GVSU SUMMER SCHOLARS SHOWCASE

August 2, 2016

Hager-Lubbers Exhibition Hall
DeVos Center
Grand Rapids, MI
4:00 p.m. - 7:00 p.m.

Grand Valley State University
Office of Undergraduate Research and Scholarship

Order of Events

Welcome and Remarks 4:00 P.M. - 4:15 P.M.

Robert Smart, Ph.D.
Vice Provost for Research Administration
Executive Director, CSCE

Oral Presentations by: 4:15 P.M. - 5:00 P.M.

James Bell • Cameron Bunker • Kaitlyn Denney • Kayla Williams

Poster Presentations by: 5:15 P.M. - 6:15 P.M.

Brooke Armistead • Bria Atkins • Mark Baker • Daniel Beachnau • Brandon Beltz • Aaron Capps • Parryss Carter-McGee • Deseree Eudave • Emma Hahs • Cory Highway • Allison Hoppe • Thomas Killeen • Kendra King • Jenna Koelsch • Allison Ludge • Michael Michalski • Bikash Mishra • Emily Noordyke • Aaron Orellana • Megan Plekker • Jonathon Richards • Kelsey Rogers • Gloire Rubambiza • Kelsey Scott • Eric Sheffield • Brittany Sincox • Jared Sweet

Oral Presentations by: 6:15 P.M. - 7:00 P.M.

Matthew Grace • Michael Michalski • Matt Oudbier • Darwin Perry

Welcome to the 2016 GVSU Summer Scholars Showcase!

On behalf of the Office of Undergraduate Research and Scholarship and the Undergraduate Research Council, I welcome each of you to the 2016 GVSU Summer Scholars Showcase. Today, we celebrate the scholarship, research, and creative work of undergraduate scholars in the Student Summer Scholars (S3), Modified Student Summer Scholars (MS3), and McNair Scholar Programs.

Each scholar began the summer with a research question, a methodological roadmap, and the guidance of a faculty mentor. These tools provide scholars with a solid foundation to engage in mentored inquiry. In doing research and scholarship, they begin to direct their own educational paths and familiarize themselves with the requirements and structure of professional research. Successful projects require tenacity, courage, and patience. These attitudes, in concert with a foundation of academic and critical thinking skills, help scholars further their knowledge in a specific area while learning to incorporate academics with professional work.

The research and creative work you will see today is not complete. Rather, the presentations represent scholarship in process. We hope that you take a moment to connect with our scholars, listen to their presentations, and inquire about their work and future plans.

Dr. Susan Mendoza, Director, Office of Undergraduate Research and Scholarship

2016 Student Summer Scholars

Brooke Armistead (Koeze Fellow)
Mark Baker
Daniel Beachnau
Brandon Beltz
Cameron Bunker
Aaron Capps (Ott-Stiner Scholar)
Kaitlyn Denney
Matthew Grace
Emma Hahs (MS3)
Cory Highway
Allison Hoppe (MS3)
Thomas Killeen
Kendra King
Jenna Koelsch (MS3)
Allison Ludge
Michael Michalski
Emily Noordyke (Schroeder Fellow)
Aaron Orellana
Megan Plekker (Ott-Stiner Scholar)
Jonathon Richards
Kelsey Rogers (MS3)
Kelsey Scott
Eric Sheffield
Jared Sweet

2016 McNair Scholars

Bria Atkins
James Bell
Parryss Carter-McGee
Deseree Eudave
Bikash Mishra
Matt Oudbier
Darwin Perry
Gloire Rubambiza
Brittany Sincox
Kayla Williams

Brooke Armistead, S3 Koeze Fellow

Faculty Mentor: Sok Kean Khoo, Cell and Molecular Biology

Molecular Biomarkers for Early Detection of Cerebral Palsy

Cerebral Palsy (CP) is a term used to describe a group of neurological disorders that appear during early childhood. CP is characterized by impaired control of motor function and is the most common motor disability affecting children worldwide. CP has a prevalence of 2 to 3 per 1,000 children and can cause a variety of motor symptoms in addition to cognitive, visual and hearing complications. In most cases, CP is not diagnosed until the age of 3 to 5, and is based on clinical observations and motor skill development analysis. Here, we used newborn blood spots to evaluate gene expression of two target genes – S100A9 and ENTPD1 - which were previously shown to distinguish CP patients from healthy controls. These genes could potentially serve as biomarkers to diagnose CP just after birth, allowing CP patients to have early intervention and treatment to better their chances of overcoming development or learning disabilities.

Bria Atkins, McNair

Faculty Mentor: Jing Chen, Psychology

Do Children Have Their Own Mind? A Study on Maternal Mind-Mindedness

Maternal mind-mindedness (MMM) is defined as a mother's ability to attune to a child's mental state (Meins, 1998). Research indicated that MMM was associated with attachment security, mentalizing abilities, and behavioral problems. In this project I investigated how various demographic factors (e.g., mother's education) relate to MMM. MMM was measured using mothers' description of their child. These mothers (N=318) were enrolled in a child maltreatment prevention program offered by a non-profit organization. Regression analyses revealed only some variables significantly predicted MMM scores. The results will inform future interventions aimed at improving MMM in terms of allocation of resources.

Abbreviations: MMM for maternal mind-mindedness, MM for mind-mindedness, ASQ for Ages and Stages Questionnaire.

Mark Baker, S3

Faculty Mentor: Amy Gyorkos, Movement Science

Effects of Combining a Paleolithic Diet and HIIT Exercise on Cardiovascular, Metabolic, and Cognitive Health Markers

Deadly inflammation has been slowly affecting human populations across the globe, resulting in an emerging pandemic of chronic disease. Chronic systemic inflammation may be a result of significant change in the feeding and activity patterns of the human race over the past 10,000 years. Our late ancestors ate a diet rich in organic foods which was void of highly processed foods that are commonly consumed today. In addition, they engaged in frequent exercise of various intensities due to the hunter-gatherer lifestyle. Although the human genome remains almost identical, diet and activity patterns have changed dramatically since, creating a mismatch that may contribute to inflammation and chronic disease. This study examines the effects of adopting the lifestyle habits of our ancestors, on cardiovascular, metabolic, and cognitive health in adults with Metabolic Syndrome. The study adopts a crossover design with subjects randomly adopting a Paleolithic diet (4wks) and a Paleolithic diet with HIIT exercise (4wks), separated by a four week washout period.

Daniel Beachnau, S3

Faculty Mentor: Martin Burg, Biomedical Sciences

Investigating the feasibility of using the GAL4-UAS system to determine histaminergic cell types in larval gut tissue of *Drosophila melanogaster*

Histamine has recently been found in larval gut tissue of *Drosophila melanogaster*, although histamine's function in the gut is currently unknown nor has the cell type generating histamine been identified. To determine the identity of histaminergic cells in the gut of *D. melanogaster* larvae, a co-localization strategy was employed, which relies on expression of cell- or region-specific GAL4 genetic drivers and a UAS-GFP (green fluorescent protein) reporter line. In this strategy expression of GFP enables specific regions of the gut to be visualized. Histamine immunostaining and GAL4 expression patterns were imaged using wide-field fluorescence confocal microscopy. Initial investigations indicate that histamine is localized to specific gut regions which overlap with GFP expression induced in select GAL4 lines. Future work will now be focused on using the methodologies developed to further investigate histamine localization using additional GAL4 lines.

James Bell, McNair

Faculty Mentor: Douglas Montagna, History

The Amoy China Mission of the Reformed Church in America, 1937-1951

This research utilizes primary documents from the Joint Archives of Holland to add to the current scholarship on the Amoy China Mission of the Reformed Church in America. Its purpose is to analyze how effective the Reformed missionaries' were in accomplishing their objectives of evangelism and the establishment of an indigenous Chinese Church throughout the continuous social and political turmoil that rock China from 1937 to 1951. Sources used indicated that while major historical events during this time period resulted in the closure of the mission, the Reformed Church succeeded in assisting in the creation of an indigenous Chinese church that proved hardy enough to weather the religious persecution leveled against it by the Communist party, as well as the dark days of the great leap forward and cultural revolution. The topic is important because it reveals how a small Christian denomination based in the United States was connected to major events in Chinese history and reveals why Christianity is relevant in China today.

Brandon Beltz, S3

Faculty Mentor: Michael Henshaw, Biology

Red Spider, Blue Spider, When is One Spider Two Spiders?

Gene flow between populations should limit genetic differentiation, and the most prominent models of speciation incorporate geographic isolation which limits the mixing of genes. The bold jumping spider, Phidippus audax, is common throughout North America, but is morphologically polymorphic and may constitute distinct forms despite the potential for gene flow. We have characterized the nature of genetic differentiation. We sequenced 672 bp of the mitochondrial Cytochrome c Oxidase subunit I (COI) gene. We also genotyped spiders at 7 microsatellite markers found throughout the nuclear genome. Analysis of the mitochondrial sequences found two genetically-distinct clusters, but the nuclear markers did not identify two separate genetic groups. This disagreement between the mitochondrial and nuclear loci might result from male-biased gene flow or from divergent patterns of selection. We plan to investigate this discordance to better understand the process of differentiation in this species.

Cameron Bunker, S3

Faculty Mentors: Mario Fific, Psychology and Michael Wolfe, Psychology

Influence of Self-Esteem on Stopping Rule Decision-Making

One of the most important topics in the decision making domain is how individual subjects determine to stop evidence collection and make effective decisions. This is defined as the stopping rule problem. To answer this problem, researchers have focused on developing successful models for stopping rules, usually from the point of optimal (or suboptimal) decision performance. In the current study, we explored whether self-esteem could be used to explain individual differences in decision making. In particular, whether self-esteem could be used to develop personality-driven decision making strategies. We manipulated self-esteem, through false feedback on a "Critical Thinking" exam, to assess how participants' stopping decision behavior (deferred decision task, measuring decision accuracy, and the number of recommendations opened) would be affected. By exploring this relationship, we find that personality enables us to better understand decision-making processes involving stopping rules.

Aaron Capps, S3 Ott-Stiner Scholar

Faculty Mentor: Scott Thorgaard, Chemistry

Metal Nanoparticle Detection at an Ultramicroelectrode: a Unique Way of Detecting Metal In the Act of Performing Catalysis

Single metal nanoparticles (MNPs) were studied using electrocatalytic amplification via the oxidation of hydrazine while isolated at the surface of an ultramicroelectrode (UME). Pd MNPs were synthesized by reducing PdCl2 in the presence of sodium citrate as the capping agent. The oxidation of hydrazine proceeds slower at the surface of the UME compared to Pd and Pt MNPs; this allowed for the observation of a jump in current anytime one MNP landed at the UME surface and catalyzed the reaction. The size of the MNPs was independently determined by transmission electron microscopy. This allowed for the correlation of the particle size to the jump in the current observed in the collisions. This method's strength lies in its ability to tell us how a single MNP behaves during catalysis (data are not averaged over many MNPs). We have already extended this method to hydrogen peroxide oxidation at Pd MNPs on a carbon UME and are working to extend it to other reactions and metals.

Parryss Carter-McGee, McNair

Faculty Mentor: Elizabeth Arnold, Anthropology

Bringing the food to the city: Reconstructing the nature of the animal economy in early urban centers of the near east through stable isotope analyses

This study will use stable isotopic analyses (strontium, oxygen, and carbon) of 8 domestic animals, mainly ovicaprines (sheep/goat) from the Southern Levant of the ancient Near East to better understand herd management patterns in urban centers. Analysis will focus primarily on the site Tell es-Safi/Gath. The central research question is how urban centers in this region acquire and utilize domestic animal resources. From this main question follows several others such as: Are animals raised locally or at a distance from the settlement? Are different areas of the city supplied with variable resources based on differences in class, ethnicity or function? Previous results from a pilot study at Tell es-Safi/Gath indicate variation in herd management strategies, but overall local grazing patterns. As sample size increases in this project, we further delimit these patterns.

Kaitlyn Denney, S3

Faculty Mentors: Megan Woller-Skar, Biology and Amy Russell, Biology

Accumulation of the liver toxin microcystin in fish and big brown bats collected from throughout the State of Michigan.

Harmful algal blooms have been increasing in severity due to factors such as eutrophication. A hepatotoxin produced from these algal blooms, microcystin (MC), causes concern for human and animal health. MC levels in bats are a concern because this toxin could pose a threat to an organism already facing multiple conversation pressures. Human consumption of fish containing MC makes monitoring toxin levels valuable for public health reasons. I used enzyme linked immunosorbent assay (ELISA) to measure MC levels in 80 fish muscle samples along with 20 big brown bat livers from various locations in Michigan. Preliminary results indicate that microcystin concentrations are low in bats with 15 samples testing under the limit of detection. MC concentrations in fish ranged from 0.0003 µg/g (±1.9194E-5) to 0.0078 µg/g (±0.0028). Although these levels of MC are low, continued exposure to MC could have negative long term effects and further work to monitor levels is crucial.

Deseree Eudave, McNair

Faculty Mentor: Elizabeth Flandreau, Psychology

Effects of Diet on Sensitivity to Social Defeat Stress in Mice

Exposure to stress can lead to symptoms of psychiatric disorders in stress-sensitive individuals while resilient individuals remain healthy. Our research examines environmental and genetic sensitivity and resiliency factors. One potential environmental factor influencing stress-sensitivity is diet. Using an ethologically relevant mouse model, we exposed mice to social defeat stress (SDS) for 10 days concurrent with an unhealthy diet high in fat or sucrose or control diet. We assess sensitivity/resiliency using several behavioral tests. All but 2 SDS mice exhibited social avoidance in the social interaction test. SDS mice also displayed increased anxiety-like behavior in the elevated zero maze and open field test. Intriguingly, of the non-stress mice, only the chow-fed mice had low anxiety-like behavior in the open field. These data suggest that an "unhealthy" diet may increase the risk for psychiatric symptoms even in individuals with low environmental stress exposure.

Matthew Grace, S3

Faculty Mentor: Gabriele Gottlieb, History

Communities in Conflict: A Comparative Analysis of the New York City and Philadelphia Committees of Safety

In 1774 the Continental Congress ordered the establishment of committees in all colonies throughout British North America in order to enforce the boycott against British goods. By 1776 these political bodies had become a leading force behind the revolutionary movement. Nevertheless, the composition, political outlook and functioning of those committees depended highly on local conditions, leading to major differences in the committees' roles in the revolution. For example, the Philadelphia Committee consisted of "new men" who gained political power through revolutionary activities. They were able to overthrow the Pennsylvania Assembly and establish a new radically democratic state constitution. In contrast, the New York Provincial Congress, led by the powerful Livingston clan, approached independence more apprehensively. They were more hesitant to disrupt the traditional power structure and feared taking proactive steps that could assist the growing Loyalist movement in New York.

Emma Hahs, MS3

Faculty Mentor: Sok Kean Khoo, Cell and Molecular Biology

Effects of microRNA 34b/c in SH-SY5Y cells for Parkinson's disease study

Parkinson's disease (PD) is a neurodegenerative disorder without a known cure. With a pathological hallmark of alpha synuclein (aSyn) protein aggregation in neurons, developing new drug therapies that block aSyn aggregation could potentially stop or slow the disease progression. MicroRNAs (miRNAs) are small, conserved RNAs that regulate gene expression, as well as protein aggregation. Here, we aim to establish a feasible study evaluating the expression of miRNA-34b/c in a differentiated SH-SY5Y cell line induced with rotenone, replicating a PD phenotype. miRNA-34b/c are predicted targets for aSyn and are shown to be down-regulated in PD brain specimens. Once the feasibility of this study is established, we can apply miRNA mimics or inhibitors to this cell model to investigate their effects on aSyn aggregation. miRNA mimics or inhibitors can increase or reduce the expression of a targeted gene and are potential novel drug agents to improve treatments including PD.

Cory Highway, S3

Faculty Mentor: Paul Keenlance, Biology

Diets of Kit-Rearing Female American Martens in West Michigan: She Ate What?!

American Martens (*Martes Americana*) are small arboreal carnivores that inhabit forests in northern latitudes. Due to their high metabolic rate, food availability is essential, especially for lactating female martens who are also providing calories for their kits. This project focused on the diets of kit rearing female American Martens in the Manistee National Forest. Radio telemetry was used to track females to their dens. Scat, prey remains, and game cameras were used to collect data at den sites. By realizing what prey items are being selected, management practices can be developed by natural resource agencies to increase and preserve optimal marten habitat. Preliminary results from images taken at den sites have revealed that martens prey mostly on small mammals and birds, yet they still are found to prey on larger mammals. Female martens were also found consuming eastern moles, which has only been documented once before. Analysis of scat is ongoing and will contribute to the results.

Allison Hoppe, MS3

Faculty Mentor: Derek Thomas, Biomedical Sciences

Investigating a Novel Type of Protein Degradation in *Candida albicans*

Previous experiments studying protein changes in Candida albicans during filamentation at 37 degrees Celsius revealed that the proteins may be degraded by a unique mechanism distinct from ubiquitin dependent protein degradation. To further study this we constructed two different strains that represented this discordance, these being C4_00700c_a and Smt3. The parent was manipulated to contain the proteins with Myc tags added to the end of these proteins. Western Blot Analysis used antibodies to detect the tags and demonstrate the discordance of the individual protein at 37 and 30 degrees Celsius respectfully at time points of 1 and 3 hours. An ubiquitin inhibitor of dependent protein degradation was used to test the method by which these proteins were degrading. Our data correlated with the interesting finding from the previous experiments and denoted the importance of one of these proteins to filamentation.

Thomas Killeen, S3

Faculty Mentor: Richard Vallery, Physics

Study of Rubbery Polymer Nanocomposites at Low Temperatures

In this experiment we will study the porosity, the empty space between the chemical chains, of polymer samples. Polymers can be engineered to adopt different qualities like increased flexibility or strength. By infusing nanoparticles into the silicone samples we can modify the porosity and structure of the polymer. We are interested in looking at these polymers at their glass transition temperature (T¬g) to see how the porosity changes as we transition from the rubbery to glassy phase. Using Positronium Annihilation Lifetime Spectroscopy (PALS) we can determine the porosity of our samples. By analyzing the lifetime of the positronium we can determine the porosity throughout the polymer. Silicone rubber samples have a Tg below room temperature; therefore, we must cool them. Using a custom built vacuum chamber and an Air Products Displex cryopump we can potentially reach temperatures of 70K. With the cold chamber we can study all sorts of materials at cold temperatures using PALS.

Kendra King, S3

Faculty Mentor: Brandon Youker, School of Social Work

A Case Study Examining Participants Perceived Stress After Hot Yoga and Restorative Yoga

Studies indicate that when participants engage in yoga interventions throughout their lifetime they experience decreased stress and physical tension but what types of yoga are most effective on participants' perceived stress? This study examines the cases of nine participants non-randomly assigned to eight classes of either hot yoga (n=4) or restorative yoga (n=5). Yoga classes lasted an hour and fifteen minutes and were held twice a week for 4 weeks. Participants completed two self-administered standardized assessments, i.e., the Perceived Stress Scale and the Ardell Wellness Stress Test. Additionally, participants answered open-ended survey questions to further assess their perceived stress before and after each class as well as throughout the eight weeks. The preliminary findings indicate that participants in both yoga groups demonstrated no change in stress levels according to the stress assessment instruments but did report a small decrease in perceived stress after each yoga class.

Jenna Koelsch, MS3

Faculty Mentor: Merritt Taylor, Biomedical Sciences

You are what you eat: The effect of DHA on neurogenesis

Neural stem cells (NSCs) of the developing neural tube proliferate, differentiate, and mature to give rise to the central nervous system. Various factors, including factors in our diets, regulate this cycle. DHA is a polyunsaturated fatty acid (PUFA) in the brain that is obtained from our diet, and it has been shown to play a role in the development of neurons. Recent studies show that DHA can promote neuron formation from adult rat NSCs *in vivo*, but it has not been shown how DHA affects embryonic NSCs *in vivo*. This study examined the impact DHA has on neuron birth via embryonic NSCs *in vivo*. By administering DHA directly into the neural tube of in vivo chick embryos, the effects on embryonic NSCs compared to a vehicle control have been examined. Changes in cell proliferation, cell cycle arrest, and neuron counts were monitored. Investigating the influence of DHA on embryonic brain development is essential to better inform proper nutritional intake during pregnancy and throughout life.

Allison Ludge, S3

Faculty Mentor: Kyle Barnes, Movement Science

Dumbbells for your Diaphragm: Effects of Acute Inspiratory Muscle Training on Respiratory Function and Running Performance

Prior warm-up exercise is a universal feature of performance preparation in competitive sports. Inspiratory muscle priming (IMP) is a form of warm-up exercise for muscles primarily involved in the processes of breathing using a resisted breathing trainer, however the effects of IMP on running performance have not yet been investigated. This study was conducted in a randomized crossover design. Subjects were initially familiarized with the resisted breathing trainer and all testing procedures. Subsequently, each subject performed 2x two-mile time trials, preceded by either IMP or sham IMP in a randomized order, separated by at least seven days. Prior to each time trial, subjects performed standardized mobility drills and a 15-20 min warm-up jog, followed by either 15x IMP or sham IMP breaths and 4 x 80-m strides. Maximal inspiratory breathing characteristics were measured before the warm up, prior to and after the two-mile time trial, and VO2 was measured throughout the running test.

Michael Michalski, S3 (Poster)

Faculty Mentors: Sheila Blackman, Cell and Molecular Biology and Jennifer Winther, Biology

The Effect of Intercropping White Clover on Aspects of Soil Ecosystem Function in Small Scale Market Gardens

Little is known about soil ecosystem function in agricultural systems and how agricultural practices impact organisms within soils. Intercropping a living mulch is a sustainable agricultural practice that potentially decreases input requirements by promoting soil ecosystem functions and suppressing weed growth. This summer's Global Agricultural Sustainability Class (BIO 319) established and maintained an experimental plots containing vegetable crops with ("Experimental") and without ("Control") intercropped white clover living mulch. This project documents the effects of the treatment on the soil ecosystem. Microbial DNA extracted from soils sampled before planting and after crop establishment (but before clover intercropping) suggests more than 5,000 microbial species were initially present. Microbial metabolic activity measured as soil respiration suggests high soil microbial activity was present. Analysis of the results is ongoing, and current findings are presented.

Michael Michalski, S3 (Oral)

Faculty Mentors: Sheila Blackman, Cell and Molecular Biology and Jennifer Winther, Biology

Effects of an Intercropped White Clover Living Mulch on Small Scale Market Gardens

Our current system of industrialized agriculture uses large amounts of fertilizers, water, and fossil fuels and is widely considered to be unsustainable. GVSU's Sustainable Agriculture Program strives to investigate practices that reduce these inputs without reducing yield. Intercropping is a technique of growing two different crops together. Living mulches are those intercropped plants grown for the sole purpose of protecting and replenishing the soil. My work studies the impact of intercropping clover on crop yield, and the soil ecosystem. Students in the Sustainable Agriculture Class (BIO 319) set up and maintained an experimental plot with clover, and a control plot without. To assess the benefits of this practice students in the class measured the effects on crop plants (including harvest yield) and weeds, while I measured soil nutrients, microbial respiration, and microbial diversity. Preliminary data indicates intercropping clover has an impact on small scale market gardens.

Bikash Mishra, McNair

Faculty Mentor: Suganthi Sridhar, Biomedical Sciences

Role of CD82 in prevention of prostate cancer metastasis

CD82 is a tumor suppressor gene present in all normal cells but it's expression is usually lost in cancer cells, which allows them to move away from it's origination. The proposed research will look into how the reintroduction of CD82 in metastatic prostate cancer would prevent cell motility and affect the cell signaling and cell adhesion. Understanding the mechanism by which re-introduction of CD82 affect the cell signaling, cell adhesion and cytoskeleton structure rearrangement propose a greater potential for controlling the mechanism of metastasis. If metastasis could be controlled, it would provide a huge step towards preventing metastatic cancer.

Emily Noordyke, S3 Schroeder Fellow

Faculty Mentor: Anne Marie Fauvel, Liberal Studies

Nutritional Analysis of GVSU Managed Colonies

Managed honeybee colonies are declining worldwide. The interaction between poor nutrition, pests and diseases, and pesticide use are most likely responsible for the precarious state of the beekeeping industry. By evaluating food coming into the hive, one can draw conclusions about the quality and availability of forage. Pollen from an apiary with historically low honey production and poor colony health was compared to pollen from an apiary with high honey production and good colony health. Pollen was collected weekly in a 24-hour period, hives were weighed, and colonies were assessed for overall growth and health. The early summer results do not indicate a significant difference in forage or colony health between the study sites. However, the data will help construct a pollen timeline and supplemental planting suggestions specific to each area. The methods for this research will be reproduced for collection of broad geographic data via a mobile application that is in development.

Aaron Orellana, S3

Faculty Mentor: Matthew Christians, Cell and Molecular Biology

Determining the role of the amino terminal portion of the Light Regulating BTB E3 ligase in *Arabidopsis thaliana*

Plant growth and development is controlled by the different wavelengths in the electromagnetic spectrum. Phytochrome B, a red and far-red light photoreceptor in plants, plays an integral role in shade avoidance and flowering time. Proper degradation of this photoreceptor is crucial to the function of these processes and occurs via the ubiquitin-proteasome system. The light regulating Bric-a-Brac/Tramtrack/Broad Complex (LRB) protein is part of an E3 ligase complex which facilitates the attachment of ubiquitin to phytochrome B. Preliminary research has revealed a highly conserved region of the LRB protein near its N-terminus which may function in controlling rubylation. A truncated version of the LRB gene missing this highly conserved region was inserted into a wild type and *lrb1 lrb2* double mutant *Arabidopsis thaliana*. To date, phenotypic and immunoblot analysis of homozygous lines featuring the truncated LRBs suggest that the N-terminal region may play a role in their function.

Matt Oudbier, McNair

Faculty Mentor: Peggy Vandenberg, Philosophy

The Position of Negative Liberty in Value Pluralism

Value pluralism describes the multiplicity, incommensurability, and incompatibility of values. As a result individuals are forced to make a choice between values. It is from here that liberal pluralists; like Isaiah Berlin and William Galston, begin to argue that a minimum degree of negative liberty is necessary for acceptable political organization. My research focuses on countering some of these arguments and providing a description of value pluralism that avoids granting negative liberty a position above other values. The freedom to do what one will without interference; negative liberty, is not distinguished by value pluralism as Berlin or Galston would contend. Instead negative liberty resides as one value among many others that could be valued. Political organizations can come in a variety of forms, even those that do not value negative liberty.

Darwin Perry, McNair

Faculty Mentor: Dolli Lutes, McNair Director

Mass Incarceration and White Fear in the 21st Century

There is plethora of racial stereotypes associated with African Americans that affects how they are treated and perceived. As stated by Eddie Glaude Jr, in his book *Democracy in Black*, these racial stereotypes are expressions of white fear, or the general frame of mind that black individuals are threats to the overall well-being of US society. The purpose of this paper is to better understand the mass incarceration of African Americans in the early twenty-first century. To accomplish this task, I will interpret mass incarceration as (1) the third racial caste system in America and (2) as an expression of white fear. The mass incarceration of African Americans in the twenty-first century has been rationalized as a means to sustaining the well-being of society. However, this phenomenon is more than an attempt to upkeep a safe society. Rather, it is an aspect of placing African Americans into inferior positions by law and custom.

Megan Plekker, S3 Ott-Stiner Scholar

Faculty Mentor: Jessica VandenPlas, Chemistry

An eye-tracking study of visual representation use for problem solving in organic chemistry

There are many different molecular representations used within organic chemistry classes, and many students find it hard to choose the right one to use. This study examined students' use of different representations of molecules to answer questions on multiple organic chemistry topics. The goal of this study was to see if students favor some structures over others, or if they are using these structures correctly based on the type of question asked. To collect this data, 26 organic chemistry questions were created and an eye-tracking computer was used to see were the students looked on the screen during problem solving. Results showed that gender does not impact student choice of representation, but question type and experience in chemistry affected which representation students used when answering questions.

Jonathon Richards, S3

Faculty Mentor: Georgette Sass, Biology

Paternal effects on offspring revealed by analysis of telomere state in *Drosophila melanogaster*.

This study investigates the heritability and phenotypic effects of chromatin states at telomeres in *Drosophila melanogaster*. We asked if telomere length is positively correlated with paternal age and if a longer paternal telomere contribution enhances longevity in offspring. We found a positive correlation between paternal age and longevity (10 and 20 day old fathers produce longer-lived progeny; p-value <0.0001). Telomeres from sperm will be collected from a male throughout his life and then measured via quantitative PCR methods. In addition, Telomere Position Effect (TPE) is used to study how chromatin states at telomeres are inherited via the male germline. We find that TPE can be modified in offspring when telomeric inserts are actively expressed in the paternal germline supporting the inheritance of this altered chromatin state. Our results support *D. melanogaster* as a good model system to study mechanisms of telomere function.

Kelsey Rogers, MS3

Faculty Mentor: David Kurjiaka, Biomedical Sciences

Fatty Acid Receptor 4 Reduces Endothelial Cx43 Expression

Chronic inflammation is the hallmark of atherosclerosis in the vasculature. The endothelial cells (EC) lining the inside of vessels play an important protective role in this process. Free fatty acids (FFA) circulating in the blood impact the development of atherosclerotic plaques: some are protective while others are not. We are interested in understanding how cis FFA are protective of plaque formation. These FFA appear to bind to a FFA4 receptor. We hypothesize the presence of FFA4 receptors on the cultured EC that will decrease connexin 43 (Cx43) expression in a dose dependent manner. Cx43 expression is a marker of EC health as its expression increases in atherosclerotic plaques. We detected the expression of the FFA4 receptor in cultured EC (bEnd.3). The remaining experiments will address the dose dependency of the FFA4 receptor. We expect increasing cis FFA concentrations will lead to further reductions in Cx43 expression.

Gloire Rubambiza, McNair

Faculty Mentor: Jerry Scripps, School of Computing & Information Systems

Improving African Internet Traffic through Maximization of Node Centrality

North America has 23 times the internet connectivity of Africa in population terms [1]. This disproportionate connectivity creates a disadvantage for Africa's academic potential because most of its internet traffic is routed through international fiber optic links – which is more costly than direct connections within Africa [2]. One of the causes for slower internet traffic is the lack of cooperation between the Internet Service Providers (ISPs) across Africa. This study will explore whether we can increase the average closeness of a sample network representing African internet traffic by designing and testing strategic link-prediction algorithms versus a random link-prediction algorithm.

[1] R. Echezona and U. C.F., "African University Libraries and Internet Connectivity: Challenges and the Way Forward," Library Philosophy and Practice(e-Journal), Nsukka, 2010. [2] J. Chavula, N. Feamster, A. Bagula and H. Suleman, "Quantifying the Effects of Circuitous Routes on the Latency of Intra-Africa Internet Traffic: A Study of Research and Education Networks," in 6th International Conference, AFRICOMM 2014, Kampala, 2014.

Kelsey Scott, S3

Faculty Mentor: Brian Drake, Mathematics

Congruences for Colored Two-Rowed Arrays

Congruences for the partition numbers were first established by Ramanujan in the early twentieth century. Since then, arrays called generalized Frobenius partitions have been shown to satisfy the same kinds of congruences. We investigate similar arrays wherein the rows may differ in length and show that the numbers of these objects satisfy analogous congruences.

Eric Sheffield, S3

Faculty Mentor: James Reed, Biomedical Sciences

Variation in density of human cranial dura mater using computerized tomography

The meninges – connective tissue coverings of the brain – are vital structures that help protect the health of the brain. Other research has suggested that due to its close relationship to the brain, the meninges – especially the dura mater – may be affected by diseases of the brain and show changes in thickness and density. While these signs could be important, there is a dearth of research on the normal density and thickness of the dura. This project evaluates the normal variation in the density of the dura mater from thirty-three individual CT scans obtained from Saint Mary's Hospital System. Density was measured in Hounsfield units, using the coronal suture as an anatomical landmark to facilitate comparison. A total of eighteen data points were collected for each scan. Six of these were directly deep to the coronal suture, with the other twelve points being two slices anterior and posterior of the suture.

Brittany Sincox, McNair

Faculty Mentor: Eric Ramsson, Biomedical Sciences

Characterization of Acetylcholine in Porcine Retina Using Fast Scan Cyclic Voltammetry

Porcine eyes are an affordable resource that can be used to study retinal function in response to stimuli. Acetylcholine is a neurotransmitter with neuroprotective properties, and these properties can make it useful when regulated to prevent retinal diseases such as glaucoma. Using Fast Scan Cyclic Voltammetry, multiple electrode types and porcine eye dissections were tested for optimal acetylcholine readings. The electrode types and eye dissection techniques were tested for a future experiment which aims to measure acetylcholine release in response to DMP-543 within porcine retina. Carbon fiber and copper wire based electrodes were not able to repeatedly measure acetylcholine. We hypothesize that the eye cup dissection technique is ideal measuring acetylcholine release in response to DMP-543.

Jared Sweet, S3

Faculty Mentor: Roderick Morgan, Biology

Evaluation of the Antibacterial Properties of Cinnamon Bark Oil and Oregano Oil

The proliferation of antibiotic resistant microbes is a direct response to evolutionary pressure. Microbes live and die on a rapid time scale that allows for evolution to occur at an accelerated rate. Decades of antibiotic use, often overuse, has provided ample time for microbes to develop resistance. The lack of profitability coupled with resistant microbes has created an urgency to develop new antibiotics. Plant based essential oils have an extensive history as antimicrobial agents that can be linked to their phenol or phenol-like compounds. There are multiple different essential oils that display antimicrobial properties at dilutions of 0.125% but oregano and cinnamon bark oil inhibit *E. coli, Staphylococcus aureus*, and methicillin-resistant *S. aureus* at concentrations as low as 0.031%. Additionally, Cinnamon bark and oregano oil retained a low MIC in the presence of 10% human serum. Essential oils and their active components provide a source for antibiotic development.

Kayla Williams, McNair

Faculty Mentor: Chris Haven, Writing

The Vocabulary of Depression: Using Literature to Understand a Clinical Disease

To assist writers in portraying depression, this multi-genre study analyzes the vocabulary around it's depiction within clinical, fiction, and creative non-fiction sources over a range of time. The vocabulary analyzed in this study can overall be defined as terminology and identity: clinical definitions versus how patients see themselves. Currently, clinical sources define depression's effects in face of an absent cause; though basing the disease upon its medical symptoms does not create a complete picture. Narrative works, which in this study shall be defined as fiction and creative non-fiction, provide "identity" language that creates a humanizing feature. Without a clear "cause and effect", metaphor becomes a powerful tool for writers to make the disease more relatable, though how this is approached and what perception is created is determined by genre. By understanding the demands of genre, writers and readers recognize the significance of literature on the effect of depression.