GVSU SUMMER SCHOLARS SHOWCASE

July 24, 2018

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.

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

Oral Presentations by: 4:15 P.M.

Caitlan DeVries • Erin Fish • Brendan Kosnik • Ruth Ott

Poster Presentations by: 5:00 P.M.

Safiya Best • Kimberly Bottenberg • Rachel Britton • David Bronicki • Roberto Carriedo Ostos • Alexander Denison • Kendra Garcia • Lavar Green-Jackson • Alexis Hansen • Sabrina Jenkins • Jordan Juzwiak • Alyssa Langenberg • Eleanore Larson • Tyrese Lillard • Michael McCabe • Aaron Nelson • Maxwell Okros • Anna Prince • Cecelia Roehm • Katrina Teunis • Isabel Thompson • Nicholas Urban • Faith Ureel • Eric Vaitkevicius • Maureen Wood • Jessica Wyn

Oral Presentations by: 6:00 P.M.

Gage Paul • Amarri Smallwood

Welcome to the 2018 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 2018 GVSU Summer Scholars Showcase. Today, we celebrate the scholarship, research, and creative work of undergraduate scholars in the Beckman Scholars at GVSU, Library Scholars, REACH Scholars, Student Summer Scholars (S3), and Modified Student Summer Scholars (MS3).

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

Beckman Scholars

Kimberly Bottenberg (2017)
Erin Fish (2018)
Gage Paul (2018)
Faith Ureel (2017)

Library Scholars

Rachel Britton
Aaron Nelson
Ruth Ott
Maureen Wood

REACH Scholars

Safiya Best
Alexander Denison
Caitlan DeVries
Kendra Garcia
Lavar Green-Jackson
Alexis Hansen
Amarri Smallwood

Student Summer Scholars

David Bronicki
Roberto Carriedo Ostos (Stiner Scholar)
Nicholas Dewey
Hannah Fisher
Sabrina Jenkins (Ott-Stiner Scholar)
Jordan Juzwiak
Brendan Kosnik
Alyssa Langenberg
Eleanore Larson
Tyrese Lillard, MS3 (Ott-Stiner Scholar)
Michael McCabe (Koeze Fellow)
Maxwell Okros, MS3
Anna Prince (Schroeder Fellow)
Cecelia Roehm
Katrina Teunis, MS3
Isabel Thompson, MS3
Nicholas Urban
Eric Vaitkevicius
Jessica Wyn

2018 Beckman Scholars

Kimberly Bottenberg

Faculty Mentor: Cynthia Thompson, Chemistry, Biomedical Sciences

Controlling for Contamination in Scent Mark Analysis of the Common Marmoset Monkey (*Callithrix jacchus*)

Primate olfaction research has been limited by an inability to characterize scents in animals' natural environment. Use of gas chromatography-mass spectrometry (GC-MS) to ascertain the chemical compounds of in-field scent marks has been difficult due to contamination. To determine whether we can control for contamination, we collected airborne scent samples from common marmoset monkeys (*Callithrix jacchus*) at Tapacurá Field Station in Pernambuco, Brazil using an Inficon Hapsite portable GC-MS unit. After, a control sample of nearby bark and ambient air was obtained to assess background contamination. The number of chemicals found in the gas chromatogram of each sample and control was analyzed. There were significantly more compounds in scent marks than in controls ($\bar{x}$difference = 5.6 peaks, $t_{63} = 7.1$, $p < 0.001$). This suggests that compounds unique to the signaling animal were detected, indicating a possibility to control for contaminants by subtracting background compounds.

Erin Fish

Faculty Mentor: Brad Wallar, Chemistry

Structural analysis of a novel inhibitors bound to *Acinetobacter*-derived Cephalosporinase (ADC-7)

Present day bacteria have developed many resistance mechanisms to combat β-lactam antibiotics. One of these mechanisms is the production of β-lactamases which break down the antibiotics, rendering them ineffective. In *Acinetobacter baumannii* infections, the production of *Acinetobacter*-derived cephalosporinase (ADC) β-lactamases provides a bacterial mechanism for deactivating antibiotics. In order to design a molecule that inhibits the ADC enzyme, it is imperative to determine the molecular structure of the ADC enzyme with the inhibitor molecule bound. We have characterized a group of novel inhibitors containing a triazole ring that are easier to synthesize and modify than previous inhibitors. We have determined the structure of four triazole-containing inhibitors bound to ADC-7. Future studies will determine if triazole-containing compounds inhibit ADC at a high level, as their ability to be modified serves as a more practical option for possible future clinical applications.

Gage Paul

Faculty Mentor: Sok Kean Khoo, Cell and Molecular Biology

Beta-synucleain as treatment for Parkinson's disease: a study in fly

Parkinson's disease (PD) is the second most common neurodegenerative disorder that impacts 1-2% of the elderly population. PD is characterized by the loss of midbrain dopaminergic neurons, leading primarily to motor impairment. Another hallmark of PD is α-synuclein (α-syn) protein aggregates, also known as Lewy bodies. Lewy bodies can be targeted by β-synuclein (β-syn) protein homolog to reduce α-syn aggregation. In *Drosophila melanogaster*, α-syn is expressed within its nervous system by inserting human α-syn gene in its 3rd chromosome. The flies are fed β-syn peptide in a dose dependent, controlled environment. The effect of Lewy bodies inhibition by β-syn will be assessed by locomotion assays and immunofluorescence microscopy to visualize protein aggregation in fly brain. The use of β-syn to treat motor impairment and protein aggregation in fly can potentially lead to novel and noninvasive treatments for patients.

Faith Ureel

Faculty Mentor: Amy Russell, Biology

Disease Detective-Work Through Demographic Analysis: European Bats Provide Historical dHints for White-Nose Syndrome Management in North America

White-Nose Syndrome (WNS), a disease caused by the fungus *Pseudogymnoascus destructans* (*Pd*), has drastically affected North American bats. However, WNS has been found in European bat species such as *Myotis myotis*, the greater mouse-eared bat, without the same morbidity. There is evidence to suggest that European bats have previously evolved adaptations that make them more tolerant of *Pd*. Thousands of years ago, European bat populations experienced genetic bottlenecks. If extant European bat populations are the descendants of survivors of an ancient WNS epidemic, these populations may hold clues to direct bat conservation practices in North America. We are using Bayesian models to reconstruct the evolutionary histories of *M. myotis* and European *P. destructans* using previously published data. Here we present data showing changes in effective population size of both *M. myotis* and *Pd* through several millenia before the Last Glacial Maximum.

2018 Library Scholars

Rachel Britton

Faculty Mentor: Gayle Schaub, University Libraries

Dysmorphia

"Dysmorphia" reflects the descent from reality into obsessive states of mind through imagery. Influenced by body dysmorphic disorder--the preoccupation with real or imagined flaws of the physical body that produces behaviors such as hair pulling, skin picking, and looking in mirrors often--I am fascinated with the overwhelming presence of the disorder in people's lives. I distort reality through digital manipulation and lighting effects to reflect the mind in turmoil driven by these hidden and obsessive traits.

Aaron Nelson

Faculty Mentor: Barbara Harvey, University Libraries

The Mary Idema Pew Library: How Libraries Transform from an Architect's Floor Plan to a Geographer's Map

This project began as an experiment to use computer software popular within Geography (GIS) to give administration an understanding of how the spaces of the new Mary Idema Pew Library (MIPL, at Grand Valley State University (GVSU)) were used. To the author's surprise, data for this had already been collected at the Library, but also as part of a new topic of study within Library and Information Sciences (LIS): Space Use and User Experience (UX).

It has always been the mission of academic libraries to "support student learning", but this has classically been defined as shelving space for a burgeoning collection of volumes. However, digitization has largely omitted shelving on the floor plan, creating open spaces, and forcing libraries to redefine.

The second part of this project became to discover how GVSU has defined their libraries overtime, leading to the MIPL being a famed example of student learning. Using diverse spaces has redefined libraries to be a geographic inquiry.

Ruth Ott

Faculty Mentors: Leigh Rupinski & Emily Frigo, University Libraries

Addressing Issues in LGBT Historical Research

For many reasons, little is known about the history of LGBTQ communities in the United States. This presentation discusses the various roadblocks to conducting historical research on the LGBTQ community, and how libraries and archives factor into the process. Topics discussed include how teleology, contextual authority, and the sociopolitical positioning of libraries and archives present challenges to researchers seeking to understand LGBTQ histories. This presentation will also feature discussion of a program being developed for the Mary Idema Pew Library that will provide research strategies for students conducting historical research on LGBTQ communities and movements.

Maureen Wood

Faculty Mentor: Erica Millspaugh, University Libraries

Help! It's due in two hours: point-of-need research services from a student's perspective

Despite the important role that research plays in higher education, learning research skills is not always a well emphasized goal within individual college courses. To that end, there are many college students who struggle to understand how to do research. The library plays a critical role in connecting students with resources that will help them be academically successful, but at Grand Valley there is no mandatory library research orientation or course. As an RA it's obvious that some students are missing vital research instruction when they come to me for last minute help with assignments. By creating an online library guide to function as a starting point for learning these skills students will have a new point-of-need resource. This will help them be successful both at the last minute, and/or to plan ahead for future assignments.

2018 REACH Scholars

Safiya Best

Faculty Mentor: Rick Rediske, Annis Water Resources Institute

A comparison study of Colilert and Quantitative Polymerase Chain Reaction (qPCR) methods at Pere Marquette Beach in Muskegon County, MI

Pere Marquette Beach serves as the primary attraction for tourism and coastal development in Muskegon, MI. Because beaches attract many people daily, it is important to test the beach to prevent individuals from being contaminated with bacteria. Molecular-based methods are emerging as replacements for culture-based techniques for monitoring beaches. Culture-based methods require 18-hour incubation while (qPCR) can yield results in two hours. My research examines the correlation between the culture-based Colilert 18 method and qPCR and the effect of turbidity on the results for a Muskegon County beach. While Colilert 18 is a defined substrate method, the qPCR array quantifies living and nonliving DNA. Regression analysis is used to correlate turbidity results with and the Index of Agreement is employed to evaluate method comparability. This study is important for assessing the applicability of qPCR for providing same-day results for potentially dangerous pathogens in local beaches.

Alexander Denison

Faculty Mentor: Michael Wolfe, Pyschology

Poor Awareness of Belief Change About Gun Control

Our work examines whether people were aware of changes to their beliefs about gun control effectiveness. Participants report their beliefs about gun control effectiveness at the start of the semester and in a subsequent experimental session read a text that was consistent or inconsistent with those beliefs. After reading, participants reported their current beliefs and recalled their initial beliefs about gun control. Participants who read a belief inconsistent text had greater belief change than those who read a belief consistent text. Recollections of initial beliefs were generally inaccurate and biased in the direction of participants' current beliefs. Further analyses showed that more belief change resulted in larger errors in previous belief recollection. These results suggest people are relatively unaware of belief changes when they happen. Implications are discussed in terms of common situations in which people report beliefs they used to hold.

Caitlan DeVries

Faculty Mentor: Glenn Valdez, Pyschology

CRF_2 Receptor Regulation in Anxiety Responses Following Long-Term Alcohol Withdrawal

Alcoholism is a public health epidemic. It the third-leading preventable cause of death in the United States. Globally, it is the first risk factor for premature death in 15-29-year-olds. Previous research presented urocortin 3 (Ucn 3), which activates CRF_2 receptors, as effective in reducing anxiety during acute alcohol withdrawal; but withdrawal-related anxiety is a long-term problem. Therefore, the current study tests Ucn 3's effectiveness in reducing anxiety-like responses in the elevated plus maze (an animal model of anxiety) after a long period of alcohol abstinence. **The hypothesis is that Ucn 3 will reduce anxiety-like behaviors in rats with a history of ethanol dependence.** The overall goal is to determine if CRF_2 receptors can be targeted to create effective pharmacotherapies for decreasing withdrawal-related anxiety and to ultimately improve treatments for long-term alcoholism management.

Kendra Garcia

Faculty Mentor: David Stark, History

Who Is a Mexican? Afro-Mexicans Reclaim Their Place in "The Cosmic Race."

The research examines the field of Afro-Mexican history, in particular how the field has evolved and what gaps exist within the historiography. Two questions guide my analysis, how the voices of Afro-Mexicans were marginalized and silenced and why there was a resurgence of interest in the field during the 1990s. The gap in the research is due to the erasure of Afro-Mexicans from national identity, and general emphasis on *mestizaje* in the period after the Revolution. Resurgence in the discipline began as a result of a growing interest in comparative history, the era of post-emancipation, and a small segment of the Afro-Mexican population becoming involved in politics beginning in the 1980s which led to this renewed interest in the lives of contemporary Afro-Mexicans. The research is important because there is not one Mexico, diversity abounds in the nation, but this is yet to be acknowledged.

Lavar Green-Jackson

Faculty Mentor: Glenn Valdez, Pyschology

CRF_2 Receptor Regulation of Depressive-Like Behavior During Protracted Ethanol Withdrawal

Alcoholism is the third leading preventable cause of death in the United States. While there are certain medications to help treat alcoholism, there are none that pacify depressive symptoms experienced following long-term withdrawal. This study seeks to understand why individuals experience depression during alcohol withdrawal, which often leads to relapse. In our experiment, we examined the ability of the CRF_2 receptor to alleviate depressive-like behaviors following long-term withdrawal from alcohol by investigating the ability of Urocortin 3 (Ucn 3), a neuropeptide that selectively activates CRF_2 receptors, to reverse immobility in the forced swim test, an animal model of depression. We predict that the animals injected with the Ucn 3 will display less immobility compared to rats that are injected with the control solution. After analyzing our results, we hope to find a treatment for humans experiencing depression following long-term alcohol withdrawal.

Alexis Hansen

Faculty Mentor: Lawrence Burns, Pyschology

Developing a Transcartohistoriography

Transgender issues have come to the forefront of mainstream LGBTQ dialogues, and our culture has begun to put a greater spotlight on trans celebrities, but a critical theoretical lens is often lacking from such narratives. Our study elucidates a more nuanced story by mapping the past, present, and future scholarly topography of transgender studies in order to uncover a roadmap of where the trans perspective is centered, what dialogues appear in the field, and where this area of study is going. Metadata from abstracts and article titles of three literature databases was organized into bibliometric networks that map key topics and shifts in terminology over time. These maps suggest an increase in disciplinary divisions over time but less pathologized conversation. As a pilot study, our research also showcases the value of transgender theoretical framework as a catalyst for major social change and effective political praxis, evidenced by correlations between activism and semantic shifts.

Amarri Smallwood

Faculty Mentor: Ayana Weekley, Women and Gender Studies

A Black Feminist Content Analysis of Gender and Sexuality in *Living Single*

Between the 1980's and 1990's there were many female-centered sitcom television shows like *The Golden Girls*, *Designing Women*, and S*ex in the City* that explored women's sexuality from an autonomous perspective. However, Black women's sexuality in sitcoms has yet to be examined as both oppositional and equally significant. This research focuses on the importance of resistant sexual representations in the 1990's sitcom *Living Single*. This content analysis is drawn from eight episodes spanning season's one through four. The study uses a Black Feminist theoretical framework to analyze how *Living Single* countered stereotypes of Black women's sexuality. Additionally, this project examines how *Living Single* challenged gender norms for Black women. The questions that will be explored are: How did *Living Single* provide alternative representations for Black women's gender and sexuality? In addition to, why is Black women's sexual freedom an important representation for television?

2018 Student Summer Scholars

David Bronicki

Faculty Mentor: Brett Bolen, Physics

The Gravitational Signature of Asteroid Populations on LISA Orbits

We have modeled the effect of the asteroid belt on the LISA spacecrafts. To do so, we obtained orbital and other parameters of 700,000 belt asteroids from the Jet Propulsion Laboratory Small-Body Database. Since many of the masses are unknown, we used measured values of albedo, absolute magnitude, and asteroid type to estimate the individual masses via a Monte Carlo method. The asteroids' and LISA spacecrafts' orbits are then simulated, and the force of the asteroids on each spacecraft is calculated. We can then generate several different scenarios by repeating the mass generation. This allows for creating a statistical distribution of the asteroid belt on the LISA spacecrafts. We expect to obtain a long-term secular influence on the LISA spacecrafts. In addition, we can probe the effects of different initial LISA configurations as well as what influence close-approach asteroids may have on the LISA constellation.

Roberto Carriedo Ostos (Stiner Scholar)

Faculty Mentor: Kristin Hedges, Anthropology

Mind the Gap: Intergenerational loss of Traditional Medicinal Knowledge (TMK) among Maasai

An accumulation of evidence suggests that traditional medicinal knowledge (TMK) among indigenous populations is at risk of being lost. This project, with its focus on urban Maasai seeks to tease out the underlying influences responsible for the intergenerational loss of TMK among Maasai. Data from the 2017 Olosho Ethnobotany Project found that Maasai elders believed the younger generation did not want to use traditional medicine. Methods used was a combination of participant observation and in-depth interviews of 10 participants. Results from current fieldwork found a number of sociocultural factors contributing to the loss of TMK among younger generations. The surprising finding was while younger generations were amenable to learning and described a strong desire to learn, elder Maasai were not forthright with their teaching of TMK. We have concluded to support TMK methods of transmission must be adapted to suit the new urban and modern lifestyles of new generations.

Nicholas Dewey

Faculty Mentor: Richard Lord, Chemistry

In Pursuit of High-Energy Molecules: Why Do Some First-Row Transition Metals Transfer Carbene to Isocyanide While Others Do Not?

Ketenimines, a structural analogue of carbon dioxide, are a useful synthetic starting point for the synthesis of heterocycles in materials and pharmaceutical applications. Recent work between the Lord and Groysman labs has shown that the first isolable high-valent cobalt carbene (J. Am. Chem. Soc., 2016, 138, 5531-5534) can transfer its carbene moiety to isocyanide and form ketenimines despite formally being a Schrock-type carbene. The goal of this presentation is two-fold: (i) to uncover the mechanism by which carbene and isocyanide couple, with the carbene acting as a Fischer-, Schrock-, or radical-type carbene and (ii) to explore why other first-row transition metal carbenes in the same ligand environment do not show similar reactivity.

Hannah Fisher

Faculty Mentor: Timothy Evans, Biology

Evolution of CAM photosynthesis in the plant family Bromeliaceae

CAM photosynthesis is a pathway in which plants use an alternative mechanism for carbon fixation than that used in the typical C3 photosynthesis. This pathway has been derived several times within the plant family Bromeliaceae (pineapple family). In this study, we examined the evolution and predicted protein structure of PEP carboxykinase (PEPCK), an enzyme in the CAM photosynthetic pathway. Exon regions in the gene that codes for PEPCK were sequenced in 9 bromeliad species representing both CAM and C3 lineages, and the inferred amino acid sequence for each species was determined. The 3-dimensional structure was predicted for each species based on the amino acid sequences and compared to one another. Variation was found within both the DNA and inferred amino acid sequences. Preliminary analyses revealed variation in structure within and between CAM and C3 species. This variation will be interpreted in the context of enzyme function and phylogenetic structure within Bromeliaceae.

Sabrina Jenkins (Ott-Stiner Scholar)

Faculty Mentor: Scott Thorgaard, Chemistry

Sensing of Bacteria Using Blocking Electrochemical Collisions and the Dependence of Current Transients on Supporting Electrolyte Concentration

Electrochemical collisions enable the determination of bioanalyte concentrations with greater speed than traditional microbiological techniques and provide characterization at the single cell level. We extend the application of blocking collisions to unstudied bacteria species to understand how cell characteristics influence current transients produced during experiments. Decreases in the current at an ultramicroelectrode (UME) were observed when bacteria collided with it in solution. Bacteria arrive at the UME by electrophoresis due to the charge on their cell walls. Current transients in the experiment depended on the bacteria species and the solution electrolyte concentration. At low electrolyte concentrations, blip-shaped transients were more abundant for some bacteria species. At high electrolyte concentrations, only step-shaped transients observed. Simultaneous fluorescence microscopy implied that the mechanism of blip-shaped transients involves reversal of the bacteria charge.

Jordan Juzwiak

Kyle Barnes, Movement Science

A Comparison of the Metabolic Cost of Running in Sub 2-hour Marathon Running Shoes in Elite and Recreation Runners

Background A sub 2-hr marathon requires an average velocity that is 2.5% faster than the current world record of 2:02:57 and could be accomplished with a 2.7% reduction in the rate of oxygen uptake (VO2) during running. Both Nike and Adidas have developed shoes to help runners break the 2 hr marathon barrier. *Purpose* To determine if, and to what extent these new shoes reduce VO2 compared with established marathon racing shoes. *Methods* 20 elite and 20 recreational runners (10 male and female) ran five 5-min trials in Nike Vaporfly, Adidas Sub2, and Adidas adios 3 marathon shoes in a randomized counterbalanced design, followed by a max aerobic capacity test. Elite men ran at 16 km.h-1, elite women at 15 km.h-1, and all recreational runners at 11 km.h-1. We measured the subjects' VO2 and biomechanical stride characteristics (contact time, stride length, and stride rate). Data collection is currently ongoing, and results will be presented at the Student Summer Scholars Showcase.

Brendan Kosnik

Faculty Mentor: Gary Greer, Biology

Effects of Hurricane Maria on an epiphytic plant community in Puerto Rico

Last September, Hurricane Maria devastated Puerto Rico's forests. Epiphytes – plants attached to trees – are of particular concern, given their dependence on trees as habitats. My summer research documented the impacts of Hurricane Maria on the epiphytes at El Verde Field Station, El Yunque National Forest. The first goal of the study was to discern changes in the number of epiphytic species and shifts in species abundances. The second was to determine the relative impacts of damage from hurricane force winds versus damage from the resulting exposure to sunlight because of changes in canopy structure. This second goal was accomplished through detailed study of ferns in the genus *Elaphoglossum* and flowering plants in the family Bromeliaceae (pineapple family). My study also establishes a baseline for future studies of the recovery of an epiphytic community following an unprecedented natural disaster.

Alyssa Langenberg

Faculty Mentor: Amanda Dillard, Psychology

Reducing an Impact Bias Towards a Health Food

Affective forecasting theory says that when people make decisions, they tend to overestimate the intensity and duration of feelings, a phenomenon known as the impact bias (Buehler & McFarland, 2001; Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998). The aim of this research was to explore the impact bias as it applies to healthy food choices that have been linked to lower risk of diet related diseases, such as diabetes and heart disease. In the present study, we tested if participants showed an impact bias toward kale. We further tested an adaptation recall intervention to reduce a potential impact bias as well as motivate intentions to eat healthy. After participants read a message about kale, they completed measures on their anticipated emotions when eating kale. Then they reported experienced emotions before and after eating kale. Results indicated that participants showed an impact bias towards kale: they overestimated the amount of negative emotion they would have while eating, and underestimated the positive emotion. Further the negative emotion effect was moderated by the intervention such that relative to the control group, those in the adaptation recall group experienced the least negative emotion after eating. Those in the adaptation recall group also reported higher intentions to eat more kale in the next two weeks (but this effect was marginal). There were no significant differences for the intervention in how pleasurable participants rated the kale or how much they ate. These findings may suggest that reminding people of their ability to adapt could reduce their negative affect toward health foods, and may ultimately motivate more healthy choices.

Eleanore Larson

Faculty Mentor: Patrick Colgan, Geology

Investigating groundwater springs and sapping valleys in western Ottawa County, Michigan, U.S.A.

Groundwater is a crucial resource for scientists to understand. Sapping valleys are valleys eroded by groundwater springs and their streams. Groundwater springs and valleys appear to be common along the Pigeon River. We hoped to prove that these structures are sapping valleys with a focused groundwater flow, and hoped to learn the controls of valley formation. Two sets of nested wells were installed in each of two valleys along the Pigeon River. Sediment samples were taken from these wells and the stream bed. Our grain size analyses confirmed that the sediment in these valleys is fine to medium grain sand, which creates the perfect environment for sapping. Probes were placed in the wells to measure temperature, conductivity, and pressure of the groundwater from May to July of 2018. This data showed that the groundwater has a positive hydraulic gradient, and thus a focused groundwater flow. It appears that these are, in fact, sapping valleys with relatively stable stream discharges.

Tyrese Lillard, MS3 (Ott-Stiner Scholar)

Faculty Mentors: George McBane & Stephanie Schaertel, Chemistry

Pressure broadening of carbon monoxide infrared absorption lines by neon

Carbon monoxide (CO), a deadly gas, is able to absorb infrared light that is invisible to the human eye. This absorption occurs at specific wavelengths that correspond to changes in energy levels in the molecule. We measure how the absorption of infrared light is affected if the CO molecules are also colliding with another gas. Specifically, we measure absorption spectra of mixtures containing both CO and neon (Ne). Ne is an inert gas that does not absorb the infrared light, but the addition of the Ne causes the CO to absorb a wider range of wavelengths. Using a set of increasing Ne pressures we determine how sensitive the absorption widths are to the neon pressure, and characterize this sensitivity with a pressure broadening coefficient. These coefficients can be computed from a theory of Ne-CO collisions, so our experiment can be used to test theoretical collision models. Theoretical collision models are used to predict chemical reaction rates.

Michael McCabe (Koeze Fellow)

Faculty Mentor: James Reed, Biomedical Sciences

Anisotropic variation in the collagen fiber structure of *Macaca* pericardium

The pericardium is a fibrous sac which encloses the heart, stabilizing it as it contracts. Previous research has demonstrated that the collagen fibers which primarily constitute its structure may be anisotropic. That is, oriented in a preferred direction. However, the degree of anisotropy can vary with both species and position on the heart. To date these variations have only been investigated with a limited number of species. Therefore, in this study we sought to determine what, if any, anisotropic variation exists in the pericardium of *Macaca* fasicularis and *M. mulatta*, representing a novel model of pericardial anisotropy. To assess anisotropic variation, *Macaca* hearts were obtained whole, and the pericardium dissected to obtain samples overlying the right and left ventricles and apex. Samples were sectioned, stained, photographed. The resulting images were analyzed to determine fiber anisotropy. Anisotropy ratings from each location were compared to determine variation.

Maxwell Okros, MS3

Faculty Mentor: Merritt DeLano-Taylor, Biomedical Sciences

qPCR analysis on the effects of PKA on Nato3 and DA neuron gene expression

Parkinson's disease is caused by the degradation of dopamine neurons in a region of the midbrain known as the floor plate. Discerning the mechanisms that underlie dopaminergic neurogenesis may assist in providing therapeutic treatment options for Parkinson's patients with options such as cell replacement therapy. Nato3 is a transcription factor that is known to have an important role in the development of dopamine neurons. Phosphorylation of proteins similar to Nato3 have been shown to change the function of these transcription factors in the cell. Past, unpublished, data has shown that phosphorylation of Nato3 is important in its function in dopaminergic neurogenesis through increased expression of DA markers in a phospho mutant version of Nato3. In many similarly structured proteins, PKA has been shown to play a role in the phosphorylative effects of the protein. The goal of this research is to determine, through experimentation with combinations of PKA, PKI and wild-type Nato 3, a mechanism in which Nato3 may be phosphorylated in the cell and its effects on DA marker expression.

Anna Prince (Schroeder Fellow)

Faculty Mentor: Martin Burg, Biomedical Sciences

Localization of histamine in the accessory gland and its influence on male-induced female behaviors in Drosophila

The accessory gland in Drosophila males is functionally comparable to the human prostate gland because of its contributions to both sperm health and induction of biological responses in the female. Studies of *D. melanogaster* accessory gland function have demonstrated that 'secondary cells' in the accessory gland are responsible for increased egg laying and female rejection of male courtship advances. Histamine immunolocalization was conducted using flies that express green fluorescent protein (GFP) in secondary cells, to confirm that histamine is present in these cells. To determine the role of histamine in any post-mating response, normal females were mated with either normal or *Hdc* mutant males (which lack histamine in the secondary cells). Preliminary results indicate that absence of histamine in the male disrupts the female egg laying behavior that is observed when females are mated with normal males. The effect on other behaviors, such as courtship rejection, is less clear and requires further adjustments in experimental design.

Cecelia Roehm

Faculty Mentor: Elizabeth Arnold, Anthropology

Archaeological Isotopic Investigations of Animal Resources at Early Urban Centers in the Southern Levant

This study examined the teeth from several domestic species (sheep, goats, cattle, pigs and donkey) using stable isotope analyses (carbon, oxygen and strontium) to provide detailed information about the use and management of animal resources at several urban sites in Israel. The central research question of this project is how do occupants of developing urban centers gain and use animals? Of interest are several adult female donkeys that have been recovered under EB III houses at Tell es-Safi/Gath, Israel. The donkeys are expected to show high mobility with high diversity in strontium isotope values recorded in their teeth. Other domestic species are expected to have lower diversity in their signatures and show isotope values that indicate a local herding pattern. Stable isotope analyses tests this hypothesis by examining the life history of the recovered animals with a reconstruction of diet, mobility, and management practices obtained through sequential sampling for isotope analyses.

Katrina Teunis, MS3

Faculty Mentor: Lauren Keough, Mathematics

The Combinatorics of RNA

RNA, much like DNA, is made up of four building blocks called nucleotides, Adenine, Guanine, Cytosine, and Uracil. These nucleotides form a string that likes to fold in on itself and bond together - Adenine with Uracil and Guanine with Cytosine. The order and number of nucleotides present will determine how many ways the string of RNA can fold. Using these guidelines, we move into the theoretical and consider what happens when we have $2n$ nucleotides. For strings containing only one nucleotide and its bonding pair we describe how to build strings of a given foldability and expand on what is known about all of the possible ways to fold strings of given length.

Isabel Thompson, MS3

Faculty Mentor: Jodee Hunt, Biology

Effects of enclosure complexity on the behavior of big cats at John Ball Zoo

Zoos exhibit wild cat species (felids), but their enclosures differ in size and complexity. Animals kept in complex enclosures are thought to be more active and use space more evenly. Our objectives were to assess behavior of 3 tigers, 4 lions, and 2 lynxes in relation to features of enclosures and to master ZooMonitor, an application supporting spatial data. We quantified behavior in 30-minute bouts of all-occurrences interval sampling, alternating AM and PM observation sessions. More than 130 total observation sessions were completed. Animals expressed particular behaviors, such as patrolling or pacing, in specific locations, and individuals housed within the same enclosure used their space differently. Newly introduced individuals exhibited more uniform and evenly distributed use of space compared to well-established individuals. Our study demonstrates that captive animals benefit from enclosure complexity, information that can be used by zoo personnel to improve animal welfare.

Nicholas Urban

Faculty Mentor: Ruijie Liu, Biomedical Sciences

Study the Cardio-Protective Effect of ERK1/2 Using Genetically Modified Mice

Heart disease remains the most prominent health issue in the United States. Previous studies have demonstrated the cardio-protective benefit of an increase in extracellular signal-regulated kinase 1 and 2 (ERK1/2) activity by genetically knocking out either of the known dual-specificity phosphatases (DUSP6 or DUSP8) responsible for regulating ERK1/2 phosphorylation in mice. In this study, genetically modified mice with knockouts of both the DUSP6 and DUSP8 genes (DKO) were used to study the beneficial effects of ERK1/2. Western blot analysis showed an increase in ERK1/2 phosphorylation in the DKO mice compared to wild type mice (WT). DKO mice also demonstrated significantly increased organ/bodyweight ratios compared to WT mice, and histological analysis showed a significant increase in the cell area of DKO mice. In conclusion, our mouse model demonstrates that an increase in ERK1/2 phosphorylation may potentially prevent disease from various organs, such as the heart and liver.

Eric Vaitkevicius

Faculty Mentor: Ian Cleary, Biomedical Sciences

Testing the role of an uncharacterized gene in *Candida albicans* filamentation

The fungus *Candida albicans* is in most human intestines and mucous membranes, and it typically does not cause disease in healthy individuals. However, with changes in the host, such as in immune compromised individuals, disease can arise due to *C. albicans* ability to change cellular shape between round yeast and elongated filaments. In *C. albicans* cellular shape is regulated by a genetic program. The function of many genes associated with filamentation is unknown. Our goal is to understand the particular contribution to this process of one gene, *FGR16*. *FGR16* overexpression caused increased biofilm growth in some media, and increased clumping in some broth cultures. Changes in plate growth included reduced filamentous growth, as well as increased invasion. These results confirm that *FGR16* overexpression affects cell shape. We are testing how well this gene's function is maintained between organisms; by overexpressing homologs in *C. albicans* and looking for effects on cell shape.

Jessica Wyn

Faculty Mentor: Eric Ramsson, Biomedical Sciences

The Effect of Melatonin on Dopamine Signaling

As a primary component in the regulation of the Circadian Rhythm, Melatonin affects neural activity levels in the brain, with a potential effect on the pleasure-reward center, the Nucleus Accumbens, as well as the movement and learning center, the Caudate Putamen. Fast Scan Cyclic Voltammetry was used to measure real time Dopamine stimulated release events in a mouse brain slice during exposure to Melatonin and after Melatonin washout, as well as during and after exposure to Tasimelteon, an agonist of the Melatonin receptor. Over the course of an acute exposure of 60 min, Dopamine release decreased significantly, with minimal recovery post-washout. Due to the importance of the Nucleus Accumbens in regulating pleasure-reward based cognition, these findings have implications in behavioral neuroscience, specifically into how Melatonin may impact behavior regarding addiction. The effect in the Caudate, an area affected by Parkinson's, also implies that Melatonin could factor into severity of symptoms.

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