts of Felix Fabri, the Dominican monk from Ulm, Germany. When Felix Fabri wrote his accounts from a first trip to Jerusalem in 1480, and his second trip in 1483-84, when he traveled further

to Mt. Sinai in Egypt. The printing press was introduced in Europe in the late 15th century, aiding the circulation of available texts. I argue that the details that Felix Fabri provides in the more mundane elements of his travel to Jerusalem provide a model for life as a Christian. I think it is worthwhile to expand on these, as I have not found any other scholar who has. And I think it will be especially interesting noting the contrast of these in his writing before arriving in the Holy Land, to after, for Fabri's tone not surprisingly shifts to a more serious one in and around Jerusalem.

134. Xingzhi Wang (Chemistry), *Next Generation Nitric Oxide-Releasing Polyurethane Membranes for Implantable Glucose Biosensors*
Track: Health & Well-Being
Advisor: Mark Schoenfisch (Department of Chemistry)
Graduate Student Contributors: Maggie Malone-Povolny, Lei Yang, Sara Elizabeth Maloney

Abstract: Continuous blood glucose monitoring using implantable glucose biosensors is an essential tool for diabetes management. Current commercially available glucose sensors tend to experience a rapid decrease in performance within a week of their implantation due to host-mounted foreign body response, limiting their overall clinical utility. Nitric oxide (NO), an endogenously produced signaling molecule, plays an important role in the regulation of wound healing and the inflammatory response. Previous studies have shown that polyurethane glucose sensor membranes doped with macromolecular NO-releasing vehicles mitigate foreign body response via the spontaneous NO release, thus enhancing sensor performance and in vivo use lifetime. However, leaching of the NO donor vehicle remains a potential problem with these membranes, with potential toxicity concerns. We have begun to investigate next generation macromolecular NO-releasing scaffolds, including hyperbranched polyesters and polyurethanes, and biopolymer systems for use in sensor membranes with adequate biocompatibility, potential biodegradability, and tunable NO-release properties. Herein, we describe the fabrication of polyurethane glucose sensor membranes doped with these novel NO-releasing systems. The NO-release characteristics of these membranes are assessed as a function of membrane hydrophobicity and scaffold concentration to determine their potential for use in implantable glucose sensor membranes.

136. Nicholas Witham (Biomedical Engineering), *Functional Actuation of Mandrel Formed Twisted Coiled Polymer (TCP) Muscles in Organic Temperature Ranges*
Track: Health & Well-Being
Advisor: Kenneth Donnelly (Biomedical Engineering)
Undergraduate Contributors: Bryan Labra

Abstract: Mandrel formed TCP muscles are an existing, but under researched form of thermally actuated artificial muscles, which are made by coiling a highly twisted monofilament plastics such as Nylon 6/6 (sewing thread) helically. An increase in temperature causes the fiber to shrink axially and expand radially. The radial expansion causes fiber untwisting, which compounds in a much larger tensile actuation (TA) and tensile stress (TS). To cause expansions, TCP muscles can also be coiled in the opposite direction of their fiber twist. These heterochiral fibers can be used to counteract length changes of the homochiral muscles caused by ambient temperature changes. Currently, the maximum contraction of 49% for mandrel formed TCP muscles has taken place at a 5.1 spring index and has achieved a 1 MPa stress over a 70K temperature range (25 degrees C to 95 degrees C). Human muscle have an average TS of 0.35 MPa and TA greater than 40%. To make viable TCP muscles to be comparable with human muscle, which have an average TS of 0.35 MPa and TA greater than 40% that actuate over body temperature range of (33.2??C to 38.2??C) the contraction must be improved by 1143% and the stress can be reduced by 65%. The main goal of this study was to conduct an isometric

test where the muscles are heated from 33.2??C to 38.2??C and contract while tensioned by a 1.75g (most likely 2g) weight to determine if the muscle made from 0.25mm diameter monofilament can contract 40% its length while exerting a stress of 0.35 Mpa.

138. Kristin Weiss (Biology), *Detection and Quantification of Vibrio cholerae in Water Using the Compartment Bag Test*
Track: Health & Well-Being
Advisor: Mark Sobsey (Department of Environmental Sciences and Engineering)
Graduate Student Contributors: Megan Lott
Faculty/Postdoc Contributors: Dr. Mark Sobsey

Abstract: Cholera is an acute diarrheal disease caused by the bacterium Vibrio cholerae that, if left untreated, can be fatal. Cholera is endemic to many areas of the world, especially in areas that lack infrastructure to provide clean drinking water. Effective disease control depends on timely detection of V. cholerae in drinking water. Currently available detection methods for V. cholerae are rarely applied to surveillance of drinking water because they require electricity, specialized equipment, and advanced training that are rarely available in the developing world. The aim was to develop a V. cholerae-specific broth culture medium that could be used with an existing field test method, the adapted Compartment Bag Test (CBT). The quantification of V. cholerae concentration was compared in a CBT to the quantification of V. cholerae concentration in a Multiple Tube Test (MTT) for three strains of V. cholerae: O1, El Tor Ogawa (ATCC BAA-2163), O139 (ATCC 9-51395), and Non-O1 (ATCC 35971). The sample matrix used was deionized water with Tellurite Taurocholate Gelatin Broth (TTGB) medium. The difference in quantification by these two methods was not statistically significant. Thus, the CBT is as effective as the MTT to quantify concentrations of V. cholerae for all three strains. For future studies, the sample matrix should be modified and experiments should be done in a more realistic matrix such as a comparison between test water and local surface water.

140. Lindsey Wells (Biomedical Engineering), *Application of Nanodroplets to Enhance Chromatin Fragmentation and Endospore Rupture*
Track: Health & Well-Being
Advisor: Paul Dayton (Biomedical Engineering)
Undergraduate Co-Authors: Chelsey King
Graduate Student Contributors: Sunny Kasoji
Faculty/Postdoc Contributors: Austin Quimby, Dr. Virginia Papadopoulou, Gabrielle Grandchamp, Dr. Rachel Bleich, Dr. Samantha Pattenden

Abstract: We hypothesize that the nanodroplet reagent can improve chromatin fragmentation in yeast cells and increase efficiency of bacterial spore rupture. For this study, yeast cells and spore-forming bacteria were chosen as model systems. Yeast cells contain chromosomes and similar cellular pathways to human cells, which make them a common organism for drug screening. Current methods of DNA fragmentation in hard to sonicate cells require treatment prior to sonication to destroy the tough cell membrane, and the aim of this project is to reduce the need for the additional treatment. Anthrax is a particular spore-forming bacterium of significance, and there is substantial interest in developing a detection kit for the disease based on PCR. This kit would require quick isolation of DNA from anthrax spores to detect if a biomarker is present that identifies the pathogen. The methods in this project utilize B. subtilis, a type of nonpathogenic spore-forming bacteria typically used as a model for anthrax. It was determined that in the presence of traditional ultrasound the nanodroplet reagent fragmented chromatin in yeast more efficiently than without the reagent. However, there was no significant difference in the amount of spores ruptured using ultrasound with the nanodroplet reagent added versus without.

142. Teddy Wong (Chemistry), *Photochemical Hydrogen Evolution from Ruthenium Hydrides*
Track: Environment
Advisor: Alexander Miller (Chemistry)
Graduate Student Contributors: Kate L. Pitman

Abstract: Visible light-triggered hydrogen evolution from [(Arene)Ru(bpy)(H)]+ (bpy is 2,2-bipyridine) systems is reported. Our lab recently reported an iridium molecular photoelectrocatalyst capable of H2 evolution with visible light at mild overpotentials in neutral water. Aiming to expand the scope of molecular photoelectrocatalysis, we prepared analogous ruthenium complexes and demonstrated new photochemical reactivity for H2 release. Understanding the chemical mechanism and electrochemical properties will motivate future design of molecular photoswitchable hydride catalysts.

144. Zeyun Xue (Biostatistics), *Investigating the Structure and Functional Role of the C-Terminal Domain of the Drosophila XMAP215 Protein Family Member Minispindles*
Track: Health & Well-Being
Advisor: Kevin Slep (Biology)
Undergraduate Co-Authors: Brian F. Saway
Graduate Student Contributors: Rebecca C. Adikes

Abstract: Microtubules (MTs) are cytoskeletal polymers responsible for multiple cytoplasmic activities. A group of highly conserved MT-associated proteins (MAPs), the XMAP215 family, promote MT growth by specifically localizing to the MT plus end. XMAP215 family members promote MT polymerization via TOG (tumor over expressed gene) domains that bind to tubulin heterodimers. We hypothesize that the structural elements of the conserved CTD of XMAP215 family proteins are responsible for regulating MT dynamics by properly localizing the full-length molecule to MT plus ends during mitosis and interphase. Here, we show that the CTD, in particular the CTD predicted TOG domain, of the Drosophila XMAP215 family member, Msps, is required to properly localize Msps in Drosophila S2 cells. Using secondary structure predictions and multiple sequence alignment analysis of the TOG domain we identified conserved predicted surface exposed charged residues. We systematically mutated these residues and determined that particular small sets of residues (2-3 amino acids) within this region are required to localize Msps to MT plus ends and rescue MT growth rates. In addition, previous studies have shown that depletion of Sentin, a plus-end tracking protein, severely reduces plus-end accumulation of XMAP215 in S2 cells. Thus, we hypothesize that the CTD TOG domain interacts with Sentin. We are currently performing knocksideways assays to discern the shortest Sentin piece that interacts with the CTD.

146. Anthony Yang (Computer Science), *Sex Work in Nawal El Saadawi's Woman at Point Zero*
Track: Diversity & Equity
Advisor: Claudia Yaghoobi (Department of Asian Studies)
Undergraduate Co-Authors: Anahata Batchu, Lilika Okita, Kayla Woodley

Abstract: This project explores sex work industry in Egypt as presented in Nawal El Saadawi's Woman at Point Zero. We examine various forms of oppressions and empowerment that the participants of sex work industry experience. The fundamental goal is to educate our audience on the social status of sex workers in Egypt, how individuals enter sex work industry, and how the industry operates politically and socially. Through the perspective of Firdaus, the protagonist, we witness the struggles of a woman to live a dignified life in a society in which women have limited options. Nawal

El Saadawi exposes the subjugation of women in Egyptian society by enforcing a taboo against sex workers. The taboo prevents the public from understanding the dynamics and intricacies of the industry. This project hopes to bring the issue to light and explore a deeper meaning of this issue. One of the ways is by understanding the oppression and power dynamic that exists both within and outside of sex work industry. The public may regard a sex worker with a condescending attitude; however, El-Saadawi exhibits the ways that a sex worker may also experience power and exercise control over their own bodies and over their customers. Firdaus finds economic security in her newfound profession, but there is oppression folding in from all sides including from her male and female pimps.

148. Kou Yang (Exercise & Sport Science), *Test-retest Reliability of a Coincidence Anticipation Timing Assessment: Implications for Concussion Management*
Track: Health & Well-Being
Advisor: Johna Register-Mihalik (Exercise Sports Science)

Graduate Student Contributors: Christina B. Vander Vegt, Nikki Barczak

Abstract: Reaction time is an essential component of the concussion assessment battery; however, the anticipatory aspect of this measure is not currently examined clinically. Coincidence anticipation timing (CAT) as assessed by the Senaptec Synchrony may provide important information with respect to concussion injury risk, diagnosis, and post-injury management strategies. PURPOSE: To determine the test-retest reliability of the Senaptec Synchrony CAT assessment in a single laboratory session. METHODS: Physically active individuals (N=43; age=20.95 +/- 0.99 years) completed two identical CAT testing sessions-one hour apart-consisting of two trials in both a seated and standing position. Average timing error in milliseconds for each trial was used for analysis, where negative values indicated an early response and positive values, a late response. Interclass correlation coefficients (ICC) were calculated between the average timing error of each testing session for each position to estimate test-retest reliability. RESULTS: The reliability coefficient for the seated test was 0.801 ($F_{(38,38)}=5.018$, $p<0.05$) and 0.905 ($F_{(38,38)}=10.559$, $p<0.05$) for standing. CONCLUSIONS: These preliminary results suggest that Senaptec Synchrony has moderate to high reliability for seated and standing assessments of coincidence anticipation timing. This test may provide reliable information regarding anticipatory reaction time and may be worthy of inclusion in the concussion assessment battery.

150. Hailey (Han Bit) Yoon (Computer Science), *Auto EACSF (extra-axial cerebrospinal fluid)*
Track: Health & Well-Being
Advisor: Martin Styner (Departments of Psychiatry and Computer Science)

Abstract: My research goal is to develop an interactive software tool for automatic computation of brain extra-axial cerebrospinal fluid (EACSF) from Magnetic Resonance Imaging (MRI) scans. Specifically, the tool attempts to extract EACSF from T1 weighted (or/and T2 weighted) MRI scans. The success of this research, developing Auto-EACSF, will further verify and confirm the relation between the amount of EACSF and Autism Spectrum Disorder (ASD). In addition, Auto-EACSF will benefit ASD patients by providing early diagnosis.

152. Liwen Zhou (Biology), *Pyk2 Regulates Phagocytosis and Suppresses Remyelination*
Track: Health & Well-Being
Advisor: Glenn Matsushima (neuroscience center, Department of Microbiology and Immunology, Intergrative Program Biologocal & Genome Sciences)
Faculty/Postdoc Contributors: Nathan Ahlgrim, Laura Herring, Akhil Patel

Abstract: Multiple sclerosis is characterized by lesions consisting of dying mature oligodendrocytes, inflammatory response by immune cells, and subsequent demyelination of axons. The role of macrophage and microglia are only partly known. Our lab has been studying Mertk, a macrophage tyrosine kinase receptor prominently known for recognizing apoptotic cells and sufficient for starting phagocytosis. Previous unpublished data from our lab suggests Mertk activation leads to phosphorylation of Pyk2 (also known as PTK2B or FAK2), a proline-rich tyrosine kinase that has been previously reported for macrophage migration; therefore, we hypothesize that Pyk2 acts downstream of the Mertk receptor as an important mediator of the phagocytosis and signal transduction pathway in macrophage activation. In addition, our in vivo data suggests the initial level of remyelination in pyk2-/- mice is significantly higher than that in WT mice during initial remyelination. This suggests that the removal of Pyk2 promotes remyelination, potentially making Pyk2 a candidate for therapeutic target.

154. Xueqi Zhu (Biology), *A Unique Population of Neurons Within the Extended Amygdala Encodes Anxiety States*
Track: Health & Well-Being
Advisor: Garret Stuber (Psychiatry, Cell Biology & Physiology)
Faculty/Postdoc Contributors: Jose Rodriguez-Romaguera, Randall L Ung, Hiroshi Nomura, Pengcheng Zhou, Oksana Kosyk, Liam Paninski, Thomas L. Kash, Michael R. Bruchas, and Garret D Stuber

Abstract: Anxiety disorders are characterized by elevated anxiety states. Neural circuits implicated in pathological anxiety involve multiple brain regions. The bed nucleus of the stria terminalis (BNST), also known as the extended amygdala, has emerged as a hub in networks that regulate anxiety. The BNST is a functionally heterogenous region involved in many other motivated behavioral states. We must study distinct neuronal populations to disentangle the role of the BNST in motivational states. To do so, we used a transgenic mouse line to target a subset of BNST neurons that uniquely express prepronociceptin (Pnoc). We developed an assay to present olfactory stimuli to head-fixed mice while simultaneously measuring pupil diameter with a camera, locomotion on a running disk, and calcium activity of PnocBNST neurons with 2-photon imaging. In the presence of anxiogenic synthetic predator odor 2,4,5-trimethylthiazoline (TMT), we observed increases in PnocBNST neuron activity, pupil diameter and locomotion. Furthermore, we used optogenetic tools to activate PnocBNST neurons while simultaneously measuring pupil diameter, heart rate, body movement, and reward-seeking behavior. This activation led to increases in pupil diameter and heart rate. Taken together, these findings suggest that PnocBNST neurons are involved in driving autonomic responses characteristic of anxiety-like behavior. Thus, PnocBNST neurons could be a target for pharmacological intervention to reduce pathological anxiety.