GVSU Summer Scholars Showcase

August 6, 2013

Grand River Room, Kirkhof Center

Allendale, MI

4:00 p.m. - 7:00 p.m.

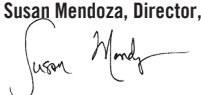
Welcome to the 2013 GVSU Summer Scholars Showcase!

On behalf of the Office of Undergraduate Research and Scholarship and the Undergraduate Research Council, I welcome each of you to the 2013 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 more than experimentation, data collection, and deep study. Students must have 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. Again, welcome to the GVSU scholars' community.

Susan Mendoza, Director, Office of Undergraduate Research and Scholarship



2013 GVSU Summer Scholars

Abigail Carlson (S3)
Holly Cassell (S3)
Christopher Churches (S3)
Jozlyn Clasman (S3)
Jacob Dec (S3)
Alexander Fisch (S3)
Vincent Gasparotto (S3)
Julia Gjebic (S3)
Breanna Gould (S3)
Nkrumah Grant (McNair)
John Gravelyn (MS3)
Danielle Harris (S3)
Garrett Hisler (McNair)
Rachel Hughart (S3)
Sorscha Jarman (McNair)
Lisa Keeney (S3)
David Leestma (S3)
Kayla Lockmiller (MS3)
Kristy Moore (McNair)
Andrea Morrow (S3)
Alice Munday (MS3)
Jessica Pontow (S3)
Aula Ramo (S3)
Mitchell Roth (S3)
Alyssa Snyder (McNair)
Max Spencer (S3)
Aubriana Spenski (MS3)
Wyatt Stahl (McNair)
Jordan Straight (S3)
Hollister Swanson (S3 Koezee Fellow)
Marissa Swartz (S3)
Adam Terwilliger (MS3)
Jared Toogood (S3)
Josephine Werner (MS3)
Jaqueline Williams (McNair)
Noah Zucker (S3)

Order of Events

Welcome and Remarks **4:00 P.M. - 4:15 P.M.**
Gayle R. Davis, Provost and Vice President for Academic and Student Affairs

Oral Presentations by: **4:15 P.M. - 5:15 P.M.**
Holly Cassell • Julia Gjebic • Breanna Gould • Sorscha Jarman • Lisa Keeney

Poster Presentations by: **5:15 P.M. - 6:15 P.M.**
Abigail Carlson • Christopher Churches • Jozlyn Clasman • Jacob Dec • Alexander Fisch • Vincent Gasperotto • Nkrumah Grant • John Gravelyn • Danielle Harris • Garrett Hisler • Rachel Hughart • David Leestma • Kayla Lockmiller • Kristy Moore • Andrea Morrow • Aula Ramo • Mitchell Roth • Alyssa Snyder • Max Spencer • Aubriana Spenski • Jordan Straight • Hollister Swanson • Adam Terwilliger • Josephine Werner • Jaqueline Williams • Noah Zucker

Oral Presentations by: **6:15 P.M. - 7:00 P.M.**
Alice Munday • Jessica Pontow • Wyatt Stahl • Marissa Swartz • Jared Toogood

Abigail Carlson

Faculty Mentor: Dan Bergman, Biomedical Science

Exercise Induced Neurogenisis Using A Crayfish Model System

Neurogenesis is the formation of new neurons from neural stem cells that occurs throughout adulthood in a variety of animals, including humans. Exercise enhances cell proliferation in mammals, and has been linked to ameliorating age associated declines in memory. Since the nervous system operates under common rules and themes in both vertebrates and invertebrates, our experiment aims to observe the effects of exercise on the simpler nervous system of invertebrates using BrdU, which labels newly synthesized DNA and indicates cell proliferation. Multiple factors involved in sample preparation, preservation in paraffin, and sectioning via microtome created various challenges. Our fundamental focus has been centered on mastering these techniques, as it is crucial to eliminate any variability that might affect our results. After much practice and troubleshooting, we have recently obtained viable brain tissue sections and are currently progressing to the exercise phase of our project.

Holly Cassell

Faculty Mentor: Lisa Feurzeig, Music

Reviving German-American Musical Culture: The Works of William Henry Pommer

William Henry Pommer (1851-1937) was a versatile German-American composer and musician of St. Louis. He held various musical positions as an educator, director, and performer. He was also an active composer with almost 500 works to his credit, composed in a variety of styles that reflect the variety of the different positions he held. Through archival work in St. Louis and by studying and playing through Pommer's music, we have identified different styles that he composed in and begun to pick music for performances to best represent his work. In addition to performances, recordings of these performances will be on display as a permanent auditory exhibit in Hermann, Missouri at the Deutschheim Historic Site- the Pommer family house. This presentation will further discuss Pommer's music and what role he played in the German-American community in Missouri and will include a short performance of his work.

Christopher Churches

Faculty Mentor: Peter Wampler, Geology

Geomorphic Characterization of the Grand River near Grand Rapids: Baseline Data Collection and Predicted Dam Removal Effects

Five low head dams located on the Grand River in Grand Rapids, MI are under consideration for removal. These dams, referred to as anthropomorphic hydraulic controls, were constructed in the late 1800's. This study provides an explanation of the geomorphic history of the Grand River, with an emphasis placed on the portion near Grand Rapids upstream to Lowell, MI. A natural hydraulic control was identified on aerial photos and confirmed using bathymetric mapping. Water well log analysis of over 20,000 wells revealed several areas of exposed or shallow bedrock beneath the river bed, a bedrock channel of the ancestral Grand River, and truncated bedrock ridges near the mouth of the Grand River. A longitudinal profile of the Grand River shows that the modern gradient varies from 0.00012 (0.63 ft/mi) to 0.00045 (2.376 ft/mi). The several knickpoints on the profile may be 1) bedrock / shallow bedrock; 2) glacial till eroded by the river; or 3) boulder / sand and gravel from outburst floods.

Jozlyn Clasman

Faculty Mentor: Dave Leonard, Chemistry

Structural Analysis of the Clinically-Derived Class D β-lactamase OXA-24 with a Pro227Ser Mutation

OXA-24 is a carbapenem-hydrolyzing class D β-lactamase that poses a serious medical threat by destroying carbapenem class antibiotics. OXA-160 is a clinically-derived OXA-24 variant with a Pro→Ser substitution. Previously, it was shown that OXA-160 has higher activity against cephalosporins compared to OXA-24 and maintains activity against penicillins and carbapenems. To slow deacylation, we introduced a second mutation (Val130Asp) to allow us to capture a drug-complex structure. We examined OXA-160/Val130Asp in complex with cefotaxime, ceftazidime, and aztreonam using X-ray crystallography. Our analysis shows that all three of these bulky antibiotics require β5-β6 and/or omega loop deviations, and we propose that these conformational changes are made possible by replacing the restricted proline with the more flexible serine. These structures reveal that a Pro227Ser mutation enlarges the active site, better accommodating advanced cephalosporin drugs.

Jacob Dec

Faculty Mentor: Matthew Christians, Cell and Molecular Biology

Assessing the light requirements for E3 complex assembly in *Arabidopsis thaliana*

Plants sense changing light patterns within their environment, which allows them to adapt their growth patterns in response to different forms of light. Phytochromes (Phys) are proteins that perceive red and far-red light using two photo-interchangeable states. Light response BTB (LRB) E3 ligases act within the Phy signaling pathway and may function to target specific proteins within the plant for degradation via the 26s proteasome. The LRB proteins are part of a larger complex that together tag proteins for degradation, and an interaction between the LRB and Cullin subunits are required for E3 ligase activity. Previous studies in Arabidopsis thaliana have established that this Cullin-LRB interaction is present in red light but not in darkness. This study aims to identify if far-red light can reverse the affects of red light and disassociate LRB from cullin, thus inactivating the complex in a Phy dependent way. Currently, we are undertaking an immunoprecipitation approach using GFP-tagged LRB proteins in Arabidopsis seedlings to assess E3 complex assembly in dark, red and far-red light treatments.

Alexander Fisch

Faculty Mentor: Osman Patel, Cell and Molecular Biology

Effect of Telomerase Inhibitors on Malignant Breast Cancer Cells

Current therapies have nominal effect on the most intrusive-type of breast cancers (triple-negative) that have a higher tendency to metastasize or recur. Recent studies reveal an enzyme, telomerase, as key for unlimited cell growth (immortality) and replication. Therefore, our objectives were to assess (i) short- and (ii) long-term effects of a novel anti-telomerase agent (GV6) developed at our institute and compare it to a known analogue, BIBR1532 on MDA-MB 231 breast cancer cells. Cell viability was measured on days 5, 9, 14, 18 and 27 after treatment with GV6 (n=4), BIBR1532 (n=4) or solvent alone (Control, n=3). The number of viable cells in GV6 and BIBR1532 treated flasks (T75) fell about 35% ($p<.05$) and 40% ($p<.05$) relative to Control by day 14, respectively. Further drops of roughly 35% ($p<.05$) were observed for both on day 27. Our results indicate the anti-telomerase effects of GV6 parallel that of BIBR1532 and should be investigated further.

Vincent Gasparotto

Faculty Mentor: Martin Burg, Biomedical Science

Detecting deletions in the *Hdc* gene generated by *Minos* transposon excision in *Drosophila melanogaster*

Histamine is an important neurotransmitter used by photoreceptor cells and central brain neurons in the fruit fly, *Drosophila melanogaster*. While mutants in the *Hdc* gene have been identified that eliminate up to 98% of *Hdc* activity, they do not eliminate total expression of the *Hdc* gene and it is possible that a stronger phenotype could be generated by deleting the Hdc gene. Histamine is synthesized by the enzyme histidine decarboxylase (HDC) that is encoded by the *Hdc* gene. With the use of a *Minos* transposon element (Mi{ET1}) that contains the gene encoding green fluorescent protein (GFP), an excision of the *Minos* element could be detected by the absence of GFP gene function. As the (Mi{ET1}) element is located in the Hdc gene's second intron, only removal of the element and surrounding DNA will result in the disruption of the Hdc gene. Once the Hdc gene is deleted, the ability to synthesize histamine will be eliminated and easily detectable when examining flies for the presence of histamine.

Currently, Minos excision experiments have yielded (306 GFP- flies/ 2044 total flies) for an excision rate of about 14.9%. Of the excision flies generated, over 80 b eeding lines, generated from single excision bearing flies with the correct genotype, have been extablished. A number of these lines are being examined for the lack of histamine. Once histamine deficient lines have been identified, the molecular extent of the deletions generated will be determined using PCR methodologies. It is anticipated that of the GFP- flies generated, approximately 5% will have deletions that remove Hdc function. These flies will then be available for phenotypic analysis in determining the function of Hdc in the central brain of Drosophila..

Julia Gjebic

Faculty Mentors: Karen Gipson, Physics & Marlen Vavrikova, Music

A Study of Oboe Reeds

Professional oboists spend more time making reeds than they do playing the oboe. Therefore, a high value is placed on reed-making in the oboe community. In this study, a controlled batch of reed cane (internodes of the grass *Arundo Donax*) was selected based on microscopic inspection of cellular composition as well as macroscopic physical characteristics. For most of the participants, the cane was then processed identically to the stage known as a *blank*, after which the participants finished their reeds according to their usual methods. (The few participants who made their own blanks still used the controlled cane and also a controlled *staple*, the metal cylinder that attaches the reed to the oboe.) The sound spectra of recordings of each participant playing on his/her respective reeds were analyzed, as was a spectrum of the *crow* (sound without the oboe attached) of each reed in an anechoic chamber. These spectra were correlated to measured physical attributes of the reeds.

Breanna Gould

Faculty Mentor: Jennifer Moore, Biology

A landscape genetic analysis of eastern box turtles, *Terrapene carolina carolina*

Reptiles represent some of the most imperiled species on the planet, with 25% listed by the Fish and Wildlife Service as threatened or endangered. Habitat loss and degradation have been cited as principle threats to the reptile populations, and their unique life-history characteristics compound their susceptibility to these threats. Regionally, the eastern box turtle (*Terrapene carolina carolina*) is listed as a species of special concern, and their geographic range in Michigan has declined from 31 to 18 counties in the last decade. Population isolation and reduction can be accompanied by disrupted gene flow and losses of genetic diversity, leading to inbreeding and ultimately affecting survival and reproduction. Maintaining gene flow via dispersal is necessary to increase genetic diversity and counteract the deleterious effects of inbreeding. Given this, we assessed current levels of genetic diversity among individuals of *T. c. carolina* located within two regions of the Manistee National Forest. Using a known suite of microsatellites to generate genotypes specific to each individual, we report whether significant losses have occurred. Results are presented here, and are relevant for regional conservation of eastern box turtle populations.

Nkrumah Grant

Faculty Mentor: Rod Morgan, Biology

Anthranilic Acid Derivatives as Novel Antibiotics against MRSA and other Gram Positive Microorganisms: Combating Antibiotic Resistance

Implementation of antibiotics to treat bacterial infections began during World War II. Since then, a number of antibiotic resistance microorganisms have emerged, one of these being Methicillin Resistant *Staphylococcus aureus* (MRSA). This resistance can be accredited to multiple factors, but the greatest contributor is the similarity in the chemical composition of the commonly prescribed antibiotics used to treat MRSA. MRSA is the most frequent health acquired infection in the United States and to combat this growing problem, we have developed a novel class of antibiotics derived from anthranilic acids that show antibacterial activity against MRSA. Our derivatives record a minimum inhibitory concentration (MIC) of 2-32 μg/ml, however when in the presence of human serum protein (HSP) this value increases, decreasing their effectiveness. We have identified a component of HSP, albumin, that causes the increase in MIC, and have characterized the intermolecular interactions allowing this to occur. Using this information we are currently synthesizing new derivatives with a low binding affinity for albumin, or when bound does not lose antibacterial activity.

John Gravelyn

Faculty Mentor: John Farris, Engineering

The Trainer Project

Mobility is something most of us take for granted everyday, but some people have no choice or ability to move. The power wheelchairs that make mobility possible for this population are extremely expensive and must be customized to each person. The PWCT solves this problem by converting the person's existing manual push wheelchair into an extremely safe power mobility device. The device has been built before multiple times but each iteration had a lot of room for improvement and the newest version will be the one that is reproduced. The summer research is focused on designing and building the sixth version of the power wheel chair trainer (PWCT). This version is designed to be reproduced at a high rate, is much less expensive, and is also designed to be safe enough to be approved by the FDA and the IRB. The design relies on mechanical principles and requires fewer motors and which are expensive and less safe.

Danielle Harris

Faculty Mentor: Richard Vallery, Physics

DDS/DGEBA Epoxy Used as a Model for Studying Polymer Confinement in Polymer Nanocomposites

An interesting class of materials is polymer nanocomposites (PNC). Essentially, PNC's are polymer matrices with nanoparticles dispersed within it. These nanoparticles provide a surface for attachment within the polymer, potentially resulting in alterations of macroscopic properties, such as conductivity, hardness, and flame-retardence. This change in attachment can also alter microscopic properties, such as voids in the polymer. Since it has been well studied, an ideal model system for studying polymer attachment to silica nanoparticles (15-20 nm in diameter for this study) is diglycidyl ether bisphenol A (DGEBA) with 4,4'-diaminodiphenyl sulfone (DDS) hardener. Using Positronium Annihilation Lifetime Spectroscopy (PALS), we can study these voids by analyzing the lifetime of positronium (the bound state of an electron and its antiparticle, a positron) which tends to localize in the voids of the polymer matrix. Preliminary results will be discussed, as will the PNC fabrication process.

Garrett Hisler

Faculty Mentor: Amanda Dillard, Psychology

Effects of information processing systems and health message format on skin cancer risk perceptions and behavioral intentions

Previous research has found inconsistent effects with regard to whether a narrative health message may be more effective than a standard factual health message in increasing risk perceptions and motivating health behaviors. These inconsistent effects could relate to the information processing style that people are in when reading these messages. For example, people may process information rationally, based upon logic and reason, or experientially, based upon feelings and past experiences. In this experiment, we examined how health message format would interact with information processing style to influence risk perceptions and behavioral intentions related to skin cancer. Participants included 147 female college students who reported use of tanning beds and were enrolled in psychology 101 courses. Participants were randomly assigned to read either a narrative or a factual message about how tanning beds can increase the risk of skin cancer. Prior to reading the message, participants were randomly assigned to instructions designed to activate either an experiential or rational information processing style. They then answered questions about their risk perceptions of skin cancer, worry about cancer, and behavioral intentions. No main effects of message format or processing style were found. However, results revealed significant and nearly significant Processing X Message interactions for three types of risk perceptions and worry. In each case, a pattern was observed that suggested risk perceptions and worry were most likely to increase when participants read the narrative message with the experiential processing style activated. There was no interaction for behavioral intentions. The present study qualifies inconsistencies in previous research that show sometimes a narrative message is more effective and other times a factual message is more effective. Our findings suggest that although narratives may be a promising route for increasing risk perceptions, they may be most effective when the information is processed in an experiential style.

Rachel Hughart

Faculty Mentors: Paul Keenlance, Natural Resources Mgmt & Joseph Jacquot, Biology

Kit Production and Survival From Birth Through Independence of American Marten in West Michigan

We tracked and documented the den sites and number of kits for three female American marten within Manistee National Forest from April through August 2013. Kits were monitored using remote, motion-censored trail cameras, and the mothers were tracked using radio telemetry. Four of the six monitored female martens had kits; however, shortly after birth, one female lost her only kit. Therefore, the three females tracked throughout the summer produced three litters with a total of six kits. Each den the female utilized preceding kit independence was characterized by surrounding vegetation, including course woody debris, brush piles, tree species and size (diameters taken at breast height) and relative amount of tree saplings. Den site will be compared to random plots to highlight characteristics important in den selection. Preliminary results indicate that mature hardwood stands containing large trees with cavities and the relative amount of course woody debris in the area are important features in determining marten den site selection.

Sorscha Jarman

Faculty Mentor: Glenn Valdez, Psychology

Kappa opioid regulation of reward seeking during acute and protracted withdrawal from ethanol

Alcohol withdrawal can induce both short-term and long-term changes in the brain's physiology, which tends to be expressed behaviorally, such as through increased reward seeking. Though short-term effects of withdrawal have been extensively studied in the literature, not much information is available on the long-term effects of alcohol withdrawal. Findings from recent studies involving animal models of alcoholism have suggested that changes in the dynorphin (DYN)/kappa opioid receptor (KOR) system specifically may play a part in this reward seeking behavior. The goal of the current study was to examine the role of the KOR system on reward seeking for saccharin following chronic exposure to alcohol, both during short-term and long-term abstinence from alcohol. Male Wistar rats were trained to self-administer saccharin, and after developing a preference for saccharin over water, were placed on an ethanol liquid diet for approximately 28 days. After removing the liquid diet, rats were injected i.p. with a saline solution and tested for saccharin self-administration 24 hours later. After being tested, rats were injected i.p. with 20 mg/kg nor-BNI and tested again for saccharin self-administration 24 hours later. Three weeks later, this same series of injections and saccharin self-administration testing took place, as described. Ethanol dependent rats showed a decrease in responding for saccharin during acute withdrawal, and this effect was not reversed by nor-BNI. However, ethanol dependent animals showed an increase in responding during protracted withdrawal, and this effect was reversed by nor-BNI. Also, animals exposed to a control diet showed an increase in saccharin responding during the protracted withdrawal condition, which was reversed by nor-BNI. No differences for water responding were observed for either ethanol dependent or non-dependent animals. These results suggest that the KOR system may be more heavily recruited for reward seeking during long-term withdrawal than during short-term withdrawal and that blockade of this brain system may reverse this reward seeking behavior.

Lisa Keeney

Faculty Mentor: Kevin Tutt, Music

Creating a Performing Edition of Sousa Opera

While composer John Philip Sousa is widely known for his marches, his operas are relatively unknown and unperformed. This is due to a lack of published editions of these operas. The goal of this project was to input hand-written scores of an opera by Sousa into notational software to be published and performed. The original manuscripts are not currently performable, as they are inconsistent, difficult to read, and only available as copies from the archives by request. The score "Selections from The Bride Elect," an arrangement by Sousa of numbers from his opera for wind band, was input and edited into a new performance edition. By creating notation that is edited, easy to read, and readily available, a modern performance of the opera is possible. This process required editing to unify inconsistencies throughout the parts and alignment of the manuscript score with a published reduction of the opera in order to ensure a performance as close to the original score as possible.

David Leestma

Faculty Mentor: Sebastian Maisel, Modern Languages

The Administration of the Hajj: An Analysis of the operation and logistics of the Islamic Pilgrimage

Over the course of the summer I've been researching the historical and contemporary aspects of Safety and Security in the Hajj. Considering the sensitive nature of this topic the data collection has been difficult. Getting primary sources, mainly government documents and interviews with various interlocutors, has proven near impossible. Rather than relying on primary sources, I have been forced to piece the puzzle of safety and security together from information public information divulged on Saudi Ministry websites and countless newspaper reports in both English and Arabic. This process, painstaking at times, involves going through articles, identifying the topics, be it an incident or a report on government preparations for the coming Hajj, and crossing and fact checking these reports with other articles.

Kayla Lockmiller

Faculty Mentor: Patricia Videtich, Geology

TOC, C/N, δC13, and δN15 of Shales from the Mississippian Michigan Formation, Western Michigan

The Mississippian Michigan Formation in Wyoming, Michigan, is composed of thick layers of gypsum with thin layers of dolomite and shale. Samples of shale from each of three units at Michigan Natural Storage Company were collected and analyzed to help determine the environment of deposition. Depositional proxies used were total organic carbon (TOC), carbon/total nitrogen (C/N) ratios, δ13C, and δ15N. TOC (0.20 - 0.51%) indicates low productivity of organic matter. C/N (3.97 – 8.50) and δ13C (-22.77 to -25.38 VPDB) imply a carbon input from mixed marine and freshwater sources. δ15N (1.77 – 3.77 % Air) remains enigmatic; however, it may also indicate a mix of sources. The lack of terrestrial land plant indicators suggests an arid environment with little vegetation. An arid environment would promote the evaporation of seawater, producing gypsum. Freshwater influx into the brine would halt gypsum precipitation and allow for the deposition of shale with mixed carbon sources.

Kristy Moore

Faculty Mentor: Eric Snyder, Biology

Unionids: Their current status in Cedar Creek and their relationship with macroinvertebrates

The decline in mussel populations in North America has been attributed to land-use modifications and unionids are endangered and likely to become extirpated. Our project investigated the status of the unionid community in a 3rd order Michigan stream and examined their relationship with aquatic macroinvertebrates. We sampled 18 randomly chosen sites within 2 separate 100-meter reaches of Cedar Creek and compared unionid and macroinvertebrate diversity, density, and richness. Variables measured included transport organic matter, chemistry, substrate, and biological samples included benthic macroinvertebrates (0.25m2) and unionids (2m2)(n=144). Mussel density was positively correlated with macroinvertebrate density (p=0.003, R=0.783) and substrate composition correlated with the higher mussel density and consisted of a mixture of gravel, cobble, sand, and Vallisneria. Sample sites that had little/no mussels present had one or two dominate types of substrate such as sand, silt, or cobble.

Andrea Morrow

Faculty Mentor: Melissa Tallman, Biomedical Science

A Comparative Analysis of the Tibia of *Paralouatta varonai*, an Extinct Cuban Primate

Primates inhabited the Caribbean islands for millions of years, possibly as early as the Miocene up until several thousand years ago. One genus, *Paralouatta* was endemic to the island of Cuba. The fossils of *Paralouatta varonai*, one of the two known species of that genus, have been well described, including evidence of possible semiterrestriality in the skeletal remains. Currently, all known New World Monkeys are arboreal, spending almost all of their time in trees. This work offers additional comparative analyses of the fossilized tibia of *Paralouatta varonai*, specifically looking at the distal articular surfaces to determine the locomotion of the extinct platyrrhine. In order to do this we created 3D scans of the tibiae of 14 extant taxa of primates along with 5 fossil taxa, including *Paralouatta*. All tibiae were landmarked in order to collect shape data that will be used to carry out comparative analyses. The Principle Component Analysis of the data collected so far shows the distal tibia of *Paralouatta* to most closely resemble *Alouatta* and *Cebus*, both arboreal platyrrhines. *Paralouatta* does not, however, clearly fall within any of the taxa analyzed. Additional data is being collected and once a larger sample size is attained we will be looking specifically at characteristics that can be used as indicators of locomotion. As there are no longer any living primates on the islands, more information on locomotion and relation can give us a better understanding of the evolution, radiation, and ecology of the Caribbean primates.

Alice Munday

Faculty Mentor: Scott Stabler, History

"Such is War": Union Surgeon George M. Trowbridge and the Personal Perils of Slavery and Race in the American Civil War

One of the most permanent effects of the American Civil War (1861-1865) was the 1865 13th Amendment that gave 10 million slaves their freedom. While most of the Union soldiers did not enlist to end slavery, after time, they began to witness the nefarious traits of slavery themselves while seeing the humanity of the thousands of slaves that fled to freedom in their Union lines. This exposure to freedmen changed many soldiers' perspectives on slavery and African Americans as a whole. Our research on the nearly 200 sagacious letters George M. Trowbridge, an Assistant Surgeon in the 19th Michigan Infantry, wrote to his wife from 1863-65 exposes the complexities and the evolution of one soldier's ideas about slavery, race, education and the war's aims. While anti-slavery from the time he joined the war, Trowbridge goes from being provincial and almost indifferent towards African Americans to inevitably becoming more tolerant and excited to see African American troops fight courageously. Trowbridge's letters reveal a personal and vivid picture of the larger narrative of slavery and the Civil War.

Jessica Pontow

Faculty Mentors: Michael Lombardo, Biology & Patrick Thorpe, Biology

An analysis of extra-pair paternity in a population of Tree Swallows in Allendale, Michigan

Tree Swallows (*Tachycineta bicolor*) are migratory, socially monogamous passerines that naturally nest in tree cavities in wetlands and fields adjacent to water. They also readily use nest boxes, which makes them an ideal study species. Previous studies have shown that Tree Swallows often exhibit high rates of extra-pair paternity, ranging from 60-99% of females having extra-pair young in their nests. While the benefits that males receive from extra-pair mating are well understood, the benefits that females receive are not well known. By conducting genetic analyses of blood samples from 60 adults and 123 nestlings, we aim to determine the proportion of extra-pair offspring in 30 families of Tree Swallows. Comparison of extra-pair young to within-pair young may offer insight into the benefits females receive through extra-pair mating.

Aula Ramo

Faculty Mentor: David Linn, Biomedical Science

Can drugs for Alzheimer's disease be of benefit in glaucoma?

Glaucoma, a neurodegenerative disease, is a leading cause of blindness. It is associated with increased intraocular pressure that may lead to death of retinal ganglion cells. Activation of acetylcholine (ACh) receptors has been shown to have neuroprotective effects against this neurodegeneration. This study examines whether a potential Alzheimer's drug (DMP 543) can increase ACh release in the retina, as in the brain, to activate these protective receptors. Retinal ACh was labeled with tritium and release measured with a liquid scintillation counter. Potassium served as a positive chemical control (via direct depolarization), flashing light as a physiological control & tropisetron (a selective ACh compound) as a pharmacological control. Preliminary results show a dose-dependent increase in ACh release with DMP 543. Future experiments will try to determine the full dose-response characteristics, site of action in retinal circuitry, and possible effects on physiological responses.

Mitchell Roth

Faculty Mentor: Margaret Dietrich, Cell and Molecular Biology

The Role of CBL10 in Stamen Development in *Arabidopsis thaliana*

For self-pollinating plants to produce seeds, the male and female floral organs must grow coordinately. Once the stamens (male) grow tall enough, the anthers release pollen onto the stigma (female). When *Arabidopsis thaliana* mutants unable to produce the Calcineurin B-Like 10 (CBL10) protein are grown in standard conditions, floral growth is normal. However, when grown in the presence of 40mM NaCl, the stamens do not fully develop, preventing pollination and subsequent seed production. This suggests that the CBL10 protein aids in development of the stamen during salt stress, and early results indicate a role in the jasmonic acid biosynthesis portion of the stamen development pathway. To determine CBL10's function in flower development, I am 1) physically treating mutant flowers with methyl jasmonate to try to 'rescue' normal flowering and 2) comparing expression levels of jasmonic acid biosynthesis genes between the normal and mutant plants. Understanding this pathway may help us improve crop yields despite decreasing soil quality, such as high salinity from over irrigation.

Alyssa Snyder

Faculty Mentor: Matthew Hart, Chemistry

Novel Biphenyl Ureas as Regulators of the Trace Amine Associated Receptor

The thyroid hormone (TH) regulates many physiological functions in vertebrates including the cardiovascular system, metabolism, brain development, and growth. A person suffering from a thyroid disorder can experience symptoms in these areas, and if left untreated, only get worse. Unfortunately, there are limited treatment options because thyroid hormone biology is not completely understood. Recent research has shown that T_1AM, a compound found in various tissues throughout the body, may play a role in thyroid hormone regulation. T_1AM acts on the Trace Amine Associated Receptor (TAAR). TAAR activation leads to physiological effects in opposition to those induced by TH. The goal of this project is to develop novel T_1AM derivatives to better understand the role of TAAR and T_1AM in TH biology. Specifically, these compounds will incorporate an extra phenyl ring and based on previous work may be antagonists for TAAR. Selective regulators for TAAR will be valuable biological tools.

Max Spencer

Faculty Mentor: James Dunn, Biology

A bioassessment of the butterflies and leafhoppers of the rare alvar ecosystem of the Maxton Plains Preserve

The alvar is an extremely rare ecosystem with remnants occurring only in the Great Lakes region of North America and Northern Europe. These northern grassland communities are found on bare limestone pavements (exposed bedrock) with little mineral soil remaining from glaciation. These sites are critically imperiled worldwide and alvar found on Drummond Island, Michigan are the largest remaining high quality sites in North America. This preserve contains an unusual mix of rare prairie and arctic species of which several species are considered threatened with extinction. Our objective was to perform an inventory of key bioindicators, the Lepidoptera (butterflies) and Homoptera (leafhoppers) which form close associations with host plants and their assessed richness of species reflect the overall ecological integrity ("health") of these sites. We also assessed the influence of vehicle traffic from a road that bisects the site. Preliminary results indicate the occurrence of rare butterflies and prairie endemic leafhoppers. In addition the unimproved road may be reducing the populations of these threatened species by the production of fine limestone dust.

Aubriana Spenski

Faculty Mentors: Joseph Jacquot, Biology & Paul Keenlance, Natural Resources Mgmt

Mechanisms of American Marten Kit Independence and Dispersal in West Michigan

We documented kit independence and dispersal of American martens in the Manistee National Forest of Michigan from July through August 2013. We had six adult females with radio transmitters, four of which produced kits based on evidence from motion-triggered cameras placed at den sites the females were tracked to. The fourth female lost her single kit soon after birth; only three females were tracked from April through July. The three remaining female marten had three, two, and one kit for a total of six kits for the field season. Daily kit activity was monitored remotely through cameras placed at each den site. Of the six kits, only three were caught, and only one was large enough for a radio transmitter. This kit was tracked from the beginning of July until August. At each site the kit was found, rest site data was collected, including but not limited to, tree species and dbh, canopy density, and basal area. The mother of the kit was also tracked during the July through August time period to better distinguish kit dispersal from the den. Preliminary results indicated that kit independence was gradual; the kit spent time both away from its mother, and with its mother at the den site. Each time the kit traveled away from a den, the distance from the den increased.

Wyatt Stahl

Faculty Mentor: Chris Kurby, Psychology

The Segmentation of Social Experience

Social interactions occur often in any given day. Previous research has investigated how people break up, or segment, the hierarchy of goals in human behavior. The current study expands this literature by investigating how people perceive events in a social context. With a greater understanding of how these social interactions predict segmentation, we may be able to infer how social variables affect the events that surround them. Secondly we are interested in how variables like grain size and type of personality may influence the segmentation of social events. Participants were asked to view short films of two people engaging in everyday activities. Throughout the films participants were asked to indicate the points at which one event ended and another event began. After each film the participants were asked to complete a recall task by typing the events that incurred in the film. Finally, participants were asked to complete a personality questionnaire.

Jordan Straight

Faculty Mentor: Merritt Taylor, Biomedical Science

Nato3 induces the expression of key DA neuron markers in a regionally and temporally specific manner within the developing CNS

In the developing stages of the central nervous system (CNS), neural stem cells gradually adopt specific cell fates and differentiate accordingly. The floor plate of the developing midbrain gives rise to dopaminergic (DA) neurons, an important class of neurons involved in Parkinson's disease. Better understanding of the mechanisms by which DA neurons are created is of great interest and would accelerate promising applications such as cell replacement therapies. *Nato3*, a basic helix-loop-helix transcription factor, is expressed in the floor plate region of the midbrain during development. In vitro studies suggest that *Nato3* overexpression is sufficient to promote floor plate and DA neuron marker expression, whereas in vivo studies suggest that *Nato3* is not. Here, we show that overexpression of *Nato3* in the developing chick produces a regionally and temporally dependent increase in DA neuron markers *Nurr1* (an immature DA neuron marker) and tyrosine hydroxylase (*TH*) (a mature DA neuron marker) within the ventral midbrain. In-ovo electroporation was used for transfection, and *Nato3* overexpression was monitored using a bicistronic EGFP reporter expression vector. The observed effects were characterized by quantitative PCR and immunohistochemistry. The regionally specific action of *Nato3* on DA neuron markers suggests that it is regulated by an unknown mechanism that functions early in development within the ventral midbrain. These data provide new insight into the action of *Nato3* on DA neuron marker expression in vivo and help to better characterize the role that *Nato3* plays in DA neurogenesis.

Hollister Swanson

Faculty Mentor: Brad Wallar, Chemistry

Identification of a Potent Inhibitor for the Extended-Spectrum Class C β-lactamase, ADC-7

Resistance to β-lactam antibiotics in the pathogenic bacteria, *Acinetobacter baumannii*, presents one of the greatest challenges to current antimicrobial chemotherapy. Majority of resistance is due to expression of class C β-lactamase enzymes, known as *Acinetobacter*-Derived Cephalosporinases (ADCs). The enzyme ADC-7 is a broad-spectrum class C β-lactamase, capable of deactivating multiple types of antibiotics. Boronic acid transition state inhibitors (BATSIs) are compounds able to inhibit by irreversibly binding to class C β-lactamases. Enzyme kinetic studies of one BATSI, designated S02030, demonstrated a greater affinity for binding than a common cephalosporin substrate. After expression and purification of ADC-7, the first known X-ray crystal structure of ADC-7 with inhibitor complex was solved at 2.03 Å resolution. The ADC-7/S02030 complex provides insight into ADC enzymes structure and offers a novel starting point for the structure-based optimization of β-lactamase inhibitors.

Marissa Swartz

Faculty Mentor: Whitt Kilburn, Political Science

Economic Context and Civic Engagement: the Effects of 'Localism' in Four Michigan Cities

The economic structure of a city affects the civic well-being of its residents. The degree of 'localism' in an economy affects the area's social capital, contributing to the development of its civic institutions. I examine the relationship between localism and social capital in four Michigan cities: Flint, Grand Rapids, Kalamazoo, and Pontiac. A more local, or independent economic structure, is resilient to harmful effects of globalization. Local business leaders support civic institutions. Bridging social capital, then, flourishes, creating a civically engaged population. The heart of a locality's economic structure, thus, provides insight into the development of a city's civic institutions.

Adam Terwilliger

Faculty Mentor: Richard Lord, Chemistry

Do We Need to Analyze Spectra by Hand?

Computational chemistry uses computer science to explore structures and energies of chemical species. A typical computational chemistry output file contains tens or hundreds of thousands of text lines. Automation makes the analysis of these large data sets increasingly more efficient. In turn, we constructed computer programs using Python that allow us to focus our time upon the chemical interpretation of these results. We used these efficient analyses to study a vanadium-oxo species synthesized by our collaborators. Our calculations answer many questions about the redox states in these compounds, though they predict that the experimental crystal structure may not reveal all species present. Subsequently, in an effort to distinguish which species are present, we simulated the absorption spectra of the lowest energy structures. These spectra motivated a spectral analysis program written in Mathematica, with which we gain greater insight into why these compounds absorb light differently.

Jared Toogood

Faculty Mentor: Gary Greer, Biology

Epiphytes, Assemble! Epiphytic fern distribution along a vertical moisture gradient

Biodiversity (i.e., species number and relative abundances) in a habitat can be, in part, related to how individual species differ in their abilities to maximize growth rate versus tolerate stress based on their suite of morphological traits. A fundamental determinant of a plant's growth rate is its ability to acquire, transport, and utilize water for photosynthesis. Conversely, a fundamental determinant of a plant's ability to tolerate drought is its ability to retain water. As a result, high growth rate in plants is generally associated with low drought tolerance. In epiphytic communities (plants growing superficially attached to trees), habitats (trees) can vary by: height, trunk diameter, bark texture, bark chemistry, and shading. Humidity tends to deceases with increasing height along a tree trunk; a gradient along which species may segregate based on their water acquisition versus drought tolerance abilities. To investigate how the morphological traits of epiphytes influence their vertical distribution along this moisture gradient, I assisted in surveying the epiphytic communities of eighty-eight trees, at three vertical sections (0-1m, 1-2m, and 2-3m) at mid-elevation tropical rainforest in El Yunque National Park, Puerto Rico in 2012. Specimens of each species encountered in the 2012 survey were collected during May 2013 for anatomical analyses. For my S3 study, I am investigating anatomical differences among a subset of the species encountered in the 2012 survey, specifically, eighteen pteridophyte (fern and fern allies) species. Digital photographs of the largest leaf of each plant and of anatomical slides I am currently preparing will be used to make precise measurements. A species' water demand will be evaluated based on the size and fractal dimension (complexity) of the leaf, specific leaf area (leaf area divided by its mass), and the stomatal (leaf pore) density. Slides of the cross-sections of the stem, leaf stalk, and tip of the largest leaf will be measured for traits relating to the ability to supply water (e.g., the cross-sectional areas of: xylem (the water-conducting tissue plants), the largest xylary cell) and tolerate drought (e.g., cross-sectional area of sclarified tissue (hard supportive and protective tissue). This data will be analyzed to identify the traits most influential on species distribution and, in the context of the larger study in which my S3 project is embedded, to aid in determining the relative contributions of ecoytpic differentiation and stochasticity on biodiversity in this epiphytic community.

Josephine Werner

Faculty Mentor: Rachel Powers, Chemistry

Expression, purification, and optimization of crystallization conditions for the antibiotic resistance enzyme OXA-24 beta-lactamase

β-lactam antibiotics (i.e. penicillin) are crucial to the field of medicine. Yet due to the reliance and over-prescription of these antibiotics, bacteria become resistant to many drugs that were once extremely efficient. Many resistant bacteria express an enzyme, known as a β-lactamase, which hydrolyzes the amide bond of the defining four membered β-lactam ring, rendering the drug inactive. The carbapenem-hydrolyzing class D β-lactamases (CHDLs), are a particularly worrisome subtype of the class D enzymes. OXA-24 is a clinically relevant member of the CHDLs and, therefore, is a key target to inhibit. Atomic structures of OXA-24 in complexes with β-lactam ligands would inform inhibitor design efforts. Currently OXA-24 is crystallized using high concentrations of ammonium sulfate (2.0 M), resulting in the presence of a sulfate ion in the active site of the enzyme, preventing certain ligands from binding. In order to discover an inhibitor for OXA-24, a complex without the ammonium sulfate in the active site must be found. In this experiment, we show that the lowest concentration that still allows for crystallization of OXA-24 is 1.4 M ammonium sulfate. We also discovered a novel crystallization condition for OXA-24 with a significantly lower concentration of sulfate (0.2 M lithium sulfate). Optimizing this new condition may aid in future crystallization efforts and eventual inhibitor discovery.

Jacqueline Williams

Faculty Mentor: Matthew Hart, Chemistry

New Modulators of the trace amine associated receptor: meta linked ureas

3-iodothyronamine (T_1AM) is a potent agonist of the trace amine associated receptor ($TAAR_1$). A rapid cellular response is exhibited when T_1AM is administered to mice. However, T_1AM induces opposite physiological effects then those caused by the thyroid hormone (TH). Previous studies have revealed a regulatory mechanism of TH action occurs on a slow time scale taking anywhere from hours to days. Given the linked physiological responses of TH and T_1AM there may be a regulatory relationship between these. Studying this mechanism may lead to a greater understanding of TH biology. Our lab has been interested in developing novel derivatives of T_1AM. Incorporating a urea functional group in place of the ether linkage of T_1AM has led to $TAAR_1$ activation. This urea contains a para-linked aromatic system. The goal of this project is to expand on this structure activity relationship by examining a meta-linked aromatic system. Herein, we report the synthesis of these novel T_1AM derivatives.

Noah Zucker

Faculty Mentor: David Kurjiaka, Biomedical Science

Affect of fatty acid structure on endothelial cell connexin43 levels

Obesity is one of the greatest health concerns in the Western world due to the increased risk of cardiovascular diseases. The positive energy balance that occurs with obesity can increase circulating fatty acids. Elevations in fatty acids likely compromise vascular endothelial cell function thereby contributing to the increased disease risk. Connexin protein expression is an indicator of endothelial cell function with increases in Cx43 expression linked to poor cell health. Thus, we assessed the impact of fatty acids on the expression of Cx43 protein in vascular endothelial cells. In particular, we wanted to determine the impact of fatty acid structure. The concentration dependence of Cx43 expression by steric (saturated), oleic (cis), linoleic (omega-6), and eladic acid (trans) were assessed after 24 hr. In addition, time dependence (0.5, 2, 12, 24, and 48 hours) was assessed at the concentration that had the greatest Cx43 expression at 24 hrs. Linoleic and oleic acid exhibited a peak Cx43 expression at 30 μM.

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