Student Name: Raisa Amin

Booth #: 1

Research Mentor: Janice Kiecolt-Glaser

Project Title: Breast Cancer Survivor's Depression and Heart Rate Variability: Risks for Heightened Pain Sensitivity

Abstract: Previous research has indicated that 25-60% of breast cancer survivors experience pain, regardless of their cancer treatment and cancer stage. The consequences of chronic pain include increased risk of mortality, impairment of sleep and memory, unemployment, and lower quality of life. Breast cancer survivors are four times more likely to have depression compared to healthy populations. While the link between pain and negative mood is well documented, the current study aims to fill the gap in the literature by investigating the effects of depression and low-heart rate variability (HRV) on pain sensitivity in survivors. HRV is the beat-to-beat variability of the heart, a good index of oneâ€™s ability to regulate emotion in the face of a challenge, such as pain. It was predicted that female survivors who are diagnosed with depression who exhibit lower HRV will be more pain sensitive than those who are not diagnosed with depression and have higher HRV. In the ongoing parent study, survivors stages I-IIIA (N=75) provided data on depression, HRV, and pain. Pain data were collected through questionnaires and a temperature based pain task; HRV data were collected through a heart rate monitor; and depression data were acquired through clinical interviews with the survivors. In our sample, 29.9% of the survivors had a diagnosis for MDD. Preliminary analysis showed that, pain sensitivity in the survivors is not significantly associated with MDD or lower HRV, or the interaction between MDD and low-HRV (ps>0.237) controlling for age, cancer stage, and treatment history. Data from self-report questionnaires suggests a marginal yet non-significant correlation between depressed mood and pain (r= 0.254, p= 0.052) in line with previous literature. A better understanding of the association between depression, HRV and pain sensitivity might ultimately help identify which survivors are at a higher risk for experiencing chronic pain and its consequences.

Student Name: Prativa Amom

Booth #: 2

Research Mentor: Anna Dobritsa

Project Title: A forward genetic screen in Arabidopsis identifies several new genes involved in formation of distinct cellular domains on pollen surface

Abstract: Exine is placed precisely in species-specific patterns around a pollen grain to protect it and facilitate reproduction by pollen recognition. In Arabidopsis thaliana pollen, exine is deposited in a reticulate pattern defined by three longitudinal gaps called apertures. Apertures allow pollen to control its moisture content and promote eruption of the pollen tubule during fertilization. The precision with which apertures develop and the fact that their patterns are diverse across species make apertures a powerful model for studying systems of extracellular deposition. Previously, only one gene, INP1, had been known to influence pollen aperture formation in Arabidopsis. In order to identify other important genes in this process an ethyl methanesulfonate screen was performed. Five complementation groups defective in aperture formation have been found and positional cloning isolated gene candidates for four of these groups. To confirm the identity of two of these genes, for mutant groups macaron and donut, and to initiate their characterization, constructs containing wild type versions of these candidates were fused with YFP and transformed into each mutant population. T1 plants containing the constructs were selected for and then studied for rescue of the wild-type phenotype.

Student Name: Leah Anderson

Booth #: 3

Research Mentor: Leo Pallanck

Project Title: Do cells select against a high frequency of mitochondrial DNA mutations?

Abstract: Mitochondria arose due to a merging event between two independent life forms. After nearly two billion years of co-evolution, these organelles still retain their own greatly reduced genome, encoding proteins essential for generating energy. As mitochondrial DNA (mtDNA) replicates over an organism's lifetime, it acquires many mutations, a process that has been linked to aging and neurodegenerative disorders, such as Parkinson's Disease. To combat the deleterious effects of damaged mitochondria, cells selectively target them for autophagic destruction through the PINK1/Parkin pathway. While we know that damaged mitochondria are selectively degraded, it is unclear whether there are mechanisms in place to select against potentially harmful mutations in the mitochondrial genome. I am therefore studying this question by overexpressing Parkin in Drosophila strains that generate high levels of mtDNA mutations. Previously published data suggests that the PINK1/Parkin pathway and autophagy play a role in decreasing mitochondrial DNA mutations. However, my findings indicate that overexpression of Parkin does not greatly decrease the number of mtDNA mutations. This may indicate that the PINK1/Parkin pathway does not select against mutated mitochondrial DNA in somatic tissues. Continuation of this research will provide critical insight into the mechanisms by which harmful mtDNA mutations rise in abundance and cause disease.

Student Name: Maryam Bainazar

Booth #: 4

Research Mentor: Ann-Kathrin Eisfeld

Project Title: Elucidating the role of NRAS isoform 2 in the hyperactivation of the PI3K signal pathway

Abstract: Gene mutations are the hallmark of almost every human malignancy, as the aberrant activation of affected genes supports or even initiates tumor cell growth and survival. After discovering the existence of four different splice variants of the Neuroblastoma RAS viral oncogene homolog (NRAS) gene in 2014, a series of functional studies revealed that each variant, or isoform, has a unique expression profile, downstream activation potential, and cellular localization. NRAS mutations arise in roughly 30% of all human cancers resulting in the initiation of gene transcription, with melanoma malignancies reported to have the highest levels. Strikingly, our initial isoform-specific mRNA expression analysis, performed using quantitative real-time PCR (qPCR), showcased the significant overexpression of NRAS isoform 2 in BRAF-mutated melanoma. Using HIV-based lentiviral expression constructs of isoforms 1 and 2, we virally transduced A375 cells. Immunoblots and confocal imaging for known NRAS downstream targets showcased an increased phosphorylation of AKT (downstream of PI3K) in NRAS isoform 2 compared to isoform 1. Next, we designed isoform-specific shRNAs, which we stably introduced to test whether the knockdown of NRAS isoform 2 would be sufficient to silence its downstream effects. Western blots demonstrated a significant decrease in activation of the PI3K pathway after isoform 2 knockdown, when compared to isoform 1 knockdown. Finally, we sought to characterize the implications of mutationally activated PI3K signaling in NRAS isoform 2-overexpressing melanoma cells compared to isoform 1 using RNA sequencing. Ingenuity analysis of RNA sequencing data identified nuclear factor NF-kappa-B (NF-κB) as an alternatively hyperactivated pathway. Overall, we determined that NRAS isoform 2 is involved in the hyperactivation of the PI3K signal pathway by signaling through AKT and has been identified to exhibit aggressive tumor progression in Melanoma.

Student Name: Kaitlin Baker

Booth #: 5

Research Mentor: Sameek Roychowdhury

Project Title: FGFR2-CLIP1 fusion and N550H Mutation: Properties of Drug Resistance and Up-Regulated Pathways

Abstract: Objectives-In cancer, fibroblast growth receptor (FGFR) has been shown to be altered through fusions, point mutations and copy number variations. Through treatment with FGFR inhibitors resistance occurs. The mechanisms of resistance are not well studied and we hypothesize that secondary mutations within FGFR are what drive resistance. The purpose of this study is to characterize an FGFR2-CLIP1 fusion and secondary FGFR mutation and investigate its sensitivity to drugs, and up-regulated pathways. Methods- Genetic testing was performed on a patient with metastatic cholangiocarcinoma and findings revealed an FGFR2-CLIP1 fusion. Subsequently, the patient received the FGFR inhibitor, INCB054828. The patient showed a 5-month positive response. However shortly thereafter had progressive disease. Genetic testing of autopsy samples revealed an N550H mutation was found within the fusion, suggesting that the N550H mutation confers resistance to INCB054828. In order to further investigate this we created three NIH3T3 cell lines with empty, FGFR2-CLIP1, and FGFR2-CLIP1 N550H vectors. We used these cells for in-vitro testing of various FGFR inhibitors such as BGJ398, Ponatinib, Dovitinib, and AZD 4547. The cells were dosed with increasing concentrations of drug from .1nM to 20 uM and after 72 hours cell viability was assessed to calculate the half maximal inhibitory concentration (IC50) of each inhibitor. Protein expressions was analyzed by western blot analysis to look for pathways activated by the fusion. Results and Conclusion- Results showed that the FGFR2-CLIP1 fusion and N550H mutation cells were sensitive to the drugs of BGJ398, Ponatinib, Dovitinib and AZD 4547. Cells that contain the empty vector were not affected by the drugs. Western blot analysis show that the fusion and mutation cells are activated through phosphorylation of the AKT, MEK, and FRS2 alpha downstream pathways. Significance-With these findings it is possible to create effective treatment of those patients that develop these unique fusions and mutations.

Student Name: Nicholas Berry

Booth #: 6

Research Mentor: Jeffrey Parvin

Project Title: Mitotic Ubiquitination of Chromatin-Associated Lamin B1

Abstract: Investigating the dynamics of epigenetic marks throughout the cell cycle is important for understanding gene expression regulation in rapidly proliferating cells. Ubiquitin is an epigenetic mark that helps bookmark the active genes of a parent cell on the promoter chromatin to then facilitate post-mitotic reactivation of gene expression. A mitotic bookmarking mechanism that involves monoubiquitination catalyzed by the polycomb complex proteins RING1A/BMI1 has an undiscovered substrate that sits at promoters of active genes during mitosis. We suggest that an inner nuclear membrane protein called Lamin B1 (LMNB1) is the substrate of RING1A/BMI1-dependent ubiquitination. Through introduction of tagged ubiquitin or tagged LMNB1 into HeLa cell lines, we are able to select for chromatin associated with a tagged protein via double affinity purification. We have found that ubiquitination of proteins bound to promoters during mitosis depends on the presence of LMNB1. Also, we found that LMNB1 associates more with highly-ubiquitinated promoter chromatin in mitosis than with chromatin during interphase when bookmarking is absent, though the results of this last experiment did not reach statistical significance. New approaches will be used to elucidate LMNB1â€™s role in this bookmarking mechanism. We will use purified ubiquitin, LMNB1, RING1A, and BMI1 reagents to perform an in vitro ubiquitination reaction. We hope to better understand this fundamental cellular process, which may have future medical applications for epigenetic regulation of gene expression.

Student Name: Matthew Besman

Booth #: 7

Research Mentor: Linn Van Woerkom

Project Title: Boosting Ion Acceleration with Micro-Tube Targets

Abstract: Useful laser-driven ion acceleration is one of the laser physics community's most auspicious goals. Beams of high energy ions have a sweeping array of practical applications, most notably the targeted treatment of certain types of cancer. Unlike typical electromagnetic radiation techniques which deposit most of their dose near the surface of the skin, ion beams can be tuned to deposit their radiation dose at the specific depth of the tumor. In order to be useful for such purposes, ions must be accelerated to energies of order 100 MeV. Extremely intense lasers can create ions with energies not too far from that goal through a process called Target Normal Sheath Acceleration (TNSA), whereby a target material is ionized and subjected to a strong quasi-static electric field from refluxing electrons freed by the laser. The ions within the target are then accelerated by the field in the direction of target normal. That said, the current state-of-the-art laser systems are still not quite intense enough to reach the desired ion energy threshold through traditional TNSA. An emerging movement within the field of study seeks to boost TNSA by deliberately structuring the laser targets. This presentation focuses on the work of Ohio State's High Energy Density Physics research group (HEDP) in structuring our targets with micron-scale tubes that take advantage of Fresnel diffraction to increase on-target laser intensity. This presentation will explain some of the theory behind our proposed structures, examine existing simulation and experimentation data, and introduce upcoming experiments which aspire to reach the 100 MeV benchmark.

Student Name: Emily Boes

Booth #: 8

Research Mentor: Jolie Braun

Project Title: Death Awareness with Jessica Mitford and Caitlin Doughty

Abstract: "Death Awareness with Jessica Mitford and Caitlin Doughty" revolves around author and freethinker Jessica Mitford and how her views on death and the American funeral industry have influenced modern cultural perceptions of death. Mitford was born to an aristocratic English family before eventually moving to the United States. She joined the Communist Party, fought for civil rights, and wrote the best-selling 1963 exposé on the funeral industry, The American Way of Death. Using this book, along with its sequel, The American Way of Death Revisited, I am comparing Mitford's passionate assessment on the American funeral industry with how practices have changed in modern times. I am using Caitlin Doughty's 2014 Smoke Gets in Your Eyes as an addition to Mitford's books. Doughty's autobiography features her time as a young woman newly employed as a crematory operator in Oakland, California. Both Mitford and Doughty believe that the American public in general is ignorant in the ways of death, but whereas Mitford focuses on the unethical selling tactics of funeral directors, Doughty specializes in the public's death-denying demeanor. The two authors speak from experience in working with funeral homes, although they speak from different ends of the funeral process: the consumer and the worker providing the service. They agree that the American funeral industry needs to change, but they disagree on how. My goal is to reconcile the merits of their different opinions and explore how Mitford may have sparked changes in the funeral industry since the 1960s.

Student Name: Zachary Botkins

Booth #: 9

Research Mentor: Jolie Braun

Project Title: Progressing the Image to the Word: A Critical Study of William S. Burroughs' Cut-Ups

Abstract: Writer William S. Burroughs began the tenth class of his undergraduate course at the City College of New York by asking students to consider writing a magical operation. While he doesn't define the "magic" of it, Burroughs continues to justify this statement by explaining that magical operations enable one to produce qualitative and quantifiable results to any given experiment. Burroughs also claims that this process of magical experimentation offers insight into generalized criteria for the evaluation of any given text; and that within the experiments themselves resides insight into how to produce successful writing. Burroughs is the originator of the "cut-ups," a writing process consisting of slicing the margins off of a sheet, cutting the remainder into four sections which are rearranged to create new literature. The cut-ups also enabled Burroughs to induce elements of dreams, perception, and randomity into his writing. Controversial upon release, the cut-ups soon became something more to Burroughs: they became a way for him to cut-out controlling, subliminal messages placed into mass media. Using the drafts available at the OSU's Rare Books and Manuscripts Library and an interview with James Grauerholz, Burroughs' editor and literary executor, I sought to create a comprehensive study of the cut-ups and justify their merit as a technique. Within this study, I examine their intentions, their misperceptions, and ultimately, the practicality of their use. By first exploring the origins of the cut-ups and then moving onto their methodology, I contextualize the argument, and its counterpoints, presented within the third section of the paper. Using the CCNY classes and transcripts of a Naropa class, I create an argument based entirely on Burroughs' own words and notes in an attempt to capture the overlooked essence of the cut-ups: reunification of word and image.

Student Name: Chelsea Bray

Booth #: 10

Research Mentor: Jonathan Godbout

Project Title: Microglial Elimination with a CSF1R antagonist Attenuates Neuroinflammation and the formation of Rod-like Microglia after Traumatic Brain Injury

Abstract: Traumatic brain injury (TBI) is associated with affective and cognitive impairments that develop or persist years after injury. Thus, it is critical we understand the neuroinflammatory processes that may persist after TBI. Microglia are innate immune cells of the central nervous system (CNS) that produce inflammatory mediators after injury. Microglia have distinct morphological and mRNA profiles that are associated with activation states. Moreover, we have previously reported that microglia in mice become "sensitized" after TBI and remain sensitized 30 d after injury. Recent studies demonstrate that oral administration of a colony stimulating factor 1 receptor (CSF1R) antagonist depletes 98% of the microglia from mice. Therefore, we aimed to eliminate microglia from the brain of mice prior to TBI and determine the effect on acute functional recovery, neuroinflammation and the formation of rod-like microglia in the cortex. Here, adult mice were orally administered control or a CSF1R antagonist (PLXxxxx) for 2 weeks prior to sham injury or diffuse TBI (midline fluid percussion injury). Motor recovery was assessed using the rotorod apparatus over 7 d. TBI caused acute impairment in motor coordination, but this was unaffected by microglia depletion. Nonetheless, TBI-induced neuroinflammation 1 day later in the cortex (cytokines: IL-1b, IL-6 and chemokines; CCL2) was attenuated by microglial elimination. Histological analysis confirmed that CSF1R antagonist administration depleted microglia in the CNS. In addition, the depletion of microglia prevented the unique formation of rod-like microglia in the cortex 7 days after TBI. This decrease in rod-like microglia was paralleled by a reduction in mRNA markers of inflammation and in mRNA markers of neuronal damage (cortex nanostring 7d). Overall, elimination of microglia prior to TBI effectively limited corresponding neuroinflammation 1 and 7 days later. Future studies will determine the longer term influence of microglial elimination prior to TBI on neuronal health and functional recovery.

Student Name: Daniel Brogan

Booth #: 11

Research Mentor: Sergei Chmutov

Project Title: Weierstrass Points on Tropical Curves

Abstract: On a tropical curve (a metric graph with unbounded edges), one may introduce the so-called ``chip-firing game." Given a configuration D of chips on the tropical curve, with possibly negative numbers of chips, one may determine whether it is possible, through a set of approved ``moves," f_i to reach a configuration E in which every point on the tropical curve has a nonnegative number of chips. More formally, we may determine which divisors D on the curve are linearly equivalent (via the sum of the f_i's) to effective divisors E. We may restrict our attention to starting configurations which have a large number of chips on a single point and some negative chips placed elsewhere in the tropical curve. It turns out that there is a meaningful way to measure how good a given point is at distributing its chips around the curve; points which have a special affinity for this are called Weierstrass points. We wish to determine the topological properties of the set of Weierstrass points, namely whether there are finitely many connected components, whether the set of all Weierstrass points is closed, and whether non-smooth Weierstrass points on a bridgeless graph are isolated.

Student Name: Olivia Carter

Booth #: 12

Research Mentor: Maegen Ackermann

Project Title: Degradation of Arrhythmogenic Cardiomyopathy-Linked Variants of Desmoplakin Due to Exposure of Calpain Cleavage Sites

Abstract: Arrhythmogenic cardiomyopathy (ACM) is a disease that affects 1 in 2000 Americans every year and segregates with sudden cardiac death. ACM is characterized by fibrofatty scarring and severe electrical dysfunction of the myocardium. In 50% of cases, the disease is linked to a known genetic variant, several of which occur in a “hotspot” region of desmoplakin (DSP) (Fig. 1). In cardiomyocytes, DSP aids in the maintenance of cell-cell adhesion at the intercalated disc (ID). The biomolecular mechanisms by which the DSP “hotspot” variants lead to ACM remain unknown. We have uncovered that increased degradation of DSP occurs in conjunction with several of these variants. This degradation is Ca2+ and calpain dependent. Our current study uses in silico methods, molecular dynamics (MD), and biochemical assays to identify calpain targeted sites and the extent of degradation in the presence of “hotspot” variants. Using in silico analysis, we have identified several potential calpain target sites within the “hotspot” of DSP; however, only two of these predicted sites were affected by the introduction of the variants. MD indicated significantly increased surface area exposure of the second calpain target site for half of the variants compared to wild type DSP (Fig. 2). MD also showed significantly fewer intramolecular bonds centered around the second calpain target site. These results indicate that the second target site would be more accessible to calpain cleavage in half of the variants. Our in vitro biochemical assay supported those findings by showing that those variants are more susceptible to degradation via a calpain-dependent mechanism. Taken together, we have developed a method to predict and assess if a single variant of DSP will be more susceptible to calpain degradation. With further testing we will create calpain resistant molecules to inhibit the degradation of DSP and consequently reduce ACM phenotypes.

Student Name: taylor cathcart

Booth #: 13

Research Mentor: Kazimierz slomcyznski

Project Title: The Effect of Economic Distress on Mental Health

Abstract: The purpose of this study is to examine the impact of economic distress on mental health in the adult population of Poland before, during, and after the Global Economic Crisis of 2008. Social science research has found that socioeconomic conditions impact self-reported mental health. In this study, I examine specifically the concept of economic distress, which I define as being unable to provide basic necessities for one's self or family, as well as being unemployed. For this project I will use the Polish Panel Survey. POLPAN, as it is called, began in 1988 and respondents were re-interviewed every five years; I focus on the 2003, 2008 and 2013 waves. The survey has variables vital for my project, including socioeconomic status, economic distress, and mental health, along with demographics such as gender, age, marital status and family composition. I used the program STATA to analyze this data, and created tables to show the different regressions that were done. STATA was also used to create the variable that were analyzed, which included emotional health and social isolation for the three different years. Each variable was created by taking the Nottingham Scale results conducted in the survey and manipulated them into new variables that combined the results. It was found that there were statistically significant results between a person being under economic distress and having poor emotional health and being socially isolated. My results coincided with some of the other research that I examined previously. This information can help look into factors that detrimentally effect a person's mental health, and moreover look into how certain situations like a economic crisis can effect a population.

Student Name: Karthik Chakravarthy

Booth #: 14

Research Mentor: Lawrence Kirschner

Project Title: Role of tumor suppressor SDHD effects on thyroid tumor growth

Abstract: Cowden's syndrome (CS) has been associated with germline mutations in PTEN tumor suppressor gene, identified in about 85% of CS-associated and 10% of sporadic thyroid cancers. Germline variations in succinate dehydrogenase complex (SDH) genes were first observed in patients with pheochromocytoma/paraganglioma and recently discovered in patients with CS/CS-like conditions. Moreover, CS patients with variants in succinate dehydrogenase subunit D (SDHD) either alone/in combination with PTEN mutation have increased thyroid and breast cancers risk compared to patients with PTEN-only mutations. As SDHD is essential for succinate-to-fumarate conversion in the TCA cycle, its deletion/missense mutation in murine-thyroid tissue may elucidate mechanisms of enhanced tumor progression observed within humans. Mouse models with thyroid-specific SDHD knockout (ko) have been shown to result in larger thyroids accompanied by increased proliferation; however, whether missense mutations in this gene have similar effects is unclear. Therefore, CRISPER-Cas9 genome editing was used to generate mice with an H50R mutation in SDHD gene, corresponding to the most common variant in human SDHD-associated tumors. Breeding of the H50R-mutation founder and a homozygous SDHD-ko mouse produced mice with missense mutation and knockout on separate alleles. Future work will involve further generating combinations of SDHD-ko and H50R-variant alleles and observing impact on thyroid and other tissues. In addition, another objective includes characterizing the interaction of SDHD and PTEN at the molecular level. Recent studies, as well as our own data, suggest that SDHD-depleted human thyroid cell lines have higher levels of oxidized-PTEN. Interactions between SDHD and PTEN were examined in SDHD knockdown (kd) thyroid cells under biological stress conditions. SDHD-kd cells under H2O2-induced oxidative stress conditions resulted in increased oxidized-PTEN levels compared to controls, with a corresponding decrease in the cytoplasmic-PTEN. However, PTEN did not translocate to the nucleus. Future studies will investigate hypoxia stress and pharmacological ER stress conditions for similar effects.

Student Name: Brian Daniels

Booth #: 15

Research Mentor: Jonathan Parquette

Project Title: Utilizing Self-Assembled Nanotubes as a Scaffold for Enzymes

Abstract: A variety of self-assembled nanostructures with many potential applications have recently been developed by the Parquette group. Molecules based on naphthalenediimide, NDI, have proven capable of assembling into nanostructures such as helical nanofibers, twisted nanoribbons, and nanotubes composed of stacked individual rings (1,2,3). These nanotubes, formed by the self-assembly of a naphthalenediimide-lysine bolaamphiphile (NDI-Bola), have shown the interesting ability to reassemble into long tube structures after being broken into small segments by sonication. These same nanotubes have also shown the ability to be wrapped by appropriately charged polymers using a layer-by-layer assembly process that relies on the net charge of each layer. Combining these two interesting properties, the self-assembling nanotubes shortened by sonication are then stabilized by subsequent wrapping with appropriate polymers. The ability to control the length and surface properties of NDI-Bola nanotubes make them a promising candidate for an enzyme scaffold, especially considering previous success by the Parquette lab using other self-assembling nanostructures for the same purpose. We hypothesized that a variety of nanoscale enzyme scaffolds could be produced using the interesting properties of NDI-Bola. Recently, we have extended the range of polymers which can be used to wrap the NDI-Bola tubes, including natural polysaccharides which go in line with the overall theme of the project. These natural polymers, a sulfated curdlan and a methylated chitosan derivative, have shown promise in creating a double-layered wrapping of the NDI-Bola nanotube. Chitosan, the outermost polymer in this composite structure, has potential to be further modified in the future to allow cross-linking of the individual nanostructures to create a superior scaffold. Testing of enzyme activity before and after immobilization on these nanostructures to determine their effectiveness as a scaffold remains to be completed, although it is expected that some variety of these NDI-Bola nanotubes will prove effective in increasing the stability of the immobilized enzymes while maintaining a high activity.

Student Name: Rhys Davis

Booth #: 16

Research Mentor: Shaurya Prakash

Project Title: Reducing Cooling Water Use at Thermoelectric Power Plants

Abstract: In the U.S., water for power plant cooling constitutes 40% of all freshwater withdrawal and 4% of all freshwater consumption. There are different kinds of power plant cooling systems, but environmental issues arise from each type, including strain on water supply in arid regions and ecological damage from high-temperature return water. The purpose of this study was to discover effective ways to reduce water use at thermoelectric power plants in an environmentally safe manner. To reduce water use, it is necessary to reduce the temperature of the cooling water at either the inlet or outlet of the working steam heat exchanger. A literature study of emerging technologies for cooling liquids was done to single out the most promising and innovative methods for reducing the cooling water temperature; a thermodynamic design process was then used to identify realistically usable cycles, and these were analyzed at thermal conditions expected for different types of power plants. The results of this research will be a matrix of cooling technologies at different conditions and the required inputs and costs of implementation for these technologies at a standard power plant scale. So far, the systems being investigated are a refrigeration cycle using carbon dioxide and ammonia as refrigerants because of their unique, compatible thermodynamic properties and low-impact environmental properties; an absorption refrigeration cycle using lithium bromide and water along with a cascading carbon dioxide cycle; and a geothermal cooling system. So far, the biggest issue involved in using these technologies for cooling large amounts of water is the energy input required, along with the costs of implementing them at such a large scale. The findings from this research will identify the types of cooling systems that will be beneficial for different regions and power plant types, and can be used to further develop these systems at a larger scale.

Student Name: Rachel Dawson

Booth #: 17

Research Mentor: Sarah Schoppe-Sullivan

Project Title: Father's Mind-Mindedness and Child Emotion Regulation

Abstract: Emotion regulation, the internal and external processes involved in initiating, maintaining and modulating the occurrence, intensity, and expression of emotions, is vastly important for success in school and throughout life. Prior research has pointed to a link between the development of strong emotion regulation skills and the parent-child relationship. One aspect of the parent-child relationships is mind-mindedness, or parents' ability to treat the infant as an individual with a mind, which requires parents to interpret infants' cues correctly and provide accurate response and sensitivity. Although the mother-child relationship is vastly studied, much less research has focused on the father-child relationship. Due to this lack of knowledge about the father's role, this research seeks to investigate the associations of father's mind-mindedness with children's emotion regulation at age seven. Participants were recruited from a sample of one hundred and eighty-two families from The New Parents Project, a longitudinal study of dual earner couples and their first born children. Father's mind-mindedness was studied at nine months postpartum using a five-minute play interaction between father and child. The interaction was transcribed and coded for mind-mindedness using the Mind-Mindedness Coding Manual (Meins, Fernyhough, 2015). Comments were marked as either attuned or non-attuned for mind-mindedness and categorized based on the type of mind-minded comment. Emotion regulation will be measured using data recently collected through a follow-up study. At age seven, children perform the attractive toy in a transparent box task. This task will be coded behaviorally for child emotion regulation strategies using The Behavior Coding Manual (Wu, Feng, Hooper, Ku, 2017). Data collection on children's emotion regulation is near completion. Upon completion, statistical analyses will be conducted to evaluate associations between father's mind-mindedness and children's emotion regulation. It is anticipated that father's mind-mindedness will be positively be associated with self-regulation strategies at age seven.

Student Name: Kyle Deistler

Booth #: 18

Research Mentor: Andy Fischer

Project Title: Characterizing the role of the NF-ÎºB signaling pathway on the formation of MÃ¼ller glia-derived progenitor cells in the avian retina as a mechanism for retinal regeneration

Abstract: Retinal degeneration causes numerous vision-related diseases and ultimately leads to a decreased quality of life. Current therapies have proven unsuccessful in slowing or reversing retinal regeneration. Muller glia, a major retinal support cell, have been shown to have the ability to dedifferentiate, proliferate as retinal progenitors, and regenerate neurons in the retina of several vertebrate groups. This mechanism for retinal regeneration is controlled by numerous signaling pathways. The purpose of this study was to characterize the influence of NF-κB signaling on the formation and proliferation of Muller glia-derived progenitor cells (MGPCs). Classically, NF-κB signaling is known for its role in mediating the inflammatory response, but it has also been shown to be involved in regulating the expression of genes associated with mediating cell survival, apoptosis, differentiation, and proliferation. This association shows NF-κB signaling to be a prime candidate for involvement in retinal regeneration. We find that there is a buildup of the NF-κB transcription factor phosphorylated-p65 in the nuclei of Muller glia in the chick retina following excitotoxin damage or growth factor treatment. Following NMDA induced excitotoxic retinal damage, pharmacological inhibition of NF-κB signaling via intraocular injections of the small molecule inhibitors Sulfasalazine or PGJ2 resulted in a significant increase in the formation and proliferation of MGPCs and a significant decrease in neuronal death. Activation of NF-κB signaling via intraocular injection of recombinant TNF ligand or the small molecule activator Prostratin resulted in a significant decrease in MGPC formation and proliferation following excitotoxic retinal damage. Additionally, after selectively damaging microglia through clodronate and IL6 injection, it was found that inhibition of NF-κB had a different effect on proliferation and neuroprotection after damage. We conclude that NF-κB signaling plays a role in the network of signaling pathways that control the formation of proliferative MGPCs and cell survival in the retina.

Student Name: Danielle Demmerle

Booth #: 19

Research Mentor: Eric Johnson

Project Title: Biblio-Archaeology: A Codicological Inventory, Inspection and Cleaning, Condition Survey and Preservation Needs Assessment of Pre-Modern Codices and Incunabula in the Rare Books and Manuscripts Collection of the OSU Libraries

Abstract: For the Undergraduate Summer Library Research Fellowship, I conducted condition surveys, a codicological inventory and preservation needs assessment of 48 pre-modern codices and 98 incunabula in the Rare Books and Manuscripts Library (RBML) of the OSU Libraries. In my proposal I planned to assess all physical features, general condition and the preservation needs of each item under the supervision and guidance of OSU Libraries' Book and Paper Conservator, Harry Campbell and the OSUL RBML Curator, Eric Johnson (my supervisors). I researched the fundamentals of building and operating a condition survey by reaching out to those who have had years of experience in conservation. I quickly became accustomed with the subject matter and created a reference document of descriptive elements that guided me through each evaluation which I adapted into my condition survey design. Upon the completion of the condition surveys I created a catalogue that would help organize 146 bound items from the RBML and guide faculty and students through the data. While it is designed to provide concise information, the individual condition surveys of each item can provide greater (or additional) detail. Condition work for special collections often go overlooked, but I was able to create a strong foundation for the recorded conditions of bound medieval manuscripts and incunabula in the RBML. I look forward to the hands-on conservation work that Harry Campbell has pre-approved for the manuscripts and incunabula that are in need of attention as part of my job as a student assistant technician in the Conservation Unit. I am hopeful that the condition and needs assessment survey I designed specifically for the RBML will become standard practice, and continue to be used to record physical aspects for future acquisitions, as well as provide an informative source for augmenting item records in the OSUL online catalog.

Student Name: Daniel Dyszlewski

Booth #: 20

Research Mentor: Venkat Gopalan

Project Title: Comparative biochemical studies of kinases and deglycases that convert Amadori products to common metabolites

Abstract: During inflammation, Salmonella enterica serovar Typhimurium, a food-borne pathogen, can utilize fructose-asparagine (F-Asn) as one of its sole carbon and nitrogen sources. F-Asn belongs to the family of Amadori compounds, which are rearrangement products that result from the reaction of a sugar with an amine. Amadori compounds are found in nature as well as in prepared human foods that are consumed regularly. The F-Asn utilization pathway in Salmonella involves the genes encoded in the fra locus, and entails the successive action of asparaginase (FraE), a kinase (FraD), and a deglycase (FraB) to convert F-Asn to aspartate and glucose-6-phosphate, common metabolic intermediates. Inhibiting the last enzyme in the F-Asn metabolic pathway (FraB deglycase) results in toxicity on account of a build-up of the uncleaved 6-phosphofructose-aspartate; this finding identified FraB as a potential drug target and has heightened the prospects for anti-Salmonella therapeutics. In this regard, we have initiated detailed biochemical studies of the FraD and FraB enzymes, focusing on their substrate-recognition determinants and mechanisms of action. Because a similar bacterial pathway involving a kinase (FrlD) and a deglycase (FrlB) also helps convert Îµ-fructose-lysine (Îµ-F-Lys) into lysine and glucose-6-phopshate, we seek to understand the similarities and differences in the two enzymes that aid catabolism of F-Asn and Îµ-F-Lys. Insights from these studies are expected to facilitate future Salmonella FraB-targeted drug discovery efforts and highlight parallels in the evolution of bacterial strategies to catabolize Amadori compounds.

Student Name: Julia Dziabis

Booth #: 21

Research Mentor: Jonathan Godbout

Project Title: TBI induced rod microglia align with injured neurons

Abstract: Traumatic brain injury (TBI) is a significant concern due to the increased risk of neurological disability and neuropsychiatric illness, which can persist long after initial injury. These complications are linked to ongoing neuroinflammation, and more specifically microglia-mediated inflammation. In response to a central nervous system insult, such as infection or TBI, microglial structural changes are observed, including phagocytic, deramified, and hypertrophied morphologies. One such morphology is the formation of "rod-like" microglia but the functional profile of these microglia is unclear. Therefore, the purpose of this study was to determine if the alignment of rod microglia within the cortex following TBI was associated with increased CNS pathology. In this study, mice (8-10 weeks old) received a moderate, diffuse TBI induced by midline fluid percussion. Histological analysis 7days post-injury (dpi) showed that rod microglia (Iba-1+) were not aligned with vasculature (Ly6C+) following injury. Instead, these rod microglia were localized near injured neurons (ATF-3+) in the lateral cortex. Moreover, there were increased mRNA levels of genes associated with neuronal injury (ATF-3, CSF-1), microglial activation (MHCII, TREM2, Tyrobp, CD14), and complement activation (CD68, C1qA, C3) at 3 and 7dpi. These mRNA data within the lateral cortex were interpreted to indicate that rod microglia are inflammatory and are in close proximity to damaged neurons after TBI. To support this conclusion, Thy1-YFP mice were used to visualize neurons in Layer V of the neocortex. These mice were subjected to TBI and novel data confirms that these rod microglia (Iba-1+) were aligned with the apical dendrites of injured neurons (YFP+). Taken together, these data indicate that inflammatory and rod-shaped microglia selectively align with injured cortical neurons following diffuse TBI. Future studies will aim to determine the specific RNA profile of these rod microglia and determine their role in impaired neuroplasticity after TBI.

Student Name: Ayla Edwards

Booth #: 22

Research Mentor: Anna Dobritsa

Project Title: Characterization of multiple novel aperture proteins in Arabidopsis thaliana

Abstract: Exine, the outer wall of a pollen grain, forms a reticulate pattern containing gaps called apertures in many species. These apertures facilitate the emergence of the pollen tube, making them important for male fertility in some plants. The positioning of these apertures is highly conserved within species, yet varies widely between species, making them ideal for studying the control and formation of extracellular microdomains. Relatively little is known about how the locations of apertures are specified. Our current work involves identification and characterization of novel proteins involved in aperture formation. This project focuses on two of the mutants found during a mutagenesis screen, both of which completely lack apertures. The candidate genes responsible for these mutations were isolated, cloned upstream of a YFP tag, and introduced into their respective mutants in Arabidopsis using Agrobacterium. Expected results include confirming the identity of the mutant proteins by phenotypic rescue, and further characterization by studying the proteinsâ€™ expression and localization using YFP. Characterizing these proteins will help elucidate the molecular pathways involved in the formation of distinct cellular domains.

Student Name: Ruba Elzein

Booth #: 23

Research Mentor: Rebecca Garabed

Project Title: Incidence of Foot-and-Mouth Disease in Cattle Herds in Far North Region of Cameroon

Abstract: Foot-and-mouth disease (FMD) is caused by a highly communicable virus that affects cattle and other livestock species. Though eradicated in select countries, this disease is endemic in parts of the Middle East, Africa, and Asia. While the approximate sero-prevalence of FMD in many affected countries is known, few studies report its persistence and spread in individual herds, specifically in developing countries with no national FMD vaccination program such as Cameroon. The purpose of this study was to use herder reports collected over a five-year period to track the incidence of FMD in both sedentary and mobile cattle herds in Far North Region of Cameroon. Pastoralists from 15 sedentary and 15 mobile cattle herds were surveyed twice per year, once in the dry season and once in the rainy season. Data was analyzed for incidence risk of FMD within herds using “R” and “R Studio” software. Current progress has revealed that FMD is widespread in the Far North Region, with every analyzed herd thus far exhibiting clinical signs of the disease. These preliminary findings suggest that FMD is ubiquitous and transmitted efficiently in cattle herds in the Far North Region of Cameroon. However, only 5.4% of individual animals experienced more than one reported clinical infection during the five-year monitoring period. Persistence of FMD may affect animal welfare, herd growth, and pastoralists’ lives and economic wellbeing. This study provides novel information that we can use to develop preventive measures against this harmful disease.

Student Name: Max Fernandez

Booth #: 24

Research Mentor: Michael McIlhatton

Project Title: Nucleolar Trafficking of Blm Affects Organismal Size

Abstract: The BLM helicase is a DNA repair protein that functions in DNA double-strand break repair through homologous recombination and non-homologous end-joining pathways. It resolves specific types of DNA structures at replication forks and telomeres, and rDNA/rDNA and rDNA/rRNA hybrids in the nucleolus. Humans with BLM mutations are cancer-prone, immune-deficient and are characterized by dwarfism. Recently, our research group demonstrated two serines (S1342 and S1345) in the C-terminus of BLM that control nucleolar localization without affecting nuclear localization or biochemical functions (Tangeman et al., 2016). Two mouse models were established using CRISPR/Cas9 gene editing techniques to evaluate the in vivo effects of mutating these two serines. BlmDD and BlmAA alleles encode aspartic acid and alanine substitutions at S1342 and S1345, respectively, Male and female Blm+/DD and BlmDD/DD mice are smaller than wild-type litter mates at 8, 12 and 16 weeks, for example: BlmDD/DD males 16 weeks, 23.8 ± 2.6g; Blm+/+ males 16 weeks, 28.5 ± 1.3g (p=0.0001; unpaired t-test). The differences in weight suggest that nucleolar functions of Blm are required for organismal growth, reflecting other data showing decreased rRNA production in BLM-/- cell lines (Grierson et al., 20121 2012). BlmDD/DD mice were crossed with Apc+/Min mice, a model of intestinal tumorigenesis. Mean adenoma numbers to date are: Apc+/Min, 41.7 ± 20.7; Blm+/DD, 54.9 ± 13.2; BlmDD/DD, 61.7 ± 8.3. Characterization of these models will reveal if nuclear and nucleolar functions of Blm can be separated and will yield insight into role of Blm nucleolar localization in growth and tumor development.

Student Name: Wilson Flores

Booth #: 25

Research Mentor: Peter Lee

Project Title: DEVELOPING ENGINERING TECHNOLOGY TO STUDY SKELETAL MUSCLE ATROPHY

Abstract: Astronauts undergo significant muscle atrophy when in spaceflight for extended periods of time. Mechanisms that steer this development are not well understood. This investigation will further the understanding on how muscle tissues sense the microgravity environment leading to muscle atrophy. The experiment will allow miniaturized tissue-engineered skeletal and cardiac muscle constructs to enter microgravity for three minutes on a suborbital reusable launch vehicle to determine how expression of key genes change when compared to controlled muscle constructs in the laboratory. In order to perform this experiment, key engineering technology is being designed, built, and tested that will allow for real-time data capture on a payload. The autonomous payload will maintain the tissues in culture for at least 6 hours, measure real-time passive and active forces, stimulate the muscle tissues to contract, fix tissues to preserve mRNA, and return the tissues alive. The engineering team is currently designing and building a 96-well tissue-culture plate that will hold both skeletal and cardiac cells. The cells will be formed and suspended around two microposts built into each of the cell culture wells producing passive forces. They will be electrically stimulated, by means of parallel electrodes, to contact and generate active forces. A force measurement system will measure the real-time passive and active forces with a sensitivity of 5uN using a camera system to capture continuous video of at least 24 frames-per-second. At the end of the microgravity period, RNAseq will be added to some wells while the growth medium is removed. This will allow the cells to stay fixed and preserve the existing mRNA for post-flight analysis. The technology being developed for the payload will ultimately help astronauts spend longer periods of time in space.

Student Name: Abhinav Gadde

Booth #: 26

Research Mentor: Gunjan Agarwal

Project Title: Estimation of persistence length of collagen fibrils in murine tissue

Abstract: Collagen type I is a major component of the extracellular matrix in many different tissues of the mammalian body. In the blood vessel wall (e.g. aorta), collagen fibrils act as the main source of tensile strength. Changes in the quality and quantity of collagen fibrils can thus affect the mechanical properties of the aortic wall. However, limited approaches exist to evaluate the mechanical properties of individual collagen fibrils occurring in-vivo. In this study, we estimate the persistence length (PL) of collagen fibrils in the mouse aorta by tracking the contour of individual fibrils in aortic cross-sections. AFM (atomic force microscopy) was used for high-resolution imaging of unfixed tissue sections. MATLAB codes were used to determine the PL using an approach utilized by us earlier for in-vitro fibrils. The first aim of this study was to compare PL of fibrils in the aorta for mice of two different genotypes (DDR1 KO vs. WT) using AFM. The second aim was to compare the PL obtained using AFM with that using SEM (Scanning electron microscopy) and TEM (Transmission electron microscopy) for the same mouse. Our preliminary results indicate that the PL of collagen fibrils in-vivo significantly differ from in-vitro generated fibrils and are dependent on the mouse genotype and microscopy approach employed. This approach can be extended to estimate changes in collagen in pathological tissues, such as in aneurysms and fibrosis, where collagen is extensively remodeled.

Student Name: Stephen Gant

Booth #: 27

Research Mentor: Jay Gupta

Project Title: Achieving Spin-Polarized Scanning Tunneling Microscopy

Abstract: Achieving atomic spin resolution in materials is an elusive and important step in characterizing spin-ordered materials. One recently popularized method in doing so is spin-polarized scanning tunneling microscopy (SPSTM). This technique has been achieved by only a handful of labs worldwide and builds upon the widely used method of scanning tunneling microscopy (STM). STM uses quantum tunneling to read the current coming from a biased sample. Changes in current are then mapped to an image that roughly corresponds to the electronic structure of the material (usually this corresponds with the topography). SPSTM builds on this by utilizing the fact the tunneling current between atoms varies between aligned and anti-aligned spins, thus by having a spin-aligned tip it is possible to achieve resolution (in the form of apparent height changes) of the spin structure in materials. Spin-ordered tips are in the process of being constructed in two ways. The first is via coating W in a thin (~10 monolayers) coating of a ferromagnetic material (Fe, Co, etc.). The second is via constructing tips out of conductive bulk antiferromagnetic materials like Cr. Using Ir(111) with 2 monolayers of Fe deposited on it, these tips' orientation can be found, allowing for SPSTM to be achieved with novel materials.

Student Name: Elijah Gardner

Booth #: 28

Research Mentor: Hui-Zi Chen

Project Title: Functional Characterization of a Novel RAF1 Mutant in Human Cancers

Abstract: Components of the RAS-RAF-MEK (also known as MAPK/ERK) mitogen signaling pathway are frequently mutated in different types of human cancers. The RAF kinase family signals downstream of RAS to promote cell proliferation and is encoded by three different genes: ARAF, BRAF, and CRAF (or RAF1). Oncogenic mutations have been identified and characterized in BRAF (e.g. BRAF V600E). However, mutations in the remaining two RAF isoforms are rare and their functional consequences poorly characterized. Here we have report a novel non-synonymous RAF1 mutation, P261R, which was identified in a patient with non-small cell lung cancer. Although sequencing studies have previously detected this mutation in both hepatocellular carcinoma and cholangiocarcinoma, its functional significance remains unknown. We propose to elucidate the biologic consequences of RAF1 P261R using cell-based assays. First, we generated a P261R-expressing mutant in the mammalian retroviral vector pBABE-neo using site-directed mutagenesis. Subsequently, we transduced established non-small cell lung cancer (NCI-H522) cells with RAF1 wildtype and mutant vectors to create stable expression of the encoded proteins. We hypothesize that RAF1 P261R will have oncogenic functions through promoting constitutive activation of the RAS-RAF-MEK mitogenic signaling pathway, leading to uncontrolled cell proliferation. To test this hypothesis, we performed cell growth and viability assays in RAF1 wildtype and mutant H522 cells. We also sought to determine activation of downstream RAF1 targets including level of phosphorylated MEK protein. Our results may ultimately reveal RAF1 P261R to be a molecular target for therapeutic intervention in human cancers.

Student Name: Elizabeth Gilbert

Booth #: 29

Research Mentor: Catherine Calder

Project Title: Modeling Hair Cortisol as a Biomarker of Chronic Stress

Abstract: Stress has negative impacts on the human body when sustained over time, such as obesity, diabetes, and mental health issues. To mitigate these effects, chronic stress needs to be better understood, which can be accomplished through measuring biomarkers of stress. Cortisol is the primary stress biomarker in humans and can be measured in blood, saliva, urine, and hair. Compared to other stress biomarkers, hair cortisol measures stress over more time. The primary purpose of this study is to model hair cortisol concentration over length, considering individual differences in the levels of stress. Additionally, some hair samples are discovered to be too light in weight to assay once it gets to the lab. We propose a hair adjustment method to create an adjusted hair cortisol concentration from the underweight sample supplemented by the tail ends of the hair sample. The data used for this study come from 31 participants who took part in The Ohio State College of Nursing Hair Cortisol Study. Each participant provided multiple hair samples and completed a 4-page survey. Descriptive analyses and Rasch modeling were used to understand differences in stress levels, and it was found that the Rasch score of recent stressors is a better predictor of recent reported stress levels ($\rho = 0.3$) than any measured demographic variables. From 26 hair samples, the linear model of hair cortisol concentration shows that hair cortisol concentration in pg/mg decreases over length of hair in cm as expected with $\beta = -0.11$ pg/mg/cm, and α intercepts per subject ranging from 3.5 pg/mg to 15.15 pg/mg. This model predicts the last three months of cortisol concentration, given the past and recent cortisol concentration. Our descriptive statistics contribute to a better understanding of chronic stress, and we hope that our adjustment method provides a post-collection solution to the issue of lightweight hair samples.

Student Name: Adam Green

Booth #: 30

Research Mentor: Michael Barton

Project Title: Galapagos Spreading Center Trace Element Analysis to Determine Magma Evolutionary Processes and Crust Formation at Plume Influenced Divergent Plate Boundaries

Abstract: This study is part of a larger project aimed at understanding magmatic processes and crust formation at divergent plate margins. The focus is the Galapagos Spreading Center (GSC), an intermediate spreading ridge off the west coast of South America that passes just north of the Galapagos Islands and terminates against the EPR. Studies of this ridge allow the effects of plume-ridge and ridge-ridge interaction on MORB magma evolution and plumbing systems to be examined. Published analyses of lavas collected along the ridge were used to examine variations in magma chemistry in terms of plume-ridge interaction. Ratios of W/U, Sb/Ce, Mo/Ce, La/Sm, Rb/Ti, La/Yb, and Rb/Tl indicate that the plume influences magma sources between 95.5°W and 86.5°W. The plume center is located at about 91°W. Trace element analyses will shed light on the influence of the Galapagos plume on the geochemistry of ridge basalts. Variation in trace element concentration provides insight to minerals crystallizing along the ridge. Pressures of partial crystallization are consistent (within error) with crystallization at the base of the crust. Samples collected from the ridge affected by the Galapagos plume yield higher average pressures (323 MPa) corresponding to greater depths (average ~11.7km). We suggest that the high pressures calculated for some samples do not represent the actual pressures of partial crystallization, and that the anomalous melt compositions and unusual correlations reflect interaction with pre-existing crust. Additional research is underway to test this hypothesis.

Student Name: Levi Griffith

Booth #: 31

Research Mentor: Joshua Hawley

Project Title: A Look at Rent to Own Housing in Ohio

Abstract: This research was done in order to obtain the basic descriptive statistics of properties and their tenants in the Ohio Housing Finance Agency's Lease-Purchase housing program. These included the outcomes of properties after their initial compliance period, as well as their value, tenants, and tax delinquency. This data was obtained via the county auditor websites for each respective county, and was analyzed by amassing various tables depicting these outcomes, as well as scatter plots to show things like property value, degree of delinquency, and tenant income.

Student Name: Gabrielle Grose

Booth #:

Research Mentor: Aaron Moberly

Project Title: Audiovisual Speech Weighting in Cochlear Implant Users and Normal Hearing Listeners

Abstract: The sound processing strategies of a cochlear implant (CI), a device used to restore hearing sensation in individuals with severe-to-profound hearing loss, do not permit a clear speech signal to be delivered. The transmitted signal becomes even more degraded in the presence of background noise. CI users in particular tend to rely on visual cues, such as speechreading (i.e., lipreading), in noisy environments to aid in speech perception, but the mechanisms underlying audiovisual (AV) integration in CI users are still poorly understood. According to MacDonald and McGurk (1976), AV integration can actually lead a listener to perceive a multimodal AV stimulus differently than what is presented using either an auditory or visual unisensory stimulus alone. In this study, we tested how visual speechreading cues affected auditory performance in sixteen CI users and sixteen normal hearing (NH) listeners. Participants were presented with incongruent auditory and visual stimuli in two different signal-to-noise ratio (SNR) conditions and two different visual conditions: clear and blurry. We hypothesized that under-utilization of the auditory signal among CI patients would be associated with over-reliance on the visual modality. Results of the study supported this hypothesis. While CI users' were insensitive to SNR, they demonstrated visual dominance when the visual stimuli were clear. In contrast, NH participants demonstrated auditory dominance across all conditions. Our findings suggest that the integration of auditory and visual modalities or, conversely, reliance on one sensory modality is based on multimodal experience. Individuals with hearing loss and CIs often rely on the visual modality, specifically speechreading skills, to compensate for the limited auditory information they receive. Future work will be designed to investigate how retaining these speechreading skills that have developed over time might impact CI users' improvement in auditory performance.

Student Name: Xin Gu

Booth #: 33

Research Mentor: David Nagib

Project Title: Polarity-reversal strategy for a radical, three-components Minisci reaction

Abstract: Nitrogen-containing heteroarenes are medicinally important cores that are seen in many therapeutic drugs. The development of methods to functionalize the C-H bonds of these compounds facilitates drug discovery and is a major focus of synthetic organic chemistry. Of the various methods for heteroarene C-H functionalization, the Minisci reaction is of interest, and has been demonstrated to be a powerful tool in post-synthetic modifications of drug cores. The classical reaction is a two-component coupling between a nucleophilic radical and an electron-deficient heteroarene. Typically, the generation of the nucleophilic radical is achieved via the oxidation of a weak CH-bond or halogen-abstraction. In the interest of examining new methods to generate nucleophilic radicals, that can be employed in the Minisci reaction, a three-component process has been developed and successfully employed to functionalize three classes of heteroarene substrates in moderate to good yields. This three-component Minisci reaction involves the generation of an electrophilic radical that upon addition to some olefins, generates the desired nucleophilic radical. This polarity-reversal cascade allows for additional functionality to be installed into the side-chains of compounds, whereas with the classical variant the radical precursors must be pre-functionalized, and allows for further derivatization of medicinally useful molecules.

Student Name: Nora Gulick

Booth #: 34

Research Mentor: Aaron Moberly

Project Title: The Effects of Aural Rehabilitation on Phonological Sensitivity and Lexical Access

Abstract: Cochlear implants (CIs) restore a sense of hearing to patients with sensorineural hearing loss; however, successful listening and recognition of speech requires a number of cognitive functions and is more challenging with a CI due to the degraded sound signals it provides and the patient's diseased auditory system. Current at-home rehabilitation methods do not consistently nor effectively assist postlingual adult CI users to optimize speech recognition performance, which suggests the need for clinician-guided rehabilitation approaches. A particularly relevant skill to understanding speech is phonological sensitivity: a person's access to the mental representations of the phonological structure of their language. Successful listeners are able to match sounds they hear to internal representations of those speech sounds, which permits them to access stored lexical items from long-term memory in order to deduce the meaning. Phonological sensitivity is a known source of variability in speech recognition that may contribute to poor speech recognition performance. In the current study, we examined how clinician-guided aural rehabilitation affected the speed of phonological processing and lexical access for adult CI users, and the relationship between these abilities and speech recognition. Seven postlingual experienced adult CI users participated in 12 sessions of weekly clinician-guided aural rehabilitation. Participants were tested before and after rehabilitation to assess speech recognition abilities, phonological sensitivity, and speed of phonological and lexical access. Speech recognition abilities were tested under various conditions using real words, non-words, and full sentences. A non-auditory lexical decision task was used to assess phonological sensitivity and lexical access. Results suggest that phonological sensitivity and lexical access, as measured using the lexical decision task, relate to speech recognition outcomes. Moreover, in this small sample of CI users, clinician-guided aural rehabilitation may improve phonological sensitivity and/or lexical access speed, and improvements in these domains could be linked to improvements in speech recognition.

Student Name: Trey Hakanson

Booth #: 35

Research Mentor: Arnab Nandi

Project Title: Spatiotemporal Data Exploration Abstract

Abstract: As the availability of computing resources increases and the ease of generating spatiotemporal data decreases, the interface a person uses to interact with said data quickly becomes the bottleneck in determining insights. In addition, the barrier to entry for analyzing data via database queries has not improved much since SQL was invented. An interface that supports intuitive gestures to constrain queries and that has real time feedback is necessary to make gathering insights from large data sets accessible to anyone, technical or otherwise. To solve this problem, we created an interactive visualization tool that is compatible with any movement data set, which we define as having timestamped departure and arrival coordinates. The movement aspect of the dataset adds one more layer of complexity to the display - the visualization must show both spatial density and movement. To accomplish this, a multi-layered heatmap was used with different layers for departure and arrival, indicating movements. This tool has a multitude of features to facilitate garnering insights from spatiotemporal data sets: the data is displayed in multiple formats and in aggregate, visualizations update real time with changes to constraints, user-uploaded data sets are joined and displayed as overlays, and time-lapses/snapshots can be created to highlight trends. The visualization tool provides the user with a variety of constraining options, all of which can be used together to effortlessly ask complex questions about the data at hand. After applying the constraints, the current query is displayed via heatmap and aggregate histograms. Available constraints include: time of day, date, day of the week, trip distance, trip time, drawn geofences to designate departure and arrival, and more. All constraints are supplied via simple UI widgets, such as sliders, toggles, etc. Time lapses can also be generated and downloaded to facilitate sharing of novel trends.

Student Name: Lauren Hamer

Booth #: 36

Research Mentor: Alejandro Relling

Project Title: The Effects of Supplementing Increasing Doses of EPA and DHA Fatty Acids to Ewes in Late Gestation on Offspring Performance and Plasma Metabolites

Abstract: Multiple studies have shown improvements in performance of livestock due to supplementation of polyunsaturated fatty acids (PUFA). Other studies have shown an effect of fetal programming on offspring in livestock, though little work in this area has been done with ruminants. This research was conducted to analyze the performance and metabolic concentrations of lambs born from ewes that were supplemented with increasing concentrations of the PUFAs docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) during late gestation. The PUFAs were supplemented at concentrations of 0%, 1% and 2%. Our hypothesis was that body weight and average daily gain (ADG) would increase as the concentration of supplemented fatty acids increased. It was also hypothesized that glucose would increase in plasma and that non-esterified fatty acids (NEFA) would consequently decrease. The ewes (n=24 per treatment) started receiving the supplements 50 days prior to expected lambing. Supplementation finished on lambing day and all ewes received the same diet. Their lambs were weighed and bled at lambing, day 15, and day 60. Data were analyzed with repeated measurements considering the fixed effects of time, treatment and their interaction. There was no difference in body weight, plasma glucose, or NEFA concentrations (P>0.1). However, there was a time by treatment interaction on ADG (P <0.05). Lambs of ewes supplemented with PUFA at 1% dry matter showed a higher ADG (0.36 lb/d) than the 0% (ADG of 0.31 lb/d) or 2% (ADG of 0.33 lb/d) concentrations. The ADG from weaning to d60 was similar for the three treatments. This suggests that the fetal programming effects were only beneficial through the first 15 days postpartum. The fact that the 1% EPA and DHA supplement showed the highest ADG poses more questions to be answered. Future studies should focus on the effects within the first 15 days following birth.

Student Name: Omar Hamza

Booth #: 37

Research Mentor: Abhay Satoskar

Project Title: Live attenuated L. major centrin knockout parasites induce protective immune response in mice against cutaneous leishmaniasis.

Abstract: Leishmania is a genus of protozoan parasites that cause the zoonotic disease leishmaniasis. The species Leishmania major (L. major) is one of multiple species that cause the cutaneous form of the disease. Cutaneous leishmaniasis has 0.7-1.2 million new cases each year and causes disfiguring skin lesions that may persist for many years. Currently, there is no available vaccine and treatment options are often ineffective. Previous work has shown that mice immunized with centrin-deficient Leishmania donovani had early elimination of virulent parasite when challenged. Centrin is a calcium binding protein in eukaryotes that is necessary for leishmanial cell growth. The purpose of our study was to investigate the effectiveness of centrin-deficient L. major vaccine in mice. Mice were injected with PBS or 200x106 centrin-deficient L. major parasites via a footpad injection. Six weeks post-immunization, the mice were challenged with a subcutaneous ear injection of 104 of the virulent strain L. major LV39. Ear lesion size was measured weekly and serum samples were obtained every two weeks. At 10 weeks post-challenge, the lymph nodes and ears were harvested to determine cytokine expression. Preliminary results showed the mice that received the vaccination developed smaller ear lesions and lower parasitic loads when compared to mice that were not vaccinated. In addition to this, the mice that received the vaccine have also displayed a higher trend of disease protective cytokines. Our results suggest that centrin gene-deficient L. major parasites can be used as an effective vaccine to induce immunity against cutaneous leishmaniasis and reduce the clinical disease outcome.

Student Name: Nick harvey

Booth #: 38

Research Mentor: Matt Gray

Project Title: Double Perovskites Phase Diagrams

Abstract: For a variety of environmental and economic reasons, there has been a growing interest in renewable solar energy research in recent years. My research is focused on the synthesis of lead-free halide materials in order to map out their phase diagrams. The specific phase diagram that has been the focus of my research is the Cs-Bi-Ag-X (X= Br, Cl) phase diagram. This system has been of interest because of the double perovskites formed from these elements, Cs2AgBiX6. This class of materials ultimately will be applicable in solar cell production; we aim to increase the efficiency of these cells and seek to fully understand the syntheses of the materials of the phase diagram. The compounds (CsAgBr2, Cs2AgBr3, CsAgCl2, Cs2AgCl3) were synthesized; the bromine based compounds more readily formed pure products than the chlorine analogs. Phase pure materials were characterized by X-ray diffraction and diffuse reflectance spectroscopy. Cs3BiX6 and AgBiX4 the remaining compounds that have not yet been synthesized from the phase diagram. Once these have been made we will have a better understanding of all the properties of the materials in this phase diagram. We have found more double perovskites to research and have started to complete the phase diagrams for these materials.

Student Name: Kristen Hong

Booth #: 39

Research Mentor: Alex Sparreboom

Project Title: USING ZEBRAFISH AS A MODEL TO EVALUATE THE EFFECTS OF TYROSINE KINASE INHIBITORS ON PLATINUM DRUG TOXICITY

Abstract: Organic Cation Transporter 2 (OCT2) is partially responsible for the uptake of platinum-based anti-cancer drugs, such as cisplatin. This uptake induces severe neurotoxicity, nephrotoxicity, and ototoxicity and can be life threatening. We found a number of Tyrosine kinase inhibitors (TKIs) able to inhibit the function of OCT2 in order to lessen these toxic side effects. This project focuses on exploring the potential utility of zebrafish OCT (drOCT1) as a new model to study the effect of TKIs on the toxicity induced by platinum drugs. In vitro experiments were performed with HEK293 cells or Hela cells over expressing human OCT2 (hOCT2) or the single drOCT1, respectively. The sequence alignment program MAFFT v7, shows 71% identical protein sequences between hOCT2 and drOCT1 protein, and 91% between human and zebrafish YES1, the tyrosine kinase responsible for OCT2 phosphorylation. Various TKIs were confirmed to inhibit hOCT2 and drOCT1 uptake of the specific substrate ASP (4-[4-(dimethylamino)styryl]-N-methylpyridinium-iodide) at comparable levels: Dasatinib (63.6% vs 53.6%), Nilotinib (66.5% vs 68.8%), Sunitinib (70.7% vs 90.6%). Uptake of cisplatin by hOCT2 and drOCT1 was similarly strongly decreased in in the presence of these three TKIs as well as ibrutinib (p-values< 0.0001). In vivo experiments were performed using zebrafish 5 dpf. Treatment with Dasatinib and cisplatin show a decrease in uptake of two specific substrates, ASP and Rhodamine 123, by drOCT1 in the neuromast cells of the fish. Use of the neuromast-labeling dye FM1 43 FX confirmed loss of neuromasts after cisplatin treatment. On the basis of these findings, drOCT1 seems to be a potential model asset in further investigation of OCT2 and toxicity induced by platinum drugs.

Student Name: Justin Jiang

Booth #: 40

Research Mentor: Yizhou Dong

Project Title: Biodegradable Amino-Ester Nanomaterials for Cas9 mRNA Delivery in Vitro and in Vivo

Abstract: The Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) and CRISPR-associated protein 9 (Cas9) system has been widely used as a powerful tool for genome-editing. However, efficient and safe delivery of CRISPR systems is one of the key challenges for their therapeutic applications. In order to address these issues, we designed and synthesized a series of biodegradable lipid-like nanoparticles (LLNs) containing ester groups for Cas9 mRNA delivery. Two lead materials, termed as MPA-A and MPA-Ab, showed tunable rates of biodegradation in cell and animal models. MPA-A with linear ester chains was degraded dramatically faster than MPA-Ab with branched ester chains. Moreover, MPA-A and MPA-Ab demonstrated significantly higher delivery efficiency for Cas9 mRNA than C12-200, a lead material reported previously. Most importantly, both MPA-A and MPA-Ab LLNs exhibited effective and safe delivery of Cas9 mRNA in mouse models. Consequently, these biodegradable lipid-like nanoparticles offer a reliable platform of delivering Cas9 and merit further development as a genome-editing delivery tool for biological and therapeutic applications.

Student Name: Jillian Johnson

Booth #: 41

Research Mentor: Sarmila Majumder

Project Title: The cell autonomous role of Tlk1/2 in cell cycle regulation and development

Abstract: Tlk1/2 is a serine-threonine kinase with its activity maximal during the S-phase of the cell cycle. It phosphorylates Asf1a/b and H3, which regulate chromatin dynamics. Tlk1 was identified in a genome-wide stroma specific RNAi screen in 'Ras-sensitized' C. elegans strains. In addition to Tlk1 this screen identified 38 stromal factors that suppress the proliferation of adjacent epithelial cells. Given the important role of Tlk1 and its homologue Tlk2 in cell cycle regulation and therefore cancer, my project focusses on the cell-autonomous role of Tlk1/2. To understand the in-vivo function of these genes we generated whole body knockouts of Tlk1 and Tlk2. Our data shows that while the Tlk1-/- single knockout mice are viable, Tlk2-/- are embryonic lethal. The Tlk1-/-;Tlk2+/- (mutant) mice are viable but runted compared to the Tlk1-/- mice or their control (Tlk1+/+ Tlk2+/+) littermates. Histologically most of the tissues/organs appeared normal but the skin of the knockout mice is very thin with apparent loss of hypodermis. The mutant mice displayed a decrease in T and B-lymphocytes in the spleen. RT-PCR analysis of apoptosis related genes BAX and killer showed no difference between the control and the mutant mice. The important cell cycle regulators E2f1, 2 and 3 are deregulated in some tissues. Tlk has been shown to be important for cell-growth and development in plants and lower animals. We have concluded for the first time that Tlk2 is an indispensable gene that controls mammalian growth and development and that the knockout is embryonic lethal. In order to elucidate the underlying mechanism, we have collected tissues at a various time points during development of these mice and we will analyze the expression of cell cycle (Cyclin E, PCNA and Cdc6) and additional apoptotic genes (Cleaved-caspase 3, Puma, Noxa). Furthermore, we are studying its role in chromatin modulation by analyzing the targets like histone chaperone Asf1a/b.

Student Name: Alexander Keast

Booth #: 42

Research Mentor: Jay Gupta

Project Title: Copper Oxide Studies with Electrochemical Scanning Tunneling Microscopy

Abstract: The ability to capture and reutilize a greenhouse gas as a functional hydrocarbon addresses many world energy and environmental concerns. Using catalytic processes it is possible to efficiently reduce CO2 into CH3OH on the copper oxide surface. Copper oxide can act as a semiconductor, having a band gap which falls within the solar spectrum of light. The electron energy required to facilitate this reduction reaction also falls mid gap allowing for electrons to easily be excited to a valence band state and relaxed to this mid gap state, carrying out the reaction. These processes have been studied on a macroscopic scale but an atomic understanding is yet to be discovered. Electrochemical scanning tunneling microscopy (EC-STM) is a technique which allows us to probe surface topographies with atomic resolution while also conducting electrochemical experiments, providing an ideal method for characterizing this catalytic process. Depositing Cu(111) on the Au(111) substrate via underpotential deposition we then image and conduct experiments on the sample surface via EC-STM to study which CO2 reduction reactions are preferred.

Student Name: Brian King

Booth #: 43

Research Mentor: Devina Purmessur

Project Title: Investigating the Role of Aggrecan in Intervertebral Disc Disease

Abstract: Lower back pain resulting from degeneration of the intervertebral disc (IVD) affects nearly 85% of Americans at some point in their lives1. The mechanisms of this degeneration are not fully understood, but aggrecan, a proteoglycan, is highly implicated in its pathogenesis2. Intact aggrecan is thought to inhibit angiogenesis, or the ingrowth of blood vessels, into the IVD3. This reduces the growth of neurites which would cause pain3. In addition, aggrecan's degradation in a degenerate disc further implicates it in IVD degeneration3. Human aggrecan has a variety of molecular side-chains that, while intact, could contribute to the inhibition of angiogenesis including: 0S iduronic acid, 4S galactosamine, and 6S galactosamine4. Both aggrecan's side-chains and core protein degrade in a degenerate disc. We hypothesize that these degraded products provide necessary biomolecules for the expansion of blood vessels into the IVD and, therefore, intact aggrecan and its side chains will inhibit angiogenesis while degraded aggrecan and its side chains will increase angiogenesis relative to a positive control. To test the effect of the different side chains of aggrecan, we exposed Human Umbilical Cord Endothelial Cells (HUVECs) to the different side chains of aggrecan, both intact and degraded, at both 10 and 100 μg/ml. To represent each of our side chains, we used the commercially available Chondroitin Sulfate-B (CS-B), Chondroitin Sulfate-A (CS-A), and Chondroitin Sulfate-C (CS-C), respectively. To degrade the side chains, we used chondroitinase-ABC, and analyzed the total tubular formation for each condition after 16 hours. After completing experiments for CS-A and CS-B, we found that degraded CS-A ($p = .517$) at 100 μg/ml and degraded CS-B($p < .05$) at 10 μg/ml significantly increased angiogenesis relative to a control. This research advances scientific knowledge about the degeneration of the intervertebral disc and will allow for the development of future clinical treatments.

Student Name: Taylor Klass

Booth #: 44

Research Mentor: David Barker

Project Title: Assessment of smallholder urban and peri-urban dairy production with zero-grazing practices in Kampala, Uganda

Abstract: Many people in Kampala, the capital city of Uganda, own a few dairy cows to provide milk and income for their family. Most of these dairy farmers feed their cows with a system called zero-grazing, where the cows are confined and feed is brought directly to the cows. This research project evaluated the smallholder dairy system in urban and peri-urban Kampala, Uganda. Research studies have been conducted on specific parts of smallholder, non-grazing dairy farms in Africa before. However, this project was unique in the fact that it focused on the urban, smallholder dairy farming system as a whole. The main objective of this research project was to collect information from urban and peri-urban dairy farmers that could be used to better understand their production systems and how they can be improved to benefit the farmers and their families. 10 farms that use zero-grazing practices to feed their dairy cows were surveyed. Each survey included four different parts: Feed analysis, cow evaluation, milk yields, and milk marketing. This project showed that many of these farmers struggle with the same challenges, which include feed scarcity, herdsmen, vet, and inseminator unreliability, and lack of capital. The dairy cows in Kampala are not getting enough feed, which results in low milk production levels and reduced fertility. Each family interviewed recognized the nutritional importance of the milk they collect and consume. Where there is lack of good management knowledge, education can help. However, the bigger problem for these smallholder farmers is the lack of support and capital to put into practice beneficial management procedures for their cows. This project provided much needed information on the smallholder, urban dairy system in Kampala as a whole and showed the small amount of education and empowerment needed to make these farmers more productive and resilient.

Student Name: Ravali Kode

Booth #: 45

Research Mentor: Christopher Callam

Project Title: Synthesis of Heterocyclic Quinone Methide Precursors for the Re-alkylation of Aged Acetylcholineesterase

Abstract: Organophosphorus (OP) compounds are known to cause the inhibition of the enzyme Acetylcholinesterase (AChE). AChE is responsible for hydrolyzing acetylcholine to choline and acetic acid in the peripheral and central nervous system. When exposed to organophosphorus (OP) compounds such as pesticides or chemical nerve agents, AChE is covalently inhibited followed by an aging process. In the event of exposure, the body experiences muscle twitches, reduced vision, paralysis, vomiting, convulsions, and ultimately death. The severity of these symptoms depends on the type of OP compound and duration of exposure. Upon inhibition, current treatments include a family of pyridinium oximes which reverse the covalent binding and reactivates the enzyme. As the enzyme transitions from an inhibited to an aged state, currently there are no known pharmaceutical treatments that reverse this aging process, and chances of survival significantly decrease. Our research revolves around developing small molecules that can be used in re-alkylating the aged enzyme to ultimately reactivate them. Computational studies have shown that quinone methides (QMs) and quinone methide precursors (QMPs) are able to bind to the active site of AChE and aged AChE. This along with their ability to re-alkylate DNA has made them viable molecules in efforts to reactivate and resurrect. Our current library of compounds consists of a basic framework of pyrimidines, pyridines, and pyrroles with varying functional groups. The variation of these groups allows us to explore both electronic and steric interactions on these compounds with AChE. Â The synthesis and screening of these compounds will be presented.

Student Name: David Kormos

Booth #: 46

Research Mentor: Karen Dannemiller

Project Title: Use of Digital PCR for detection of microorganisms in house dust

Abstract: We spend 90% of our time indoors where we are exposed to a diverse community of fungi and bacteria that can negatively impact health, especially for people with asthma. Microbes may be detected in the indoor environment by using polymerase chain reaction (qPCR), but qPCR has some limitations. Digital PCR (dPCR) may provide greater precision at low concentrations and is less prone to inhibition. The goal of the study is to determine the accuracy, precision, and reproducibility of these methods. Bacillus atrophaeus, Aspergillus fumigatus, and Escherichia coli cells were spiked into house dust and embedded into low pile and medium pile carpets. These dust samples were then vacuumed from the carpets, the DNA was extracted, and qPCR was performed to gain a comparison for dPCR. Results revealed that carpet pile had a larger influence on DNA recovery than microbe type. The extraction efficiencies from the carpet ranged from 92 to 95 percent from the low pile carpet for the microbes, and 69 to 76 percent from the medium pile carpet. The efficiencies for the qPCR must be reproduced and calculated before reporting. The digital PCR experiments will soon be conducted to calculate the efficiencies and compare the precisions of the different methods. Understanding these collection and extraction efficiencies is important for accurate determination of microbial concentrations. The findings from this study will inform future studies of indoor exposures relevant to public health and policy.

Student Name: Claire Kovalchin

Booth #: 47

Research Mentor: Craig Burd

Project Title: The Impact of In Utero Bisphenol A Exposure and the Mechanisms of its Effect on the Development of Breast Cancer

Abstract: Previous studies have shown that in utero exposure to diethylstilbestrol (DES), a synthetic form of estrogen, increases the risk of developing various forms of cancer, including breast cancer, later in life. Bisphenol A (BPA) has been shown to act as a synthetic estrogen, and acts similarly to DES in rodents. Both compounds belong to a class of compounds known as endocrine disrupting compounds (EDCs), known to have hormonal activity. In utero BPA exposure can also increase the risk of developing breast cancer in rodents. The exact mechanism by which BPA alters the morphology of the mammary gland to create this susceptibility, however, is unknown. We have shown that BPA affects the expression of two key proteins, Ki67 and ERα, in the stroma, correlating to significant defects in the epithelium. These data suggest that BPA induced alterations in the stroma may affect the epithelial phenotype, specifically ductal branching. One cell type of the stroma, fibroblasts, contribute to the production of the extracellular matrix (ECM), which provides structural support for the epithelial ducts. These cells also communicate with the developing epithelium through secreted proteins. Therefore, fibroblasts are critical to both the structure and function of the mammary gland. Alterations to fibroblasts have the potential to lead to changes that can disrupt normal development and cellular function in the mammary gland. In order to assess what specific alterations in the fibroblasts may contribute to epithelial cancer transformation, we measured a major component of the ECM, collagen. We demonstrate that BPA exposed fibroblasts have increased collagen in the mammary glands, a molecular phenotype shown to increase cancer risk.

Student Name: Nydia Kung

Booth #: 48

Research Mentor: Chien-liang Lin

Project Title: Investigating increased glutamate transporter EAAT2 expression as a potential therapeutic approach for chronic stress-induced depression

Abstract: In the United States, about 16.1 million adults suffer from Major Depressive Disorder (MDD). Although drug medications exist, the most prevalent serotonin and norepinephrine-targeting antidepressants are ineffective for subpopulations of depressed patients. Drug therapy for MDD needs to be improved. Studies have shown that MDD is linked to problems with the glutamatergic system. Chronic stress increases extracellular glutamate levels in several limbic and cortical areas to abnormal levels, which could cause dyshomeostasis of the glutamatergic system. This could lead to dendritic retraction and astrocytic atrophy. The resultant synaptic suppression could be a key factor in the development of MDD. EAAT2, the main glutamate transporter expressed in astrocytes, regulates glutamate levels. The purpose of this pilot study is to explore the therapeutic potential of the LDN/OSU-215111 compound, previously shown to increase EAAT2 expression. We hypothesize that increased EAAT2 expression can ameliorate the dyshomeostasis of the glutamatergic system and prevent the development of chronic stress-induced depression. Two groups of wild-type C57BL/6 mice—one treated with vehicle and one with LDN/OSU-215111—were subjected to a previously established unpredictable chronic stress regime for 7 weeks. Following 7-weeks of chronic stress, several depression- and anxiety-related behavior tests were conducted. After completing behavioral tests, the mice were euthanized and brains were harvested for pathological assessment. Adrenal glands were removed and weighed. This pilot study is currently underway. The detailed results will be presented.

Student Name: Madeline Lambrix

Booth #: 49

Research Mentor: Justin Chaffin

Project Title: Nutrient Limitations in the central basin of Lake Erie

Abstract: Freshwater phytoplankton growth is typically assumed to be phosphorus (P) limited, but occurrences of nitrogen (N) limitation have been documented in N-fixing cyanobacteria dominant N-limited waters. The central basin of Lake Erie has low P and high nitrate-N concentrations, but blooms of the N-fixing cyanobacterium Dolichospermum occur nearly every summer. The low P and high N concentrations in the central basin of Lake Erie make the presence of Dolichospermum difficult to understand. Iron (Fe) is required for nitrate assimilation and if Fe availability is too low, nitrate assimilation will be constrained and induce N-limitation. To determine nutrient limitation of central basin phytoplankton, five nutrient enrichment bottle bioassays were conducted with water from offshore Avon, Ohio during summer 2017. Lake water was incubated with increased concentrations of P (+P, 1.0 µM), P and ammonium-N (+P+NH4, 25 µM), P and Fe (+P+Fe, 0.5 µM), and a control without increased nutrients. Chlorophyll a (Chla) and nitrate concentrations were measured before and after 1-week incubation. I hypothesized algal biomass would be greater in the +P bottles compared to control. I further hypothesized that +P+Fe and +P+NH4 would have higher biomass than +P because the Fe enrichments would allow for ambient nitrate assimilation and because ammonium-N assimilation is not dependent on Fe. In 4 of the 5 experiments, Chla concentrations were significantly (p<0.05, ANOVA) higher in +P than control, which indicates that P was the primary limiting nutrient, and in 4 of 5 experiments +P+NH4 resulted in higher chla than +P, which indicates a secondary N limitation. In all experiments, nitrate concentrations in +P+Fe and +P did not differ, which indicates that Fe was not constraining nitrate assimilation. My results indicate that N-limitation occurs in the central basin waters and promotes blooms of the N-fixing cyanobacterium Dolichospermum.

Student Name: Brent Lary

Booth #: 50

Research Mentor: Myles Moore

Project Title: Source of Hydrocarbons within Gulf of Mexico Methane Hydrates

Abstract: Although large volumes of gas hydrates (~1000 gigatons of carbon) are known to exist along continental slopes and below permafrost, their role in the energy sector and the global carbon cycle remains uncertain. Investigations regarding the genetic source(s) (i.e., biogenic, thermogenic, mixed sources of hydrocarbon gases), the location of hydrocarbon generation, (whether hydrocarbons formed within the current reservoir or underwent migration), and the timing of natural gas formation within clathrates are vital to evaluate economic potential and enhance our understanding of geologic processes. To address some of these uncertainties 14 samples were collected from pressurized cores from coarse silt/sand reservoirs ~600 m below the seafloor within the GC955 block of the Green Canyon protraction area at the edge of the Sigsbee escarpment. This study also compared previously published data from Bush Hill, Atwater Valley, and Keathley Canyon, to observe differences in gas composition/source throughout the Gulf of Mexico. These studies analyzed gas samples for hydrocarbon molecular composition (C1/C2+) and isotopic composition of methane (δ13C-CH4, δ2H-CH4), ethane (δ13C-C2H6), and carbon dioxide (δ13C-CO2) Yet, these techniques used alone can be complicated by uncertainties caused by contributions of mixing, transport/migration, methanogenesis, and aerobic or anaerobic oxidation in the subsurface. Because the original noble gas composition of a fluid is preserved independent of microbial activity, chemical reactions, or changes in oxygen fugacity, the integration of noble gas data can provide both a geochemical fingerprint for sources of fluids and an additional insight as to the uncertainty between effects of mixing versus post-genetic modification. Therefore this study analyzed gas samples collected from pressurized cores of gas hydrates for hydrocarbon molecular content (C1/C2+) and noble gas isotopes (He, Ne, Ar) to determine the source and timing of natural gas formation within the Gulf of Mexico. Preliminary results suggest that hydrocarbons gases from this study area are dominantly formed by biogenic processes with residence time estimates ranging from 6.2-49.8 kyr.

Student Name: Gabriella Leccese

Booth #: 51

Research Mentor: Thomas McDow

Project Title: How Did the Attitudes Towards Contraception from Catholic Church Impact the HIV Epidemic in Iringa, Tanzania?

Abstract: The Catholic Church's teaching that it is sinful to prevent procreation has led to a longstanding negative attitude towards the use of contraception. The church maintained this attitude world-wide, even in the face of the burgeoning HIV epidemic and proof that condoms could prevent transmission of this disease. Pope Benedict XVI, in early 2005, stated that although HIV was a cruel epidemic, it could not be cured by using contraception, causing practicing Catholics to disregard condoms as a prevention method. Yet in the last decade, even as current Pope Francis acknowledged a place of condom use for disease prevention among Catholics, Tanzanian Catholics insisted on more conservative practices. This study focus on the Iringa region in Tanzania, where the rate of HIV is 9.1% by 2014 and where Catholicism is practiced by 26.8% of the people by 2016. This study is based on interviews, each about an hour in length, with 3 priests and 9 students from the Ruaha Catholic University in the Iringa region. Here we show that attitudes of parishioners and priests did not change from Pope Benedict's original statements- in fact, contraception usage even as a method of prevention was considered morally abhorrent, demonstrating that conservative policy is still implemented by members of the Catholic Church. We found that even with contraception being enforced through HIV prevention campaigns, the use of contraception was not discussed by the church. In addition to contraception being rejected, it also was a starting place for the myths of the fallacies of condoms, such as why condoms from the "West" cannot be used in Tanzania. These findings can be used to help community-based programs to promote HIV prevention within Catholics in Iringa, as it is clear that simply promoting contraception is not effective.

Student Name: Eun-Ju (Joyce) Lee

Booth #: 52

Research Mentor: Jill Rafael-Fortney

Project Title: Aldosterone synthase in inflammatory cells in skeletal muscle acute and chronic injury

Abstract: Duchenne Muscular Dystrophy (DMD) is an X-linked neuromuscular disorder affecting approximately 1 in 5000 males ranging from ages 5 to 241. The pathophysiology of DMD isÂ dueÂ to mutations in the gene encoding dystrophin, a key structural element in skeletal and cardiac muscle. The absence of dystrophin results in significant muscleÂ degeneration and chronic inflammation, leaving patients wheel-chair bound by the age of 12 and eventually mortality. The leading cause of death is cardiomyopathy. The mineralocorticoid receptor is a nuclear hormone receptor that is most commonly bound and activated by the MR agonist aldosterone, a mineralocorticoid synthesized from the enzyme CYP11B2 (aldosterone synthase). MR has recently been found in skeletal muscle and CYP11B2 has been recently found in immune cells that characterize the chronic inflammatory response in DMD2. Preclinical studies show improvement in cardiomyopathy, and surprisingly, in skeletal muscle myopathy by treating DMD mouse models with ACE inhibitors on conjunction with mineralocorticoid receptor (MR) antagonists3. The aim of this study was to determine whether immune cell composition is altered in muscle damage in the absence of skeletal muscle MR. A skeletal muscle MR conditional knockout (MR-cko) mouse model was generated in our lab. Acute injury was induced in MR-cko and controls by injecting $BaCl_2$ into the tibialis anterior (TA), which was dissected (1 and 4 days post-injection), cryosectioned, and analyzed by immunofluorescence microscopy. We found that CYP11B2 was localized to a subset of CD68+, CD206+, and Ly6G+ cells, which supports the function of aldosterone production in the process of muscle repair upon injury. However, more co-localization was observed between CYP11B2 and CD68+ cells (M1 macrophages) than CD206+ (M2 macrophages) and Ly6G+ (neutrophil markers). Data analysis is still ongoing. Results will provide insight on potential therapeutics and combination of therapies to target cell types involved in the pathogenesis of DMD.

Student Name: Alexandria Lenyo

Booth #: 53

Research Mentor: Sameek Roychowdhury

Project Title: Point mutation E566A contributes to cholangiocarcinoma therapy resistance

Abstract: Objectives. The fibroblast growth factor receptor (FGFR) family regulates cell processes, including apoptosis, cell proliferation, and migration. Genetic alterations in FGFRs, including gene fusions, copy number variations, and single nucleotide variations can lead to malignancies in cells affected. Several FGFR inhibitors are in clinical trials, and some patients show initial disease regression while on these targeted therapies. Unfortunately, most patients develop resistance to targeted therapies within a short time, and their disease progresses. The mechanism of this acquired resistance and methods to prevent this resistance are unexplored. Methods. Next generation sequencing identified an FGFR2-KIAA1598 gene fusion in a cholangiocarcinoma patient. The patient was placed on a clinical trial for the FGFR inhibitor, BGJ398, and after two months showed significant tumor reduction. Unfortunately, she progressed eight months after starting BGJ398 and a repeat tumor biopsy was sequenced, identifying a single point mutation, E566A, in the FGFR2 kinase domain suggesting that resistance to BGJ398 is driven by E566A. To determine the effect of E556A on response to therapy, we have stably transduced NIH3T3 cells with either empty vector, FGFR2-KIAA1598 WT, or FGFR2-KIAA1598 E566A. The three conditions were dosed with increasing amounts of BGJ398, and the half maximal inhibitory concentration (IC50) was determined. Results. The results indicated that FGFR2-KIAA1598 WT responded to BGJ398 with an IC50 of 10.95 nM, while FGFR2-KIAA1598 E566A was resistant to BGJ398 with an IC50 of 422.4 nM. We also explored other FGFR inhibitors and found that FGFR2-KIAA1598 WT and FGFR2-KIAA1598 E566A were equally sensitive to Ponatinib, yet neither were sensitive to Dovitinib. Lastly, we found that while FGFR2-KIAA1598 WT cells were sensitive to AZD4547, FGFR2-KIAA1598 E566A cells were resistant to this drug. Significance. A deeper understanding of the mechanism and implications of acquired resistance to FGFR inhibitors can lead to novel clinical strategies to prevent drug resistance.

Student Name: James Li

Booth #: 54

Research Mentor: Peter White

Project Title: Selection as a Function of Local SNP mRNA Disruptions in the Canonical Transcript of BRCA2

Abstract: Prior studies have examined various coding and epigenetic consequences of BRCA mutations. There has not yet been a focused mRNA folding analysis for mutations in BRCA genes. Our aim was to see if among 60,706 individuals, allele frequencies of highly disruptive single nucleotide polymorphisms (SNPs) in BRCA2 were constrained by their local mRNA disruptions, which would support the notion that BRCA genes are at least partially selected for by folding disruptions. 2,597 SNPs within the NM_000059.3 canonical transcript of BRCA2 were extracted from the Exome Aggregation Consortium (ExAC) database. Each of these SNPs had their genomic coordinates converted to NM_000059.3 transcript positions via Mutalyzer. 101 base mRNA flanking sequences were extracted for each of those SNPs using UNIX and analyzed with the ViennaRNA Package to produce 5 RNA folding metrics. Welch's t-tests were performed between the upper 5% disrupting SNPs and the bottom 95%, and between the lower/upper 2.5% disrupting SNPs and the central 95%, for one and two-tailed metrics, respectively. A majority of highly disruptive SNPs for edit distance, stability, and ensemble diversity had much lower average allele frequencies (p-values from 5.14E-3 to 0.0111); on the other hand, significant negative changes in free energy did not noticeably constrain allele frequencies (p-values >0.05). The most disruptive type of SNPs and subregion were missense SNPs in the coding region (p-values from 0.0102 to 0.0433), and the most highly disruptive mutations were A>G and T>C transitions (p-values <0.01). The top 100 most common SNPs had higher free energies than the 100 least common (p-values: 0.0284 and 0.0363). All together, these results suggest that the sequence of BRCA2â€™s canonical transcript has been at least partially selected for by SNP disruptions of mRNA secondary structure and stability.

Student Name: Jian Ren Lim

Booth #: 55

Research Mentor: Li-Chiang Lin

Project Title: Atomistic Understandings of the Effects of Force Field on Their Predictions of Carbon Dioxide Adsorption Properties in All-Silica Zeolites

Abstract: The escalated carbon dioxide concentration has become one of the great challenges humanity is currently facing. Scientists and engineers have taken various measures to take on carbon pollution for decades. One of the promising methods to reduce carbon emissions is through Carbon Capture and Sequestration (CCS). The idea is to ad/absorb CO2 selectively from flue gases (e.g., emissions from coal-fired power plants) and store it underground. A main challenge in CCS today is to find optimal materials that are able to minimize the energy cost of the process. Compare to amine scrubbing methods, nanoporous materials such as zeolites are predicted to be able to use 30-40% less energy. In search for optimal nanoporous materials , computational approaches using state-of-the-art molecular simulations play a critical role to effectively study a vast number of materials. For this, adopting a force field to accurately describe intermolecular interactions is of utmost importance. To date, six available force fields have been reported to describe CO2 in zeolites. In this project, we strive to study the difference between force fields with the aim of identifying which force fields that may provide the most consistent predictions. More than one hundred geometrically diverse zeolite structures are investigated herein. We use grand canonical Monte Carlo simulations to calculate the adsorption property of CO2 in each zeolite. The discrepancy in predicted adsorption properties by different force fields will be also correlated to the structural properties of zeolites at an atomic level, informing us what type of zeolites may require extra care as a large uncertainty in computational predictions may exist. As a long-term goal, we aim to determine the accuracy of force fields quantitatively, and use density functional theory (DFT) calculations to provide a direct measure. We anticipate the outcomes of this work can help guide future computational studies.

Student Name: Nicole Lorig

Booth #: 56

Research Mentor: Kelly George

Project Title: Preconditioning sows with classical music to reduce aggression in group housing

Abstract: The current study examines the effect of preconditioning with music on aggressive behavior among sows placed in group housing. One group of sows was exposed to five minutes of classical music for five days preceding placement into a group pen (music group, n = 8). The control group was exposed to five minutes of background noise for five days preceding placement into the same group pen (non-music group, n = 7). During preconditioning, each group was offered feed. It was hypothesized that preconditioning with music would reduce aggressive behaviors (initiating, reciprocating, or avoiding altercations). The results confirm that preconditioning with music does reduce the number of these behaviors. The results of this study suggest that continued exploration of the use of music prior to or during exposure to group housing could benefit the swine industry.

Student Name: Shuwei Lu

Booth #: 57

Research Mentor: Nicholas Brunelli

Project Title: Increasing Fructose Yield for Glucose Isomerization through Utilizing Borate Salts

Abstract: Consumption of fossil fuels that took millions of years to produce is occurring at an unsustainable pace. To overcome this challenge, alternative methods must be found to convert biomass. In the field of biomass conversion, the isomerization of glucose to fructose is a bottleneck in producing hydroxymethylfurfural (HMF) from glucose. Studies in the past have found that Sn-BEA (beta framework zeolite with a catalytic tin site) is an effective catalyst for the isomerization of glucose to fructose. The main problem in achieving a higher yield of fructose is that the isomerization is equilibrium limited, and reliable methods are needed for the equilibrium to be shifted. Per Le Chatelier's principle, a change to a system's temperature, pressure, volume, or concentration will result in a shift in equilibrium. Borate salt and analogues have been found to selectively complex with fructose and remove it from the solution and thus decreasing the concentration of fructose in the solution. Le Chatelier's principle dictates that the system will produce more fructose to return to equilibrium. If the borate species are in solution, they can interact with Sn-BEA catalysts and deactivate it, acting as catalyst poison. We will investigate the capabilities of and immobilized borate salt species to shift the equilibrium in favor of fructose production. By removing fructose from the equilibrium and allowing for more fructose to be selectively produced, we expect the fructose yield to be higher than using only Sn-Beta or glucose isomerase in previous reported studies.

Student Name: Baylie MacRae

Booth #:

Research Mentor: Harmony Bench

Project Title: Discovering Pearl Lang

Abstract: Pearl Lang (1921–2009) is the best-connected least-known modern dance choreographer of the 20thcentury. A principal dancer for renowned choreographer Martha Graham, to whom Graham entrusted her roles upon retirement from the stage, Lang was well respected within the dance community as an artist and teacher. However, she remains largely absent from dance scholarship. Drawing from archival resources housed at the Library of Congress, including correspondence from the distinguished dance critic John Martin, Martha Graham along with her choreographic notes, I contend that Pearl Lang was an influential choreographer who helped to cultivate and represent Jewish identity on the concert stage through modern dance. I further argue that her commitment to her religious identity also alienated her from reaching a wider audience and was often compared to Martha Graham's work. In this presentation, I trace Lang's transition from the Martha Graham company into her own career as a choreographer. My findings will bolster Lang's legacy in dance history. This project was developed with guidance from Dr. Harmony Bench and is supported by an Undergraduate Research and Creative Inquiry fellowship.

Student Name: Angelique Marquina

Booth #: 59

Research Mentor: Josh Englert

Project Title: Role of mTORC1 activation in atelectrauma during mechanical ventilation

Abstract: Background: ICU patients with the acute respiratory distress syndrome (ARDS) often require mechanical ventilation (MV) and are at risk for ventilator-induced lung injury (VILI). Atelectrauma is a form of VILI that occurs from shear stress produced by repeated alveolar collapse and expansion. mTORC1 is a multi-protein complex involved in response to stress and plays a key role in regulating cell growth. We hypothesized that mTORC1 would be activated in in vivo and in vitro models of atelectrauma. Methods: Human bronchial epithelial cells (HBE) and small airway epithelial cells (SAEC) were cultured on collagen-coated glass cover slips and placed into a bioptechs chamber to induce bubble flow for varying times and velocities. C57BL/6 mice were anesthetized and a tracheostomy was performed prior to MV with varying tidal volumes without positive end expiratory pressure (PEEP) to induce atelectrauma. Lung physiology parameters were measured at baseline and hourly for 4 hours. Capillary permeability was measured by using the total protein in bronchial lavage (BAL) fluid and cytokines levels were measured using ELISA. mTORC1 activation was measured by immunoblotting for the phosphorylated isoform of the ribosomal protein S6 (P-S6). Result: In-vitro bubble flow activated mTORC1 in HBE cells in a time and velocity-dependent manner. HBE cells subjected to bubble flow had increased P-S6 levels after 30 minutes of bubble flow. Mice ventilated without the use of PEEP to induced atelectrauma had increased markers of lung injury compared to mice ventilated with PEEP. Furthermore, mice subjected to atelectrauma had increased mTORC1 activation in lung tissue compared to mice ventilated without atelectrauma. Conclusions: mTORC1 is activated in in-vivo and in-vitro models of atelectrauma. Future studies will determine the biomechanical mechanisms of atelectrauma induced mTORC1 activation including the role of shear stress.

Student Name: Aidan Matzko

Booth #: 60

Research Mentor: Sameek Roychowdhury

Project Title: Correlation of DNA repair gene methylation events with sensitivity to poly-ADP-ribose polymerase inhibitors in cancer

Abstract: Methylation occurs at 70-80% of CpG sites and can result in increased or decreased gene expression. The goal of this project is to characterize methylation events for selected genes that correlate with sensitivity to specific therapies and thereby influence selection of treatment options for patients. As an example, tumors that have mutations in DNA repair genes, such as the homologous repair genes BRCA1 and BRCA2, have been shown to be especially sensitive to a class of drug called a poly ADP ribose (PARP) inhibitor. We hypothesize that hypermethylation in the promoter of DNA repair genes will increase sensitivity to PARP inhibitors. To answer this hypothesis, we obtained Infinium microarray data representing the methylation states (3776 probes for 406 DNA repair genes) and cell viability data representing PARP inhibitor sensitivity for 949 cancer cell lines. We compared CpG methylation at the promoters of DNA repair genes in cell lines with sensitivity to PARP inhibitors or cisplatin chemotherapy, and did not identify any significant CpG sites. Similar results were seen when correlating methylation with gene expression (RNA sequencing data). We hypothesize that this is because there are many genetic and epigenetic factors that affect both sensitivity and gene expression that confound our analyses. Next, we have analyzed whole exome sequencing data for each of the cell lines to evaluate and measure substitution mutational signatures, specifically to identify signature “3” which occurs in homologous repair defective cancers (BRCA1 and BRCA2). We have identified 374 cell lines with signature “3.” This cohort will be compared to the remaining with PARPi sensitivity, transcript expression, and methylation. This is the first step in developing a predictive panel of methylated gene targets that will allow better treatment of cancer patients.

Student Name: Abigail Mills

Booth #: 61

Research Mentor: Vladimir Sloutsky

Project Title: Learning mechanism used when categorizing mathematical information surrounded by perceptual features

Abstract: Fractions and proportions are difficult concepts for many individuals to grasp. Is it possible to capitalize on a non-mathematical skill we already possess to help process these challenging concepts? We tested 97 undergraduate students at The Ohio State University in tasks that assessed their prior mathematical knowledge before having them complete a categorization task. Categorization was chosen as the method to teach proportion knowledge because much research shows adults can easily apply this skill to difficult, non-numerical concepts. The categorization task presented participants with two types of unknown creatures and asked them to differentiate between them on the basis of one of two deterministic ratios presented alongside non-numeric probabilistic features. Our results show that adults easily learned a novel fraction-rule across a variety of presentation conditions within our categorization task. We found that accuracy was lower and reaction time was slower in conditions where the deterministic feature detailing the fraction-rule was presented with perceptual features, which presumably distracted participants from the critical numerical information. This is interesting given similar data from children indicating that redundant non-numerical features aid their ability to learn this type of new fraction-rule in the same categorization task. Scores on the prior math knowledge battery significantly predicted performance, meaning individuals with more previous math knowledge did better in the categorization task. Results from this study have implications for the current math curriculum and its development. These results also inform our knowledge of how children think about tough, novel math concepts, as well as how this may develop across the lifespan. Using a well-mastered skill (categorization) to learn a difficult math concept (fractions) without the presence of distracting perceptual information intruding on learning and transfer is a novel finding and may be a unique strategy for teaching other difficult concepts both inside and outside of formal education.

Student Name: Andreas Moghimi-Danesh

Booth #: 62

Research Mentor: Alexander Wendt

Project Title: Towards a Just Acquisition of Citizenship

Abstract: Despite widespread use of the term “citizenship,” there is much debate in the literature with regards to what citizenship entails and how exactly it is acquired. Legal scholars, philosophers, historians, and political scientists alike have all advanced arguments across their disciplines to either support or undermine different models of citizenship and citizenship acquisition. For example, while 97% of citizens obtain citizenship jus sanguinis or jus soli, meaning citizenship by right of blood and by right of soil, respectively, there exist many moral and legal objections to these models. In my research, I examine Ayalete Shachar’s The Birthright Lottery, which essentially serves as Shachar’s entry into this ideological race. Contrary to traditional definitions of citizenship, Ayalete Shachar’s The Birthright Lottery posits that citizenship is an inherited property. While this theory advances general moral theorizations and assessments of trends such as nativism, it fails to address the jurisprudential ramifications of labeling an entity such as citizenship as being property, specifically an inherited property. In pursuit of satiating the absence of a jurisprudential nexus in Shachar’s argument, this paper applies the logic of various legal theories of property to modern models of the just acquisition of citizenship. In doing so, this paper will demonstrate how Shachar's taxonomization of citizenship as property is an equivocation with dangerous consequences. Ultimately, once this "stress test" has been applied to Shachar's argument, it will be clear that on normative and practical levels, Shachar's entry is as insufficient as it is threatening to the establishment of a more just acquisition of Citizenship in the modern day.

Student Name: Amber Moore

Booth #: 63

Research Mentor: Thomas McDow

Project Title: Mental Illness in Tanzania: Understanding Stigma Through Media

Abstract: Tanzania is currently ranked #7 globally in number of deaths by suicide with a rate of approximately 24.9 out of 100,000 people. To date, however, only a few studies have been conducted in Tanzania regarding mental health generally, and virtually no studies that try to understand social stigma associated with mental illnesses. This study was conducted in Iringa, the district capital of a rural region in the southern highlands of Tanzania. This research analyzes the stigma associated with mental illnesses through the perspectives of Tanzanians in rural areas. The findings are based on in-country interviews with 15 individuals that represented a multitude of ages, education levels, and geographical locations. Each interview consisted of a series of questions including perceptions and symptoms of depression, treatment and care options, and the presence of stigma in media. Interviews revealed specific understandings of depression and regionally and culturally specific associations with suicide. Preliminary analysis of interviews has shown that informants had consistent descriptions of depression symptoms: talking to oneself, acting violently, crying, and stealing. Results have indicated that men are more susceptible to suicide, especially after traumatic or embarrassing events. The relationship between shame and suicide amongst men in Iringa may be explained by historical events in the region, particularly the suicide of Chief Mkwawa to avoid capture during German conquests in 1898. Additional findings to note included the association of depression with psychotic symptoms, the overwhelming skepticism of using medications to treat depression, and the similarity of media stories. This study indicates a need for specialized mental health education that accounts for the cultural and historical values of the area to most effectively treat individuals.

Student Name: Riley Mullins

Booth #: 64

Research Mentor: Christopher Coss

Project Title: Androgen Receptor Splice Variants in Hepatocellular Carcinoma

Abstract: Liver cancer, of which hepatocellular carcinoma (HCC) comprises 80%, causes the second most cancer-related deaths, and its mortality and incidence rates are increasing the fastest and the second fastest, respectively, of all cancers. HCC is an increasing medical burden with only two drugs used in its treatment, both of which extend survival by less than three months. Evidence, namely the 3-fold higher diagnosis in men, suggests a role for male hormones and the androgen receptor (AR) in HCC. However, clinical trials using antiandrogens in HCC failed. These antiandrogens bind the ligand binding domain of AR and are unable to inhibit AR splice variants (AR-SV), which are constitutively active truncated forms of AR that lack this domain and are associated with therapeutic resistance in prostate cancer. We hypothesized that HCC cellular processes regulated through AR are ligand-independent yet receptor-dependent due to AR-SVs. The proliferative nor migratory ability of HCC cell lines was regulated through ligand-dependent AR activity; resistance to stress-induced cell death will be investigated. Putative ligand-independent AR activity in HCC was probed using novel selective AR degraders UT-155, UT-69, and galeterone or AR antagonist enzalutamide. Pilot studies included assessments of AR signaling in transformed HCC cell models and administration of AR-targeted agents to mice. These results can define a novel role of AR in HCC, a contribution that may explain the failure of antiandrogen therapies and promote study of novel anti-AR treatments.

Student Name: Spoorthi Nagasamudram

Booth #: 65

Research Mentor: Amy Connolly

Project Title: Ray Propagation Modeling in the Detection of Ultra-High Energy Neutrinos

Abstract: The detection of ultra-high energy (UHE) neutrinos can probe into Physics at the

highest energies (greater than 10^18 eV). The Askaryan effect makes it possible to detect UHE neutrinos. The interaction of a UHE neutrino with a dielectric medium produces a shower of particles that travel faster than light in the medium. The resulting electromagnetic radiation is coherent at radio wavelengths. This is called the Askaryan effect. The South Pole is a promising site to detect UHE neutrinos because there is a lot of ice. Also, the radio attenuation length of the ice is about 1 km, preventing significant energy loss. The goal of my project is to model the propagation of rays within the ice and use this model to find optimal rays that hit the detector. The index of refraction, n(z), of ice changes with its depth, causing rays to bend. We traced the path of the ray in very small steps (on the order of 10-4 m). After doing so, we scanned a range of rays with different initial angles. For each ray, we calculated the vertical distance by which the ray missed the detector. A function of initial angle that predicts the vertical miss distance can then be deduced. The optimal rays are the roots of this function. The results we found using this procedure were encouraging. We found ray solutions with miss distances on the order of a few centimeters which is reasonable. In the future, we would like to use this code in the simulation to analyze the amount of power reaching the detector. This might help understand the effect of different n(z) models on the expected number of neutrinos. We also want to understand how this technique of ray solving performs in terms of speed.

Student Name: Brecht Nash

Booth #: 66

Research Mentor: Christopher Orban

Project Title: An Interactive Approach for Using Programming Exercises in Introductory Physics

Abstract: While many web interactives for introductory physics exist students are rarely shown the computer code that generates the interactives even when the physics for these programs are relatively simple. we present an approach that addresses many common concerns around using programming exercises in introductory physics classes with a browser-bases framework called p5.js. These exercises are (1) simple, involving 75 or fewer lines of well-commented code, (2) interactive, with a high frame rate to give a video-game like feel, (3) step-by-step with the ability to interact with intermediate stages of the "correct" program and (4) thoughtfully integrated into the physics curriculum, for example, by illustrating velocity and acceleration vectors throughout. Survey results from the first activity from four semesters of introductory physics classes at OSU in which a high percentage of the students are weak or absolute beginner programmers seems to confirm that the level of difficulty is appropriate for this level and that the students enjoy the activity. We plan to test student conceptual gains using assessments questions similar to the Force Concept Inventory and Brief Electricity and Magnetism Assessment. We invite collaborators and teachers to adopt this framework in their high school or early undergraduate classes. All exercises are available at compadre.org/picup.

Student Name: Olivia Noall

Booth #: 67

Research Mentor: Rick Fishel

Project Title: Tgfβ escape of NSAIDs Chemoprevetion

Abstract: Lynch syndrome or hereditary non-polyposis colorectal cancer (LS/HNPCC) is an autosomal dominant genetic disorder caused principally by mutation of the human mismatch repair (MMR) genes HsMSH2, HsMSH6, HsMLH1, and HsPMS2. Long-term use of non-steroidal anti-inflammatory drugs (NSAIDs) has been found to be an effective chemopreventive in LS/HNPCC. Previous studies from our lab have found that NSAIDs, including aspirin (ASA) and the nitric oxide-donating aspirin (NO-ASA), increased the life span in a villin-Cre+/-Msh2flox/flox (VpC-Msh2) mouse model that displays most of the pathological phenotypes of human LS/HNPCC. Eventually the VpC-Msh2 mice succumb to tumorigenesis despite the chemopreventive effect of the NSAIDs. Mutation in the Tgfβ-RII gene occurs in 86% of human tumors that arise in patients with LS/HNPCC. Mutation of this gene was tested in our mouse model. Surprisingly, the villin-Cre+/-Msh2flox/floxTgfβ-RIIflox/flox (VpC-Msh2-Tgfβ-RII) mice were found to be resistant to the chemopreventive effects of NSAID treatment. Our goal is to determine what role Tgfβ signaling pathway plays in the chemopreventive effect of NSAIDs utilizing Next Generation Sequencing (NGS) of tumoral samples that escaped the chemoprevention effect of NSAIDs. Intestines of mice in the NSAID chemopreventive study were collected and stored in formalin. Selected tumoral and normal tissue samples were embedded in paraffin and a pathologist selected the area of interest by a tissue punch. DNA extraction was performed to represent the maximum variability across the tumor before being sent for NGS. NGS will allow us to analyze and compare what genetic mutations that have accumulated in the samples after carcinogenesis to determine which, if any, mutations in the Tgfβ pathway have occurred.

Student Name: Rachel Novinc

Booth #: 68

Research Mentor: Gunjan Agarwal

Project Title: Indirect Magnetic Force Microscopy

Abstract: This project aims to develop magnetic force microscopy (MFM) as a novel tool in histology to map iron deposits in tissues in a label-free manner. In our earlier work we had demonstrated how MFM, can map iron oxide nanoparticles in-vitro and in tissue sections. MFM studies have previously been performed using direct MFM (D-MFM), where an MFM probe makes two passes over the sample, first touching the sample to obtain the topography and then at various lift heights above the sample to detect the magnetic interactions between the sample and probe. D-MFM is time consuming and can result in contamination of the MFM probe. The goal of this research was to develop an indirect MFM (ID-MFM) technique with an ultrathin barrier between the sample and probe. Here, multiple passes over the sample are not needed, making it a high-throughput and ultrastructural magnetic mapping technique. 50nm thick silicon nitride windows commercially available for transmission electron microscopy were used as the barrier. Fluorescently labeled carboxyl magnetic particles (2 ï-m in diameter) were immobilized on one side of the window and imaged on the other side using an MFM probe in the dynamic mode of AFM. As a control, a non-magnetic AFM probe was also used. Results indicate that an MFM probe could detect the magnetic interaction between the particles and probe despite the presence of the silicon-nitride barrier, whereas an AFM probe could not detect this interaction. The presence of magnetic particles was verified using fluorescence microscopy. ID-MFM could be developed as a multimodal and ultrastructural technique that could map iron deposits in cells and tissues kept in air as well as in a fluid environment.

Student Name: Morgan Oberweiser

Booth #: 69

Research Mentor: Rachelle Adams

Project Title: Unraveling Panamanian Caterpillar/Ant Mutualism

Abstract: Thisbe irenea caterpillars and multiple ant species living in the neotropical rainforest engage in an intriguing facultative mutualism. Ants serve as attendants to the caterpillars, protecting them from predators and parasitoids, and in return the caterpillars supply the ants with extra nutritious honeydew. These caterpillars have a shared evolutionary history with their ant attendants, but there is a lack of clarity within the literature regarding which ant species most abundantly and effectively attend to T. irenea caterpillars. In order to determine this, we identified T. irenea caterpillars along roadsides and creek beds in Gamboa, Panama, and held a 30-minute observation period for each caterpillar identified. During these observation periods we collected all the ants that interacted with the caterpillar and recorded host plant location, ant attendant species, and attendant replacement rate. Overall, Ectatomma ruidum was determined to be the most common ant attendant, as well as the most effective, based on its attendant replacement rate. However, we found a definite dichotomy between creekside and roadside systems. Roadside populations consisted exclusively of ants within the genus Ectatomma, and creekside populations included mostly ants from the genus Camponotus- with no overlap between the two regions. In each region, the most dominant attendant species was also the most effective attendant: E. ruidum on roadsides, and Camponotus cf. excisus along the creeks. These results suggest that while E. ruidum was recorded as the most abundant attendant species, the ant species participating in this mutualistic relationship are most likely opportunistic and are also highly influenced by region. This regional preference of attendant species, to our knowledge, has never been recognized in previous research, and may have ecological and evolutionary implications that affect our understanding of this sophisticated symbiosis. The consideration of these implications is ongoing, and we aim to present any conclusions hereafter.

Student Name: Eleni Packis

Booth #: 70

Research Mentor: Stephane Lavertu

Project Title: Teachers' Value Added and Career Trajectories

Abstract: “Value added” is a teacher evaluation technique that has garnered quite a bit of publicity and controversy. It refers to the amount of “value” that a teacher provides as measured by gains in their students’ test scores. Research indicates that students whose teachers have high value-added scores enjoy a number of benefits later in life, including higher earnings. However, research also indicates that effective teachers (as measured by value-added) are more likely to leave low-performing schools in favor of higher-performing schools, while less effective teachers are more likely to stay in low-performing schools or leave the school system or profession altogether. In other words, it appears that teachers sort themselves in ways that might further disadvantage students in poor performing districts. This project is, to my knowledge, the first to examine such dynamics among teachers in Ohio. Specifically, it investigates the career trajectories of the 4,200 Ohio teachers whose value-added scores the Cleveland Plain Dealer publicized in June of 2013. It uses data from 2008-2016 from the Ohio Department of Education on all Ohio teachers’ education levels, salaries, specific job position and location within their school district, and the average hours each teacher worked per day. Thus, these data enable me to follow these teachers over time, to see how career trajectories diverge based on their value-added scores, and to estimate how publishing their scores affected those trajectories.

Student Name: Alex Pan

Booth #: 71

Research Mentor: Pearlly Yan

Project Title: The Effect of Epigallocatechin Gallate in a Cystic Fibrosis Mouse Model: Using a Systems Biology Approach to Identify Affected Protein Pathways with Functional DNA Methylation

Abstract: Amal and co-workers (2011) uncovered an important association between autophagy genes and cystic fibrosis (CF) disease severity. In 2017, Magalhaes et al. reported aberrant DNA methylation in key modifier genes in CF. However, the specific epigenetic effects of CF and the demethylating agent epigallocatechin gallate (EGCG) on autophagy genes and the protein pathways affected by CF and EGCG methylation are largely unknown. In this study, DNA methylation in a mouse model was evaluated for the effect of EGCG and the presence of B. cepacia in wild-type (WT) vs CF group. To interrogate the functionality of differentially methylated cytosines (DMCs) of these comparisons and the protein pathways they influence, we designed a systems biology based workflow to visualize transcription factor (TF) protein-protein interactions using DMC and TFBS positional data. DMC positions were found methylKit analysis R package, and custom scripts intersect this DMC positional data with TFBSs to produce files that can be uploaded to the transcription factor/protein interaction String Database. Once the pathways of TFs and their first protein interaction partners have been identified, relationships between these pathways can then be mapped with the Cytoscape visualization tool. The workflow we present is demonstrated with sequencing results from treatment of wild type (WT) vs CF macrophage cells with EGCG. 15,377 DMCs, 44 differentially methylated autophagy genes, and 1,003 differentially methylated TFBSs were identified in the comparison. The protein interactions of the TFs were then analyzed and uploaded into Cytoscape for visualization.

Student Name: Nicholas Pappa

Booth #: 72

Research Mentor: Traci Wilgus

Project Title: The Role of Fetuin-A in Scar Formation

Abstract: There are major differences in wound healing between adult and fetal skin. It has been discovered that early gestation fetal skin heals by regeneration with no scarring, yet late gestation fetal skin and adult skin heal with the formation of scar tissue. The formation of scar tissue can have negative effects as scar tissue can hinder normal tissue growth and even affect patients psychologically. Fibroblasts are essential to wound healing and scar formation. These cells produce extracellular matrix and collagen, which both play key roles in dermal matrix repair after injury. Fibroblasts are a crucial factor in determining whether the wound healing process will result in scar formation or the damaged skin will regenerate. Research was performed comparing protein expression in fibroblasts from different stages of development. Proteomic analysis showed that expression of the protein fetuin-A (FetA) was significantly higher in fibroblasts of embryonic day 18 skin, which heals with a scar, compared to fibroblasts of embryonic day 15 skin, which heals by regeneration. Higher levels of FetA were also observed in whole E18 skin compared to E15 skin. Injection of recombinant FetA into E15 fetal wounds increased the amount of scarring compared to control wounds. Cultured fibroblasts treated with FetA showed an increase in collagen expression compared to control samples. The data suggest that FetA may promote scar formation. Very little research has been done on the effect of FetA on fibroblast function and scar formation, but the results suggest that inhibition of FetA may be a mechanism to reduce scar formation in wounds. Further studies examining scar formation in FetA knockout mice will be performed to confirm the significance of FetA in the wound healing process.

Student Name: Ivan Pires

Booth #: 73

Research Mentor: Andre Palmer

Project Title: Quantification of Active Apohemoglobin Heme Binding Sites via Dicyanohemin Incorporation

Abstract: Hemoglobin (Hb) is the oxygen storage and transport protein of red blood cells. In Hb, a prosthetic heme group is rigidly bound inside its four hydrophobic heme-binding pockets. Heme removal from Hb forms apohemoglobin (apoHb). This apoprotein has been studied for its precursor role in Hb assembly. Additionally, due to apoHb's ability to capture hydrophobic molecules in its vacant heme-binding pocket, it has been used in heme detection and drug delivery research. Unfortunately, apoHb preparations may contain damaged globins, rendering total protein assays inaccurate for analysis of functional heme-binding sites. Yet, since many apoHb applications target the heme-binding pocket, accurate quantification of heme-binding site activity is required. Fortunately, the reaction between heme and the histidine residue (His-F8) in apoHb can be monitored spectrophotometrically. The indispensable role of heme-His-F8 bond in functional Hb and the site-specific location inside the heme-binding pocket make His-F8 a proper target for active apoHb quantification. In this work, dicyanohemin (DCNh), a stable monomeric porphyrin species, was used as a probe molecule to quantify apoHb activity through His-F8-DCNh bond formation. His-F8-DCNh bonds were quantified via analysis of the 420 nm equilibrium absorbance of DCNh and apoHb mixtures. His-F8 saturation was determined by the presence of an inflection point from a plot of the 420 nm absorbance of a fixed concentration of apoHb against increasing DCNh concentration. Various concentrations of a stock apoHb solution were tested to demonstrate the precision of the assay. The accuracy of the assay was assessed via spectral deconvolution, confirming His-F8 saturation at the inflection point. The effect of the heme-binding protein bovine serum albumin and precipitated apoHb was not significant on assay sensitivity. An analysis of the biophysical properties of reconstituted Hb confirmed heme-binding pocket activity. Taken together, this assay provides a simple and reliable method for determination of apoHb activity.

Student Name: Krystal Pocock

Booth #: 74

Research Mentor: Lauren Pintor

Project Title: The Role of Taxonomic verses Functional Macroinvertebrate Diversity as Indices of Nutrient Pollution in Ohio Streams

Abstract: Throughout the past decade, the amount of nutrient pollution entering watersheds in the U.S. has increased substantially. Agricultural and urban run-off are often listed as primary causes of surface water impairment. Nitrogen and phosphorus enter rivers via fertilizer, storm water, and sewage drainage and are carried downstream to lentic systems where excess nutrients can lead to eutrophication and harmful algal blooms. Sensitivity of aquatic macroinvertebrates to environmental stressors such as elevated nutrient concentrations has made them historic indicators of water quality. Taxonomic diversity indices are commonly used to represent macroinvertebrate abundance and diversity values, however, the use of functional diversity indices has become increasingly popular due to their ability to provide a mechanistic link connecting macroinvertebrate communities to environmental stressors. The goals of this in-progress research project are to determine whether taxonomic or functional indices of macroinvertebrate communities are better for indicating nutrient pollution in impacted Ohio watersheds. Based on previous studies, I predict that areas which have a high amount of nutrient pollution will have low functional and taxonomical diversity while areas that have a low to moderate amount of nutrient pollution will have high functional and taxonomical diversity. Furthermore, I predict that functional diversity indicators will be more accurate than taxonomical indicators at depicting the impact that nutrient pollution has on aquatic macroinvertebrates. These macroinvertebrate indices can help to identify sites that have been negatively impacted by nutrient pollution and could help pinpoint areas in which management strategies would be most effective at improving the overall function of a watershed.

Student Name: Colin Quinn

Booth #: 75

Research Mentor: Andrew Fischer

Project Title: TrkB signaling pathway promotes the formation of proliferating Müller Glia-derived Progenitor Cells in retina

Abstract: Diseases of the eye can cause death of retinal neurons and result in vision loss. Under such damaging conditions, Müller glia (MG), the primary type of support cell in retina, have potential to reprogram into Müller glia – derived progenitor cells (MGPCs). MGPCs are capable of neurogenesis and can be stimulated to repair damaged retinas. Understanding the signaling cascades responsible for the reprogramming of MG into MGPCs is crucial for the development of treatments. Currently, there are no known treatments to replace lost neurons. In this study, we investigated TrkB signaling in vivo in the reprogramming of MG into MGPCs. TrkB is a receptor for the brain-derived neurotrophic factor (BDNF) signaling pathway, which is involved in neuronal proliferation, survival, and neurogenesis. We examined this by applying intraocular injections of NMDA, an excitotoxin known to cause the death of retinal neurons and stimulate MGPC formation, to post-hatch chicks with TrkB agonist N,N',N''Tris(2-hydroxyethyl)-1,3,5-benzenetricarboxamide (LM 22A4). Using Edu labeling, we examined retinal sections for MG proliferation and found significantly more proliferation in LM 22A4 treated retinas versus control retinas. Additionally, using a TrkB antagonist, ANA 12, we see a significant decrease in the amount of MGPCs in retinas treated with ANA 12 versus control saline treated retinas. Using TUNEL assay to detect dying cells, we found no significant differences between LM 22A4 treated retinas versus control retinas. We then examined whether LM 22A4 was mitogenic to other retinal glia. Using immunohistochemistry, we observed no changes in microglia (CD45+/Edu+) and Non-astrocytic Inner Retinal Glial-like (NIRG) (Nkx2.2+/Edu+) proliferation in LM 22A4 treated retinas. These data suggests that TrkB signaling specifically promotes MG proliferation after retinal damage independent of neuronal survival; thus, TrkB signaling is a target that promotes the regenerative potential of MGPCs. Future studies will investigate the dedifferentiation and neurogenic properties of TrkB signaling.

Student Name: Nanditha Ravichandran

Booth #: 76

Research Mentor: Thomas McDow

Project Title: The Perspective of Tanzanian Medical Practitioners on Their Positions in Global Health

Abstract: In the context of the HIV epidemic, Africa became the land of opportunity for Western scientists investigating manifestations and possible cures for the virus. Foreign researchers and physicians sought to take advantage of the abundant patient population in countries like Tanzania, and this led to what one author has called “a scramble for Africa” among global health professionals. As Tanzania’s largest donor, the United States alone has spent $40.86 million towards global health efforts there. Although the work of these foreign scientists has been well documented and widely disseminated, that of their African counterparts is less well known. This research seeks to understand the perspective of Tanzanian clinicians and to detail how they view themselves as contributors to global health interventions. The findings are based on six in-depth interviews with doctors in the Iringa Region of southern Tanzania. The resource-poor environment in which these doctors trained and practice has affected not only the way they approach patients, but also their interactions with non-governmental organizations and global health funding bodies. In general, the physicians viewed these organizations favorably, as their livelihood and patient well-being depends on resources and aid that they bring. Those raising critical views cited lack of transparency between donors and local health institutions; the draining of human resources from rural areas requiring them most; and the inadequate channel of communication between local facilitators and global health funders/organizations. The heavy dependency of these medical practitioners on outside resources strongly influences their perceptions of their partnerships and the shortcomings of the organizations carrying out their missions. Understanding these perspectives can help improve relations within global health between practitioners in resource-poor settings and organizations that enlist their help to achieve healthcare goals. Better communication with on-the-ground health practitioners can improve patient outcomes, thereby increasing efficacy of global health interventions in place.

Student Name: Carley Reinhard

Booth #: 77

Research Mentor: Stephanie Shaw

Project Title: Examining African American Slave Migrations through Folklore in the W.P.A. Ex-Slave Narratives

Abstract: During the 1930s, as part of the W.P.A. Federal Writer's project, over 2,000 interviews of former slaves were completed. These interviews were transcribed and compiled into a grand collection of first-person accounts of all the former slaves who could be located at the time. Within many of these narratives, hundreds of accounts detail folktales the slaves grew up hearing in their communities. The development of these folk stories, which seem unique to African American slaves in their specifics if not in their generalities, reflect aspects of the larger development of African American culture that arose due to forced migration from Africa and, for some, their movement from the upper-South to the Lower South and Southwest as slavery expanded in the United States. Thus, these stories, along with other aspects of African American culture, arose in part as a product of the intersection of traditional African folklore and new circumstance. This research seeks to explore these stories, determining their origin and tracing their development and their dispersal. This will not only contribute to the current studies of the African Diaspora, but it will also contribute greatly to studies of the inter- and intrastate migrations of slaves that never delve into the culture of slaves and to the cultural studies of slavery that don't pay much attention to the migrations of slaves. It is my hope through the course of this research to arrive at a more complete understanding of both the significance of African American folklore and the factors, including migration, that shaped it.

Student Name: Marissa Ruzga

Booth #: 78

Research Mentor: Daria Narmoneva

Project Title: Novel Scaffold for Diabetic Myocardium Repair Following Injury

Abstract: In 2014, 8.5% of adults worldwide were affected by diabetes mellitus, and the number is growing. The condition is associated with a higher risk of myocardial infarction, or scarring of heart tissue, and a higher morbidity rate once it has occurred. MMP-2 is a protein involved in the collagen turnover. MMP-2 is decreased in a diabetic heart, which may result in impaired repair following infarction. Scaffolds can improve the healing process, with the ability to provide a structure for cell growth and to initiate angiogenesis. This study tests the effects of the RAD16 peptide nanofiber scaffold used in conjunction with MMP-2 in order to improve the healing of a myocardial infarction in a rat model of type I (streptozotocin-induced) diabetes. Development of DCM in Sprague-Dowley rats was confirmed following 6 weeks post-streptozotocin injection. MI in DCM or wt animals was induced by left anterior descending artery ligation, followed by injection of the nanofiber or saline solutions into the left ventricular wall. At 8 wks post-MI, hearts were harvested and analyzed for fibrosis (picrosirius red), vascularization (lectin) and M1 and M2 macrophage infiltration. The M1 macrophages are associated with inflammation and scarring, while M2 macrophages are associated with the regeneration and healing processes. Treatment with the nanofibers resulted in a marked and significant improvement in the survival (p<0.01). Histological analyses showed significantly improved vascularization and evidence of myocardial regeneration in the nanofiber and MMP-2 groups, as compared to saline controls. Nanofiber treatment resulted in a significantly greater ratio of M2/M1 macrophages, as compared to other groups, further indicating heart improved remodeling. These results suggest the promise of the nanofiber-based approach for targeted anti-fibrotic therapies in DCM.

Student Name: Nicholas Salamon

Booth #: 79

Research Mentor: John Horack

Project Title: APPLICATION OF VIRTUAL REALITY FOR CREW MENTAL HEALTH IN EXTENDED-DURATION SPACE MISSIONS

Abstract: Human exploration of the solar system brings a host of environmental and engineering challenges. Among the most important factors in crew health and human performance is the sustainment of mental health. The mental well being of astronaut crews is a significant issue affecting the success of long-duration space missions, such as spending a long period of time on the Moon, Mars exploration, and/or eventual colonization of the solar system. If mental health is not properly addressed, these missions will be at risk. Upkeep of mental health will be especially difficult on long duration missions because many of the support systems available to crews on shorter missions will not be available. In this paper, we examine the uses of immersive virtual reality (VR) simulations in order to maintain healthy mental states in astronaut crews who are removed from the essential comforts typically associated with terrestrial life. Various methods of simulations and their administration are analyzed in the context of current research and knowledge in the fields of psychology, medicine, and space sciences, with a specific focus on the environment faced by astronauts on long-term missions. The results of this investigation show that virtual reality should be considered a plausible measure in preventing mental state deterioration in astronauts, though more work is needed to provide a comprehensive view of the effectiveness and administration of VR methods.

Student Name: Matthew Schneider

Booth #:

Research Mentor: Becky Mansfield

Project Title: Unnatural Histories: Against the â€œAnti-Historicalâ€ Nature of Conservation+Development

Abstract: In 1990, anthropologist James Ferguson revolutionized the field of development studies, introducing the idea of “anti-politics” to describe the way economic development programs operate by obscuring conflicts and uneven power relations among governments, industries, ‘local communities’, and others. Ferguson’s contribution has been adopted enthusiastically; indeed, the “anti-political” is now frequently invoked in studies of nature conservation, which together with development is a dominant force across the ‘Global South’. My research considers how conservation and development (C+D) regimes may also be “anti-historical”. To do so, I offer reflections on the powers to shape conceptions of histories and possible futures in the workings of C+D based on my experience studying the KAZA Transfrontier Conservation Area, a new project overlapping the borders of five Southern African nations. During recent fieldwork—archival research at Zambia’s Livingstone Institute, observation with conservationists, and interviews with bureaucrats, scientists, business- and lay-people alike—I encountered many difficulties attempting to historicize socio-ecological phenomena, perhaps a result of my own research inexperience but also, I argue, of the structural temporalities of C+D. That is, the nature of these enterprises seemed to restrict participants’ abilities to describe much beyond a basic (generally Eurocentric) narrative of environmental degradation and economic underdevelopment serving to justify C+D activities in the first place. Therefore, I will discuss how C+D operate through obscuring, inventing, or otherwise falsifying particular narratives of the past to manifest in the present particular visions of the future. Finally, putting my research in conversation with the findings of scholars working elsewhere in the previously-colonized world, I make a case for “unnatural histories”: narratives of the past that strip that nature of its natural-ness to uncover the historical production of more-than-human environments, revealing the “anti-historical” limitations of C+D and potentially facilitating more just futures for all beings on Earth.

Student Name: Jennifer Seilhamer

Booth #: 81

Research Mentor: Vicki Wysocki

Project Title: Investigation of Energy Dependent Unfolding of Protein Alpha Subunit using Collision Induced Dissociation Mass Spectrometry

Abstract: Native mass spectrometry (MS) is a technique used to study the tertiary and quaternary structure of proteins. In native MS, proteins are ionized by (nano)-electrospray ionization and transferred into the gas phase. Structural information can be subsequently obtained by ion mobility mass spectrometry (IM-MS) measurements of the generated ions. Native MS offers many benefits in comparison with other structural biology techniques including high sensitivity, high speed of data acquisition, low sample consumption, and the ability to analyze biomolecular interactions directly, without the need to immobilize or label one binding partner. A particularly interesting application of native MS takes advantage of the ability to activate protein ions by gas collisions (collision induced dissociation = CID) prior to IM-MS and to monitor their unfolding as a function of the collision energy. In my work, I study the unfolding of the tryptophan synthase α-subunits from Shewanella frigidimarina, Escherichia coli, Salmonella typhimurium, Thermus thermophilus, Pyrococcus furiosus and the Last Common Bacterial Ancestor by CID IM-MS. Whereas all α-subunits share the same TIM-barrel fold (which is the most common fold found in nature), they display distinct unfolding patterns. Preliminary data indicates that the energy dependent unfolding of single-domain proteins can proceed through intermediates that are stable in relatively wide CID energy range.

Student Name: Nora Shaheen

Booth #: 82

Research Mentor: Nick Brunelli

Project Title: Acid-Base Cooperativity and Outer-Sphere Effects of Secondary Amine Catalysts

Abstract: Aldol reactions are particularly beneficial to biological and pharmaceutical industries because of the formation of new carbon-carbon bonds. Studies have shown that primary amines immobilized on a mesoporous silica surface can effectively catalyze the reaction. The polar outer-sphere of the silica surface creates a weakly acidic environment that cooperatively interacts with the polar/basic environment of the amine, leading to selective and efficient product formation. This study seeks to build on the current understanding of the primary amines by investigating the outer-sphere and dielectric environment of secondary amines. The presence of a locally high dielectric environment can alter the mechanistic approach of the reaction, thereby affecting the selectivity of the product. By tuning acid-base interactions of secondary amines, efficient and selective product formation can be achieved.

Student Name: Brenda Shen

Booth #: 83

Research Mentor: Susheela Tridandapani

Project Title: Targeting Acute Myeloid Leukemia with a novel anti-CD38-IFNγ antibody fusion protein

Abstract: Acute Myeloid Leukemia (AML) is one of the most fatal and common type of acute leukemia in adults. The current methodology of treatment includes a regimen of chemotherapy and stem cell transplant. Another treatment modality would be that of an antibody-drug conjugate (ADC), which can permit a more-selective delivery of agents to the targeted tumor cells. Developing an ADC involves an anticancer drug coupled to an antibody that selectively targets a marker expressed on tumor cells. One such anticancer drug that has been shown to be effective against AML cells in vitro is Interferon-gamma (IFNγ). However, clinical work has shown that administration of IFNγ often leads to dose-limiting toxicities that preclude its widespread use for AML. In addition, one potential surface-expressed targetable marker on AML cells is CD38. An antibody targeting CD38 has shown impressive efficacy in treatment of multiple myeloma. Interestingly, we have found that IFNγ can upregulate CD38 on AML cells, and that the combination of IFNγ plus anti-CD38 antibody induces AML cells to target and kill one another, a process termed fratricide. Our hypothesis is that a conjugated anti-CD38-IFNγ antibody fusion protein would more-selectively target AML blasts, such that lower concentrations might be used compared to combination single-agent treatments. Targeting IFNγ delivery to these CD38+ cells will lead to an upregulation of CD38, thereby making them substantially more targetable to an anti-CD38 antibody, including one linked to IFNγ. Our preliminary work thus far has result in the generation of a anti-CD38-IFNγ fusion protein; we are in the process of testing the efficacy of this novel therapy in vitro. Successful generation and function of this novel fusion protein is significant in that it will lead to the pursuit of a potential therapeutic for AML.

Student Name: Patrick Smith

Booth #: 84

Research Mentor: David Dean

Project Title: Comparison of Serum-Containing and Serum-Free Media for Production of Tissue Engineered Bone Extracellular Matrix on Poly(propylene fumarate)

Abstract: A risk to clinical translation of cell-based therapies using human mesenchymal stem cells (hMSCs) is the use of xenogeneic factors in the cell culture protocol. Standard cell culture media utilizes animal sera, specifically fetal bovine serum (FBS) which presents several risks including Variant Creutzfeldtâ€“Jakob disease (vCJD), undefined formulations, batch-to-batch inconsistencies, and the potential to induce an immunological response to antigens in the serum. To circumvent use of animal sera, RoosterBio (Frederick, MD) has developed serum-free media formulations for expansion of hMSCs which substitute human platelet lysate (hPL) for FBS. We hypothesize that culturing hMSCs in serum-free media will result in equal deposition of bone extracellular matrix (ECM) on poly(propylene fumarate) (PPF) coupons as the media containing FBS, assuming both contain the same growth factors in the same quantities previously determined optimal by our lab. This study used four groups (n=7 scaffolds per group) of media to culture hMSCs on PPF thin films for 21 days. The first group was cultured in only as-purchased FBS-free RoosterBio hMSC High Performance Media Kit XF (KT-016) as a control. The second group was cultured in media from the control kit with optimized growth factors and additives. The third media group contains 5% hPL rather than booster along with optimized additives. The fourth group, another control, contains the RoosterBio media kit with GTX booster (contains FBS). A PrestoBlueÂ® metabolic assay was performed at days 1, 3 to evaluate cell proliferation. Alizarin Red S and Alkaline Phosphatase assays were performed at days 3, 6, 9, 12, 15, 21 to measure formation of bone ECM as the hMSCs differentiate to the osteogenic lineage. The results of the study show that the serum-free media formulations perform as well if not better than the FBS-containing media regarding proliferation of hMSCs and production of bone ECM on PPF scaffolds.

Student Name: Alexandra Smith

Booth #: 85

Research Mentor: Andrea Grottoli

Project Title: Natural variability in the contribution of heterotrophic carbon to tissues of Montipora capitata

Abstract: Coral reefs are threatened by rising temperatures and ocean acidification. However, evidence suggests that some populations of coral can cope with high temperature and pCO2 conditions through physiological adaptations that confer resilience. Coral host and endosymbiotic algal δ13C and δ15N values reflect underlying coral biology. We measured δ13C and δ15N values in Montipora capitata corals from two sites around Oahu, HI to determine the proportionate contribution of photoautotrophic and heterotrophic carbon to coral tissues, to assess the relative contribution of nitrate and plankton to the same tissues, and to evaluate the relationship between their biology and environmental conditions. Haleiwa is a site with mean summer seawater temperature (26.8°C) and pCO2 levels (390 µatm) that reflect those presently observed on most tropical reefs. Kaneohe Bay is a semi-enclosed bay with elevated summer mean seawater temperature (28.5°C) and pCO2 levels (500 µatm) representative of predicted mid-century reef conditions. We found that δ13C of the coral host and the endosymbiotic algae, as well as the difference between δ13C of the host and δ13C of the algal fraction, was higher in corals from Kaneohe Bay than those from Haleiwa. This is likely because Kaneohe Bay corals are compensating for more stressful conditions by increasing the proportionate contribution of heterotrophically derived C to their tissues, or because there is a greater abundance of zooplankton providing greater opportunity for feeding. In addition, we found that δ15N of the algal fraction was higher in Kaneohe Bay corals, suggesting that these corals are incorporating more nitrate and/or heterotrophically derived nitrogen into their tissues to compensate for more stressful conditions. These results support our hypothesis that corals can cope with higher temperature and pCO2 conditions through adaptations that confer resilience. The adaptation appears to be linked with heterotrophic plasticity or increased incorporation of heterotrophic food sources into tissues.

Student Name: Prosper ssekayombya

Booth #: 86

Research Mentor: Vadim Fedorov

Project Title: Define the Functional Contribution of Neuronal and Cardiac Sodium Channel Subunits in the Human Sinoatrial Node.

Abstract: The sinoatrial node (SAN) is the primary pacemaker of the human heart. The presence of multiple voltage-dependent ion channels is one of the properties of the SAN that allow it to maintain its pacemaking integrity. Previous studies of mammalian hearts shows that there exist at least three sodium (Na+) channel subunits; neuronal (Nav 1.1 & 1.6) and cardiac (Nav 1.5). It is well known that cardiac subunits are responsible for the depolarization phase of action potentials in the atria and ventricle. Recent investigations in animal models suggest that neuronal subunits may exist within the SAN and contribute to pacemaking. However, the knowledge of the presence and functional role of these sodium subunits in the human SAN is lacking. Tetrodotoxin (TTX) can distinguish between the functional role of these subunits by selectively blocking neuronal subunits at 100nM TTX while cardiac subunits could be blocked only by ≥1µM TTX. Using a high resolution near-infrared optical mapping system, intact human SAN (n=7) were coronary perfused and electrophysiological data was collected and studied. Pacing protocols were performed at baseline and after drug perfusion. At baseline, all hearts showed stable SAN rhythm with sinus cycle length (SCL) =1036±305ms, sinoatrial conduction time (SACT) =40±28ms, and corrected sinus node recovery time (direct) (cSNRTd) =146±497ms. After TTX 100nM selectively blocked neuronal Nav subunits, SAN rhythm decreased 15%±14 and SACT increased 61%±51. TTX 100nM (n=5) changed these same parameters from SCL=563±80ms, SACT=33±21s, and cSNRTd=146±80ms, respectively, to SCL=640±66ms, SACT= 52±39ms, and cSNRTd= 350±210ms. TTX 1-3µM further depressed SAN rhythm 54%±44 and increased SACT 285%±203 (SCL=953±399ms, SACT=68±16ms, cSNRTd=196±79ms) and caused exit block (n=3). We observed that TTX can dose dependently slow SAN rhythm by affecting intranodal automaticity and conduction, which suggests that both neuronal and cardiac subunits exist within the human SAN.

Student Name: Andrew Steen

Booth #: 87

Research Mentor: John Horack

Project Title: Investigation of Satellite Constellation Configuration for Earth Observation Using Sierra Nevada Dream Chaser® Spacecraft Following Launch to ISS

Abstract: We present here initial results from an investigation into the use of multiple Sierra Nevada Corp. Dream Chaser® platforms, following their launch to the International Space Station, as a distributed constellation for remote sensing and disaster response. The payload capability and ΔV capacity of these spacecraft, combined with their reusability and prior launch to ISS under a commercial cargo delivery contract, presents a unique and compelling method to provide significant global earth observation during quiescent times, as well as the ability to respond rapidly - including through significant spacecraft maneuvering - when disasters strike around the globe. Our paper documents initial orbital dynamics calculations, optimizations, and alternatives for a variety of configurations. We explore ground coverage and various response modalities when presented with specific-case disasters across the surface of the globe.

Student Name: John Taylor

Booth #: 88

Research Mentor: Duane Wegener

Project Title: Expanding Valence-Framing Effect: Opposing or Supporting Both

Abstract: When people have a clear preference for one option over another, framing attitudes as opposition to the inferior option leads to more certainty than framing as support for the superior option (Bizer & Petty, 2005). The current work examined whether support frames would lead to more certainty when people have to choose between two similarly desired options. If opposition increases certainty, opposing two similar options might lead to increased certainty in both positions, thereby decreasing certainty in the choice itself compared to supporting both options. Participants (N=170) read about two candidates in a 2(information type: positive vs negative about both candidates) x 2(valence frame: positive vs negative design). Next, participants chose to vote for a candidate and reported certainty in their choice. Those in the positive- information/support-frame condition (M=3.91) were more certain about their choice than in any other condition, F(1, 163)=9.65, p<.004, with certainty being relatively the same for the other three conditions (Ms = 3.16, 3.20, & 3.22), F<1 for differences across means. This work suggests that support frames can increase certainty under particular conditions.

Student Name: Ariel Taylor

Booth #: 89

Research Mentor: Sheila Jacobi

Project Title: Effects of Dietary Sphingomyelin on Neonatal Piglet Intestinal Health and Membrane Composition

Abstract: This project investigates the effects of dietary sphingomyelin from the milk fat globule membrane (MFGM) compared to a soy based diet (sphingomyelin-rich diets vs. sphingomyelin-deficient diets) on piglet intestinal health following a lipopolysaccharide challenge. Piglet models of intestinal development and function serve as an agri medical model for developing piglet and human neonates. By utilizing an in vivo piglet neonatal piglet model, we are identifying how bioactive nutrients modulate gut function in relation to systemic immune challenge. We expect results to show that the piglets receiving the MFGM supplemented formula will have enhanced gut health and immune function, which will be evaluated through histological assessment and inflammatory cytokine quantification. Dietary nutrients are essential for gastrointestinal (GI) growth and function, and a significant component of neonatal development require the nutritional support of GI growth and development. Nutritional provisions of the mother's milk support normal maturation of structure and function of the GI tract in most neonates. The composition of mother's milk affects GI, mucosal immune system, and neurological development. The functional nutrients and other bioactive components of milk support a microenvironment for gut protection and maturation. However, early intestinal maladies can impair normal GI development, leading to intestinal dysfunction and even death. Therefore, further investigation of nutrient interactions of the mucosa is necessary to define nutritional requirements of the developing GI tract to minimize intestinal complications and neonatal morbidity.

Student Name: Demetrius Tuggle

Booth #: 90

Research Mentor: Chris Orban

Project Title: Accessing the impact of interactive, physics-focused computer programming activities

Abstract: There are very few initiatives that attempt to incorporate computer programing and STEM courses. This lack of integration is concerning considering that research estimates that 70% of STEM careers will require some computer programming; yet future employees lack basic programming competencies. With the aforementioned in mind, we ventured to create programming that provides students with introductory physics, a strong grasp of classical mechanics, and a sound comprehension of basic computer programming principals. We implemented a program that utilized the JavaScript Language physics based video games in which students must first finish pre-coded programs in order for the video game to operate correctly, and preserve the physics of the game. Physics based video games served two purposes: (a) to keep the student involved in the program and (b) to create simplistic animations of abstract physics concepts. The physics-based video games must be pre-coded and accessible through a browser to assure students, many of which are likely to be beginning programmers, are guided throughout the program using step-by-step instructions and are not obstructed to complete the program due to the lack of understanding and unfamiliarity of integrated development environments. Students are instructed to complete both pre-and post-programming assessments that we created which include physics only concept questions and animations to determine the usefulness of the computer programming exercises. Data will be collected throughout fall 2017.

Student Name: Tyler Webb

Booth #: 91

Research Mentor: Peter Mansoor

Project Title: The Battling Buckeyes of the 37th Infantry Division

Abstract: The 37th Infantry Division that was forged during the fires of World War I was again called upon by its nation after December 7th, 1941. These men not only fought for the United States, but also for Ohio. The 37th Infantry Division's original constituents were Ohio National Guard units, leading to its nickname, "the Buckeye Division." The soldiers' bond to Ohio was an integral part of the division spirit, as the division history recalls "it was generally assumed that Ohio men belonged to the 37th Division and that the 37th Division belonged to Ohio." The Buckeye soldiers carried their banner across the Pacific for nearly four years, fighting against the Imperial Japanese Army on various islands starting with defense preparations in Fiji, where approximately 40 percent of the division consisted of Ohioans. Their battles included the invasions of New Georgia, Bougainville, and the Philippines. The 37th proved to be an effective fighting force under the leadership of their exceptional commander, Major General Robert S. Beightler, from Marysville, Ohio. His leadership was best exemplified by the fact that he was only one of two National Guard division commanders not relieved of command throughout the war. This thesis investigates the leadership of Beightler, the role of the 37th in its battles, and furthers analysis of the lesser known battles on New Georgia and Bougainville. This study also provides insight into the once tense relationship between the Regular Army and the National Guard. However, perhaps the most important result of this research will be a better appreciation of the heroes who were the Battling Buckeyes.

Student Name: John Wildenthal

Booth #: 92

Research Mentor: F. Robert Tabita

Project Title: Functional selection of methylthioribulose-1-phosphate aldolase genes for anaerobic methionine salvage

Abstract: Methionine metabolism plays an important role in polyamine synthesis in all organisms, resulting in the production of 5-methylthioadenosine (MTA), a toxic, sulfur-containing byproduct. As biologically-available sulfur is typically limiting, many organisms possess a Methionine Salvage Pathway (MSP) to detoxify MTA and recycle the sulfur into methionine. Nearly all eukaryotes and many prokaryotes employ the "universal" MSP, which requires molecular oxygen. Recently, our group discovered the first oxygen-independent MSP in Rhodospirillum rubrum that functions aerobically and anaerobically, and a second, strictly-anaerobic MSP. The strictly-anaerobic MSP utilizes in part an operon encoding three enzymes. The third enzyme, a novel methylthioribulose-1-phosphate (MTRu-1P) aldolase, cleaves MTRu-1P, an MTA derivative, forming methylthioacetaldehyde (MT-adh). MT-adh is further metabolized to form methionine with the production of ethylene gas (C2H4) by unknown enzyme(s). Based on amino-acid sequence homology, over 320 bacterial species contain a putative MTRu-1P aldolase potentially functioning in a similar anaerobic MSP. In this study, we explored the functionality of MTRu-1P aldolase homologs from the photosynthetic bacteria Rhodopseudomonas palustris, extra-intestinal pathogenic Escherichia coli (ExPEC, ATCC 25922), Eubacterium limosum, and Morganella morganii via a gene complementation system using knockout strains of R. rubrum. In particular, the native MTRu-1P aldolase gene of R. rubrum was inactivated, disrupting the strictly-anaerobic MSP, causing ethylene to be marginally produced. To test the functionality of the MTRu-1P aldolase enzymes from the other organisms, plasmids expressing their putative MTRu-1P aldolase genes were mated into the R. rubrum aldolase knockout strain, and ethylene production was measured. The E. limosum aldolase could not fully restore ethylene production, indicating a lack of MTRu-1P aldolase activity in E. limosum. However, all other aldolases (R. palustris, E. coli, and M. morganii) restored ethylene production, suggesting a similar strictly-anaerobic MSP may exist in these organisms. Further studies will characterize these MTRu-1P aldolase homologs in their native organisms.

Student Name: Candace Williams

Booth #: 93

Research Mentor: Terry Niblack

Project Title: Effect of hydric stress on Heterodera glycines and Macrophomina phaseolina on soybean plants in greenhouse studies

Abstract: Soybeans are an essential commodity in many different parts of the world. The soybean cyst nematode (SCN), Heterodera glycines, and the fungus Macrophomina phaseolina, causal agent of charcoal rot, are important soil-borne pathogens that can reduce soybean yield and are more severe under drought conditions. Commonly fields are co-infested with both pathogens and little is known of their interaction on soybean plants. The objective of this study was to assess the interaction of these pathogens on soybean plants under hydric stress. A factorial arrangement with two factors, abiotic conditions and pathogen infestation, was used in a completely randomized design with three replications. The abiotic levels were full irrigation and half irrigation (hydric stress), while the levels for pathogen infestation included a control in which neither pathogen was present, soil infested with H. glycines, M. phaseolina and both pathogens. Experimental units were pots containing pasteurized soil in which 4 soybeans were planted and assigned to each treatment. The soil used in the nematode treatments was infested with 3000 SCN eggs, while soil under the M. phaseolina treatments was homogenized with 15 grams of millet seeds colonized by M. phaseolina. Soybean plants were harvested five weeks after planting. The colonization of M. phaseolina was measured in colony forming units (CFU) per gram of soybean tissue, while H. glycines were quantified as the number of females produced in each pot. Significantly fewer M. phaseolina CFU and H. glycines females were observed in pots containing both pathogens compared with treatments with the fungus or the nematode alone. Moreover, this result was more prominent under hydric stress conditions suggesting an antagonistic relationship. Future studies will focus on the rate at which these pathogens penetrate the soybean plants in order to better understand their interaction.

Student Name: Reginald Woods

Booth #: 94

Research Mentor: Jesse Kwiek

Project Title: The Evolution of Health Promotion in the Iringa Region and its Effectiveness

Abstract: Health promotion is the process of enabling people to have more control over their health – including individual, social and environmental interventions. Previous studies have shown that community-based health education and access programs have become more prevalent throughout the last 2 decades. Although programming has increased, the base knowledge of behavior change methods and strategies that are essential for those community-based health education programs to be effective has not advanced. The gap between the output of programming and the stagnancy of individual knowledge can be reconciled by social marketing and health communication. In Tanzania, more specifically Iringa, we should know more about the evolution of social marketing and health communication, as well as how they may influence health promotion and health outcomes. The purpose of this study is to shows the evolution of HIV prevention based social marketing and the interpretations of this imagery from local Tanzanians. We collected 35 photos posted in Iringa, as well posters archived online. Our sample was then analyzed under a systematic inspection. To get the local perception of the social marketing and health communication, we conducted 15-minute interviews with 10 students at Ruaha Catholic University. This study found that the audiences targeted, individuals depicted, and the use of the acronym 'HIV' in advertisements changed after the introduction of antiretroviral therapy to the general population in the region in around 2003. Our qualitative data from the interviews conducted suggests the social marketing and health communication efforts affected our sample of students differently. This study is a model for larger studies that combine the evolution of health communication and social marketing to understand how to better implement community-based HIV programming. Previous studies have shown on a smaller scale that the advancements of programming lead to greater participants reached. This study provides how the marketing of community-based HIV programming has evolved and affected students in Iringa. This is relevant for such developments in decreasing HIV transmission and acquisition in the region.

Student Name: Wenzhao Ye

Booth #: 95

Research Mentor: Jason Dreyer

Project Title: Analysis of Mounting Layouts for Improved Vibration Isolation Performance of an Automotive Cooling Module

Abstract: An automotive cooling module plays an important role with respect to energy efficiency and dynamic performance of a vehicle. Many studies have focused on thermodynamic aspects of such cooling modules; however, increased demand for lighter weight structures and fuel efficient vehicles requires a critical re-examination of their mounting schemes, specifically in terms of vibration isolation. Therefore, this research will evaluate a representative automotive cooling module isolation system using both experimental and computational means to better understand how the mounting layout can be modified to reduce the transmission of dynamic forces from the module structure to the vehicle body. Results of this study should provide insights into how to scale these isolation systems for new vehicle architectures.

Student Name: Nathan Yoshino

Booth #: 96

Research Mentor: Ryan Yoder

Project Title: Computational Studies of 5-Member Ring Derivatives for the Realkylation of Aged AcetylcholinesteraseOrganophosphorus compounds (OPs) are widely implemented as chemical nerve agents and pesticides. These OPs bond to and inhibit a catalytic residue, Serine-

Abstract: Organophosphorus compounds (OPs) are widely implemented as chemical nerve agents and pesticides. These OPs bond to and inhibit a catalytic residue, Serine-203, in the enzyme acetylcholinesterase (AChE) which is responsible for the hydrolysis of acetylcholine. After exposure to OPs, AChE is initially inhibited for a period of time followed by an aging process, wherein the inhibited Ser-203 residue dealkylates and forms a stable phosphonate anion in the active site. There are known treatments for inhibited AChE in the form of therapeutic oximes, but no treatments for aged AChE currently exist. If left untreated, acetylcholine will build up in the central nervous system. Previous research has demonstrated quinone methides to realkylate phosphonates and other biological molecules, and currently a lead compound in the form of a quinone methide precursor (QMP) has been found. The goal of this project is to identify 5-member ring derivatives of the lead compound that can potentially realkylate aged-AChE, in silico. Through computational methods, potential realkylators were docked in snapshots of the aged-AChE crystal structure. The docked structures then underwent molecular dynamics simulations in order to observe the ligand-protein interface over time. Statistical analysis of the results offered insight to the structural characteristics of these compounds and determined compounds with high affinity for the aged active site and thus a higher likelihood of realkylation. The most promising frameworks will then be synthesized for in vitro studies.

Student Name: Tianyu Yuan

Booth #: 97

Research Mentor: Ratnasingham Sooryakumar

Project Title: Investigation of hydrodynamics using microscopic magnetic organisms

Abstract: Hydrodynamics studies the rules of movement of objects in fluids, such as air and water. The project I have been working on over the past two semesters is a study of hydrodynamics at the microscopic scale. To study this, we utilize a special type of bacteria, Magnetotactic Bacteria (MTB). MTB are inherently magnetic due to the existence of magnetic nanoparticles within the MTB cell body, and possesses rotating flagella which allow them to swim. Because of these special properties, we can manipulate their swimming behavior using external magnetic fields, which provides a new way to investigate hydrodynamics at a microscopic level. The purpose of this study is to come up models that describe the interactions between the microscopic objects such as bacteria and the fluid media, using the cellsâ€™ inherent magnetism as an experimental probe. The primary experiment I conducted involves using a magnetic field to tilt the cells relative to a flat surface. This experiment builds upon previous work by Lauga and co-workers (REF) that investigated the movement of non-magnetic bacteria such as E. Coli, as they swim parallel to surfaces. My study investigates the motility of MTB moving parallel to as well as tilted to solid surfaces under magnetic manipulation and investigate the rules of motion when the cell is not parallel to the solid surface, with the observation that the cell veer to the right when tilted. Thus far, I reproduce the mathematical findings of Lauga et.al and describe the motion analytically when external magnetic force and torque are included. The future plan is to modify the model and analytically describe the experimentally determined motion when cells are tilted. This knowledge is crucial for many future applications including medical development and other technical fields that require understanding of the fundamental patterns of small-scale movement in fluids.

Student Name: Kacie Ziemann

Booth #: 98

Research Mentor: Joshua Hawley

Project Title: Using NSC Data to Track Ohio High School Graduates

Abstract: In partnership with the Ohio Department of Education and Ohio Education Research Center, I was tasked with using National Student Clearinghouse data to track high school graduates. The NSC is a nonprofit and nongovernmental who specializes in education reporting and research. The data includes new cohorts such as private schools and out-of-state. From the 2010 and 2014 graduating classes I was able to answer 5 broad questions.

1. What percentage of Ohio high school students are enrolling in college within 2 years?
2. Where are Ohio high school students enrolling in college?
3. Are college-going students persisting into second year?
4. What percent of Ohio high school students are attaining a degree within 6 years?
5. What affects degree attainment?

The results were produced not only for the overall cohorts, but also broken down into subgroups of race, gender, special characteristics of students, and by college attributes.