22nd Annual Celebration of Student Scholarship

Thursday, April 13, 2017
9:00 a.m. – 6:00 p.m.
Northern Michigan University
Jamrich Hall

Welcome to the 22nd Annual Celebration of Student Scholarship. This event celebrates the scholarship and creativity of both undergraduate and graduate students in all disciplines. In this program, entries are listed in alphabetical order by last name of the first author. Posters and art will be on display in the first and second floor common areas of Jamrich Hall. Presentations are held in Jamrich 1322 and 1311 from 9:30 a.m. – 4:30 p.m.

9:00 a.m. Opening Ceremony
1322 Jamrich Hall

Welcome
Dr. Lisa Eckert – Professor of English, Director of Graduate of Education

Technology Innovation Award for Students
Dr. Tom Isaacson – Assistant Professor, Communication & Performance Studies

Audrianna Maki
Reading Strategy/Technology Innovation Plan

Jack Johnson
Raised Relief Maps

12:00 p.m. Poster Award Ceremony – Jamrich 1100 Lobby

Poster Awards
Undergraduate Lower Division Poster Award
Undergraduate Senior Poster Award
Graduate Student Poster Award
Group Poster Award

5:00 p.m. Faculty Keynote – Jamrich 1100 Auditorium

NMU PRIME award presentations
9:30 a.m. Female Agency and Auctoritee in Medieval British Literature
Emily Winnell

9:45 a.m. Slave Dwelling Overnight in Wisconsin
Alex Legit-Clark, Truman Jones, Ian McGhee, Lucy Meyer, Elizabeth Michael, Greg Beamish

10:00 a.m. Pardoning Death: Death in Geoffrey Chaucer's The Pardoner's Tale
Elizabeth Fust

10:15 a.m. Eurocentrism and Environmental Justice: Multicultural Capacity Building Recommendations for the Michigan Department of Environmental Quality
Maria Rockett

10:30 a.m. The Upper Peninsula’s Carbon Exchange
Louis Lamberti

10:45 a.m. The Influence of Biomass Allocations on Health of Poplar and Willow Hybrids used for Phytoremediation
Elizabeth Rogers

11:00 a.m. Lepidoptera Biodiversity Assessment along Agricultural Gradients in Castanhal, Pará, Brazil
Zach Dykema

11:15 a.m. Don't Be a Hater, Save the Pollinator: Examining the Relationship Between Land Coverage Types and Honeybee Winter Mortality Rates in Michigan's Upper Peninsula
Rachel LaManna

11:30 a.m. Pronunciation Practice
Hanna Anderson

11:45 a.m. The Vietnam Veterans Memorial and American Perception of the Vietnam War
Sarah Zidek

12:45 p.m. Encouraging Sustainability through Music
Jeffrey Jonas

1:00 p.m. An analysis of fresh water aid delivery during the Flint Water Crisis
Michael Williams

1:15 p.m. Campus Sustainability Initiatives & Effects on Enrollment and Retention at NMU
Ella Skrocki

1:30 p.m. Blue as the New Green: A historical analysis of the politicization of the modern environmental movement
Cassidy Berlin

1:45 p.m. Sustainable Palm Oil Production
Mackenzie Anderson

2:00 p.m. Developing the Next Generation of STEM Students
Chris Lodge

2:15 p.m. Preparing Teacher Candidates as Leaders in Diverse Classrooms through a Classroom Interview Simulation
Ryan Borges

2:30 p.m. Veiling in Islam
Rabah Gabasha

2:45 p.m. A "Sentimental" Voice from the Unheard; metaphors of persuasion employed by antivivisectionists and feminists in Victorian England.
Min Park

3:00 p.m. Evaluating the use of self-relevant stimuli in attention bias modification training as a treatment for anxiety: A near-infrared spectroscopy study
Jacob Aday
3:15 p.m.  An Exploration of the Relationship between Stress, Physical Activity and Sleep Patterns in Baccalaureate Nursing students
   Alysa Kilpela, Olivia Cobb

3:30 p.m.  Hypoxia-regulated expression of GLUT1 in GBM Cell Lines
   Marissa Kane

3:45 p.m.  Comparative phylogeography and diversity of fleas from American pikas of the Intermountain West
   Niyomi Wijewardena

Jamrich 1322

9:30 a.m.  Listeria Rapid Identification with MIT Laser Technology
   Zach Jodoin

9:45 a.m.  Impact of Legislation on Effluent in Ishpeming
   Chelsey Robinson

10:00 a.m.  Effects of pH and temperature on the harpacticoid Tisbe biminiensis growth, survivorship, and morphology
   Nicole Pittoors

10:15 a.m.  Correlates of Balance and ImPACT After Return to Play Post Concussion
   Janice Hamachek, Justin Young

10:45 a.m.  Avian Foraging Response to Jack Pine Volatile Chemicals
   Katie Bjornen

11:00 a.m.  Colorimetric Loop-Mediated Isothermal Amplification (LAMP) assay for the identification of Staphylococcus aureus in clinical specimens by detection of the nuc gene
   Aaron Lewkowicz

11:15 a.m.  The Effects of Episodic and Thematic Framing on Environmental Attitudes
   Kristina Beethem, Nathan Frischkorn, Melissa Liford

11:30 a.m.  What Makes You Click: The Crossroads of Science and Social Media
   Allison Opheim

11:45 a.m.  Adaptations to Sprinting and Jumping After Training with a Resistance Harness in Track Athletes
   Mindie Clark, Dr. Randall Jensen, Dr. Sarah Clarke, Ryan Meidinger

12:45 p.m.  Analyzing the Behavior of a Backpropagation-Based Neural Network When Learning 40-Bit Binary Palindromes
   Paul Sampson, Nicholas Nowak, Matthew Trefilek

1:00 p.m.  Duration and variation in the metabolic response of juvenile lake sturgeon exposed to sub-lethal concentrations of the lampricide, TFM
   Matthew Symbal

1:15 p.m.  Effects of Winter and Summer Thermal Variability Regimes on Growth and Metabolism in Brook Trout (Salvelinus fontinalis)
   Spenser Chicoine

1:30 p.m.  Sexual Dimorphism and Morphometrics in Marine Toads (Rhinella marina)
   Collin Richter

1:45 p.m.  Interflock gargle call variation in black-capped chickadees (Poecile atricapillus)
   James VanOrman
2:00 p.m.  
*The relationship between BDNF and prefrontal cortex oxygenation following mild traumatic brain injury: Preliminary results from an NMU PRIME project*
Keara Kangas

2:15 p.m.  
*Environmental Impacts of Urbanization on Marquette, MI*
Nicole Taylor

2:30 p.m.  
*The effect of nest size and placement characteristics on internal temperature in Kingfisher (Aves: Cerylinae) nests in Brazil*
Emily Bertucci

2:45 p.m.  
*Examining the Effects of Handling on the Behavior and Long-Term Growth Rates of Brook Trout*
Caleb Welk

3:00 p.m.  
*Impacts from ice cover and other winter variations on shoreline movement near Lake Shore Boulevard in Marquette, Michigan*
Elise Oswald

3:15 p.m.  
*Modelling brook trout (Salvelinus fontinalis) Standard Metabolic Rate vs Time of Day*
Grace Zimmermann, Taylor Preul, Max Majinska, Jacob Bowman

3:30 p.m.  
*Mimicking Fantasy Authors with a Recurrent Neural Network*
Matthew Trefilek

3:45 p.m.  
*Exploring High School History Methodology in Michigan*
Erin McNabb

4:00 p.m.  
*Diversity Common Reader – Writing Contest Winners*
  - Brian Czyzyk – “We Skulk the Scene”
  - Jocelyn Stelzer – “Too Loud”
  - Madeline Wiles – “Blue or Pink?”
**Soil Microbial Interactions with Agricultural Plants in Depleted Urban Soils Amended with Various Organic Fertilizer Treatments**

Andrew Adamski, Graduate Student – Biology  
Dr. Matthew Van Grinsven, Faculty – Earth, Environmental, and Geographical Sciences  
Faculty Advisor: Dr. Donna Becker – Biology  
Poster

Urban farming is one of the most effective ways to deal with degrading city environments, food security, and public health. Lack of soil organic matter, microbial diversity and overall soil health offer significant challenges to the already challenged urban farmer. Synthetic fertilizers and pesticides are the predominant method to maintain lawns in urban and suburban environments. This practice leads to vast areas of "food deserts," contributes to polluted waterways and separates people from the land. Urban organic farming practices can provide healthy food to downtrodden city neighborhoods while providing valuable ecosystem functions such as reducing soil erosion, pesticide and nutrient runoff, and habitat for native pollinators.  
Worm castings, biochar, bokashi tea, and fish hydrolysate present novel approaches to amending heavily disturbed urban soils while costing little or nothing to produce. Individually, they have all been identified as extremely beneficial for different reasons. Worm castings (a final product of most vermicomposts) act as a primary source of microbial diversity and the other fertilizers act as a food source for the microbes and the plants in the system. An experiment was designed that would seek to explore the interactions these fertilizers have on the soil microbiota in combination with each other and individually.  
Microbial diversity, abundance, activity and plant health were all measured after one season of growth in soils with each combination of amendments. Results indicate that worm castings alone significantly increase water holding capacity, plant biomass, microbial biomass, microbial functional diversity and CO2 flux rates (p = 0.01) while worm castings in combination with biochar showed significantly greater responses in all parameters. Soil microbial diversity was correlated with plant biomass (R2=0.91; p = 0.01) indicating the increased microbial diversity in soils treated with wormcastings significantly increased the biomass of the plants in those treatments. These results may provide urban farmers with justifiable reason to apply wormcastings and biochar in combination to their soils while creating demand for more research into the diverse interactions underlying these ecological benefits. Furthermore, large scale farmers may find this information useful in remediation efforts of overused, neglected farmland through using biologically active soil amendments.

**Functional Changes in Early Latency Medial Prefrontal Cortex Activity Following Attention Bias Modification Training: A Near–infrared Spectroscopy Study**

Jacob Aday, Graduate Student – Psychology  
Will Rizer, Graduated – Psychology  
Faculty Advisor: Dr. Josh Carlson – Psychology  
Poster

Attention bias modification (ABM) is a computerized cognitive training regimen that attempts to reduce attentional biases towards threat by continuously directing participants’ attention away from threatening stimuli. Functional Magnetic Resonance Imaging (fMRI) studies utilizing ABM have found training–related changes in prefrontal cortex (PFC) activity and previous research from our lab has shown structural changes in PFC volume. Near–infrared spectroscopy (NIRS) is a noninvasive method of measuring oxygenated (HbO) and deoxygenated (HbR) hemoglobin, which are indirect measures of neural activity. Relative to fMRI, NIRS has several advantages including mobility, affordability, ease of use, and temporal resolution. Although ABM has been shown to modulate prefrontal activity using fMRI, the temporal resolution of these ABM effects on prefrontal activity remain poorly understood. To explore this, we had participants undergo 6 weeks of at–home ABM training using a cellphone app. Before and after training, participants performed an event–related dot–probe task while their brain activity was recorded using NIRS. There was an optode x session interaction 2–5 seconds post–stimulus presentation, such that optodes measuring more medial prefrontal activity showed decreases in HbR from pre to post–training. ABM training also resulted in greater HbR for congruent trials relative to incongruent and baseline trials in the medial prefrontal cortex. These results are consistent with previous fMRI studies implicating the PFC in ABM training and indicate that training–related changes in the PFC can be recorded using NIRS, suggesting early (2–5 sec) ABM–related effects on PFC activity.
Evaluating the Use of Self–relevant Stimuli in Attention Bias Modification Training as a Treatment for Anxiety: A Near–infrared Spectroscopy Study
Jacob Aday, Graduate Student – Psychology
Faculty Advisor: Dr. Josh Carlson – Psychology
Oral Presentation – Jamrich 1311 at 3:00 p.m.

Increased attentional bias to threat has been identified as a causal mechanism in the development of anxiety. As such, attention bias modification (ABM) was conceived as a treatment option where anxiety is alleviated through a computerized cognitive training regimen that reduces an individual’s attentional bias to threat. After more than a decade of research on ABM, there is meta–analytic support for its role in reducing attentional bias and anxious symptoms. However, few studies to date have examined how to tailor ABM treatments to unique individuals and how that may facilitate greater generalization of treatment effects in the real world. Additionally, the neural mechanisms underlying effective ABM are poorly understood. The participants in this study gave a list of the 10 things that caused them the most anxiety and those stimuli were incorporated into the ABM design in place of typically, experimenter–generated stimuli such as fearful faces or threatening words. The participants were split into a treatment and control group and underwent pre– and post–training anxiety measures while brain activity was recorded using NIRS to determine if 2 weeks of in–lab ABM training modulates prefrontal cortex activity and/or reduces subjective anxiety levels and attentional biases. The preliminary results indicate that incorporating self–relevant stimuli results in a more consistent bias score and that self–relevant stimuli can be successfully incorporated into the ABM protocol.

Neutron Detection Efficiency Optimization Studies of the Neutron Polarimeter for the C–GEN Electric Form Factor at Jefferson National Laboratory
Ashley Adzima, Senior – Physics/Mathematics
Faculty Advisor: Dr. William Tireman – Physics
Poster

The electric form factor is an important quantity to further the understanding of the atom and its constituent parts. The C–GEN collaboration at Jefferson National Laboratory plans to measure this fundamental quantity using recoil polarimetry. An efficient neutron polarimeter is essential for the collection of precise data and involves maximizing the ratio of elastic to inelastic events identified. The determination of the elastic to inelastic ratio of neutron events was simulated using GEANT–4, toolkit for the simulation of the passage of particles through matter, on 5 cm, 10 cm, and 15 cm thick detectors. Specific requirements were set in place by C–GEN to determine what marks an elastic event. Plots of neutron scattering events versus detector thickness were analyzed, and the ratio of elastic to inelastic events was extracted for each section per vertical slice, as well as an average ratio. The average ratio of elastic to inelastic events were 0.2206, 0.1706, and 0.1507 for the 5 cm, 10 cm, and 15 cm detectors, respectfully. The impact of these ratios on the statistics and costs of altering the polarimeter's original 10 cm detector design will be further discussed.

Pronunciation Practice
Hanna Anderson, Freshman – Speech, Language, & Hearing Sciences
Faculty Advisor: Professor Heather Isaacson – Clinical Lab Science
Oral Presentation – Jamrich 1311 at 11:30 a.m.

The purpose of the Pronunciation Practice sessions was to help college students from foreign countries learn and practice phonemes that created challenges in their use of the English language. The students volunteered to participate as a method of improving their English speaking skills so they could more easily assimilate into the American culture. The first phase of the project involved reaching out to students from the countries of Japan, South Korea, and Spain. The second phase was researching phonemes the English language contained that were not present in Japanese, Korean and Spanish languages. In the third phase, we assessed the students' current speech, oral reading skill, and pronunciation patterns. The final phase involved working with an upper–level Speech, Language and Hearing Sciences (SLHS) student as we provided practice and example pronunciations for the students. We have found that the students appreciated and supported the work we did and were eager to continue pronunciation practice in the future.
Palm oil, derived from the tropical tree African oil palm (*Elaeis guineensis*), is currently the most widely used vegetable oil in the world, and this use is only increasing. The qualities associated with palm oil allow it to be useful in many foods, cleaning products, personal care items, and even biofuel. Because of the scale of palm oil production, controversial aspects surround the industry. These topics include workers' rights, deforestation, and wildlife conservation in the tropics. The Roundtable on Sustainable Palm Oil (RSPO) is an environmental organization that works to improve the standards of palm oil production by collaborating with various stakeholders to abate the negative social, cultural, and environmental factors associated with palm oil production. Through visiting a RSPO affiliated plantation and delving into the literature on the topic, I have concluded that sustainable palm oil seems like a step in the right direction for minimizing the negative environmental and social impacts of a growing industry. My hope is that through education on the palm oil industry and its many caveats and merits consumers may be more aware of what goes into the products they purchase.

Internally Displaced Persons in Colombia: an Invisible Crisis?
Kayla Argeropoulos, Senior – History
Faculty Advisor: Dr. Alan Willis – History
Poster

Colombia today has one of the highest levels of internally displaced persons in the world. Due to half a decade of armed conflict, discrimination, and environmental degradation, indigenous and other marginalized peoples have been forced to leave their land or remain in confinement. According to the United Nations High Commissioner for Refugees, the situation has been termed “The Invisible Crisis.” This poster analyzes the causes that have affected indigenous peoples, and the consequences on the South American community. It also examines the role of the national and international community in providing relief, assistance, and support to the displaced. Finally, the poster investigates whether or not the internal displacement of indigenous and marginalized communities is truly an invisible crisis or not.

Annotation of 313,305 Bases of Genomic DNA Sequence from Drosophila ficushila
Abigail Austin, Senior – Biology/Secondary Education
Sharon Brady, Post-baccalaureate – Biology
Orry Elor, Senior – Biology
Ellie Ewald, Senior – Biology
Christina Fragel, Senior – Biology
Eric Krause, Junior – Biology
Rebecca Nyinawabze, Senior – Biology
Molly Robinson, Senior – Biology
Ronnie Schlosser, Senior – Biology
Derek Thompson, Senior – Biology
Faculty Advisor: Dr. Katherine Teeter – Biology
Poster

The fourth chromosome in *Drosophila* is highly heterochromatic with comparable gene expression and density to euchromatin. Genome annotation, which identifies the location and coding regions of genes within a genome through elucidation of intron–exon boundaries, regulatory sequences, RNA–seq, and protein homologs can assist in the comparative genomics of this phenomena. Through the Genomics Education Partnership (GEP), 313,305 bases (contigs 24, 28, 29, 30, and 36 of the *D. ficushila* Aug. 2016 GEP/3L_control Assembly) on the comparative 3L chromosome of *D. ficushila* were annotated. Following GEP's pipeline, predicted sequence tracks were examined using the GEP University of California, Santa Cruz (UCSC) Genome Browser Mirror. After identifying predictions of interest, investigators used the comparison methods NCBI BLAST and FlyBase to estimate each gene track's validity. Significant tracks were evaluated using the GEP Gene Model Checker. Five genes and two exons of the Ten–m gene were identified within the annotation.
Testing the Anti–Microbial Activity of Rubus parviflorus Tissues
Meagan Bauer, Sophomore – Forensic Biochemistry
Faculty Advisor: Dr. Brandon Canfield – Chemistry
Poster

The thimbleberry, or Rubus parviflorus, a small flowering shrub closely related to the raspberry, is native to the Upper Peninsula and other regions across North America including the Pacific Northwest. Due to the relatively small areas of growth, the thimbleberry is not a widely known or studied plant. However, Native Americans have historically used the plant for various health applications including topical skin treatments. In the work presented here, different tissues of the plant were studied, including: berry, leaf, stem, and tumor. Extracts of each of these tissues were tested for antimicrobial activity against four bacterial species and one fungal species.

The Effects of Episodic and Thematic Framing on Environmental Attitudes
Kristina Beethem, Junior – Sociology & Spanish
Nathan Frischkorn, Senior – Sociology & Environmental Studies
Melissa Liford, Junior – Sociology
Faculty Advisor: Dr. Karl Johnson – Sociology & Anthropology
Oral Presentation – Jamrich 1322 at 11:15 a.m.

This study was designed to research the effects that episodic and thematic framing of media reports have on environmental attitudes. Researchers used survey data to test the difference in individuals’ environmental attitudes after they were exposed to an environmental news story in an episodic, thematic framing or combined framework. This study is important because it fills a significant gap identified in current available literature, while at the same time investigating an understudied population in the Upper Peninsula of Michigan. We also utilized interviews to generate qualitative data to investigate in depth why one frame may be more effective than the other. Our hypothesis is that when respondents are presented the story in a combined episodic and thematic framework, they will have a stronger emotional response, demonstrate more concern, and display a stronger support for public policy than the respondents who are presented with the story in either a thematic or an episodic framework alone. We expected to find a positive correlation between level of education and pro–environmental attitudes, and a person's choice of news sources and pro–environmental attitudes, as well as between a person's political ideology and environmental attitudes. We also expected to find that episodic framing will lead to more of an emotional response, and that thematic framing will lead to a more knowledgeable and nuanced response, which will lead to stronger support for public policy.

A Survey of LNT and a Populations Awareness
Connor Benson, Senior – Environmental Science & Sustainability
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Poster

The natural beauty around Marquette is sure to bring multitudes of nature lovers outdoors in any season. The unfortunate factor related to this is that one can identify popular spots by the trash found beside a trail, along the beach, amongst the trees, etc. The Principal Investigator of this project has conducted a questionnaire to measure how wide–spread the Leave No Trace (LNT) movement has become in the student population at NMU. This study will show the effectiveness of how the principles of LNT have been spread, as well as how stakeholders should go about spreading the word of LNT. This questionnaire measures whether or not students participate in LNT; when and how they heard about LNT; and other pertinent components of the movement and its effectiveness. This information will show us the geographic regions as well as the backgrounds that LNT has reached. This can influence us on the proper way to go about spreading the principles of LNT, allowing us to reach a greater population. This survey was then sent out via email to students to allow them to take the questionnaire at their own pace in a comfortable environment, with our end goal being that the students surveyed would answer more honestly than they would in an uncomfortable environment. The data was then analyzed, showing us the best course of action to increase participation of LNT, as well as the most effective ways to advertise the LNT mentality among college students by averaging the answers to our questionnaire, identifying an appropriate direction to advance in regard to continuing the growth of the LNT community.
The current political climate in the United States has sharply polarized the conversation on environmental conservation. The argument concerning federal power as a tool to facilitate environmental reform hinders integral policy development to address some of the largest conservation problems faced by our nation. The environmental movement is rooted in widespread public support and bipartisan cooperation and most keystone pieces of environmental legislation were developed under Republican administrations. Modern conservatives eschew the progressive environmental conservation movement as an impediment to economic growth despite the fact that the majority of modern environmental concerns benefit from uniform and proactive action at the federal level. A comprehensive historical analysis reveals that environmental politicization has come at the expense of crucial legislation to address domestic pollution, land management, and climate change. By researching the emergence of environmentalism as a divisive party platform and the resultant modern consequences, we can develop a key understanding for the schisms over this common good interest. This understanding will prove crucial to the creation of a new political rhetoric that reverses the damage done by decades of dispute and inaction over pressing environmental concerns.

Extra–pair copulations is a significant common component of socially monogamous songbirds and occurs most frequently before dawn. As both sexes participate in these extra–pair behaviors, females who awaken early in the morning may be more likely to engage in extra–pair copulations. We hypothesized that males at a high risk of cuckoldry (having an early rising social mate), may alter their parental care to reflect this lack of parental certainty. The Dark–eyed Junco (Junco hyemalis) is a socially monogamous species, but extra–pair mating is common. The goal of this study was to assess the quality of a male's parental care in relation to the female social mate's rising time. Highly ornamented individuals often have been found to be less attentive parents, so ornamentation of males was controlled for in the analysis. We recorded female initiation of daily activity during the incubation period to assign timing phenotype, or chronotype, and quantified male feeding rate during the nestling phase. We found that males did not alter the number of feeding visits based on the female's timing phenotype or amount of white ornamentation, but females who arose earlier in the morning were found to be paired with less ornamented males. Therefore, our findings suggest that male ornamentation is not serving as an honest signal of parental quality in this population. If females are selecting mates based on ornamentation, it may not be indicative of relative quality of parental care. The relationship between early awakening females being mated with less ornamented males was unexpected, and future research is warranted to explore the nature of this relationship.

Burrows often aid animals in their ability to survive high temperatures. Kingfishers build their nests by excavating deep burrows into river banks where both the male and female incubate eggs and rear young. Especially during incubation, maintaining optimal temperature within the nest is important for survival and development of the offspring. Due to the high temperatures that occur mid–day in the tropics, consistency of internal nest temperature should be highly selected for in this area. This study describes the relationship between nest size and placement characteristics with temperature conditions. Data was collected during the non–breeding season in Castanhal, Pará, an area of northern, Amazonian Brazil that is occupied by Amazon Kingfishers (Chloroceryle amazona), Ringed Kingfishers (Megaceryle torquata), and Green Kingfishers (Chloroceryle americana). Internal and external temperatures of seven previously excavated nests were measured over the course of two days. We hypothesized that deeper nests would show less fluctuation in internal temperature than shallower
nests, relative to external temperature. The internal temperatures of all of the nests in this study fluctuated less than external temperatures. Average internal temperature fluctuations were not significantly different between nests classified as shallow and deep.

**Avian Foraging Response to Jack Pine Volatile Chemicals**
Katie Bjornen, Graduate Student – Biology
Faculty Advisor: Dr. Alec Lindsay – Biology
Oral Presentation – Jamrich 1322 at 10:45 a.m.

Omnivorous and insectivorous birds can improve tree and forest health by foraging on the herbivorous insects that significantly damage trees. Many of these damaged trees emit volatile organic chemicals (VOCs) that can act as defense and serve as signals. Birds that can direct foraging activity to trees with higher insect loads should benefit through increased foraging efficiency. Avian olfactory abilities are understudied, but new research shows some avian taxa use chemical cues to alter navigation, foraging behavior, and individual recognition. We tested the hypothesis that birds detect chemical cues emitted by trees and subsequently orient their foraging effort toward trees with particular olfactory profiles. To do this we measured VOCs released from jack pine trees and tested whether avian foraging behavior preferentially directed to trees that differ in the released VOCs. Here we present preliminary results that should prove useful both for further study of avian olfaction and for forestry management.

**Identification of Bacterial Cells by Cellular Light Scattering**
Maggie Bohm, Freshman – Biology/Chemistry
Kayleigh Hollen, Graduated – Biology
Nicole Shoup, Graduate Student – Biology
Anthony Treloar, Senior – Clinical Life Sciences
Zachary Jodin, Junior – Biology/Physiology
Dr. David Haavig, Chief Scientist – Micro Imaging Technologies
Faculty Advisor: Dr. Josh Sharp – Biology
Poster

There are many situations, such as in the food industry and clinical settings, where speedy identification of bacteria is crucial. This study tests the quickness and accuracy of an instrument and data analysis method for identifying bacteria suspended in water based on laser light diffraction patterns and measurements. Isolates were tested for identification from both the inclusive target set, *Staphylococcus spp.*, and the exclusive set, *non–Staphylococcus spp*. Both sets of isolates, the *Staphylococcus spp.* and the non–*Staphylococcus spp.* were grown on Sheep Blood Agar, Tryptic Soy Agar, Brain Heart Infusion Agar, or Luria–Bertani Agar, and were identified based on how each species of cell scatters light. *Staphylococcus spp.* grown on solid media were correctly identified greater than 92% of the time. To determine if the system could also identify bacteria grown in liquid culture, six different *Staphylococcus spp.* and six different *non–Staphylococcus spp.* were grown in Tryptic Soy Broth, Brain Heart Infusion Broth, or Luria–Bertani Broth. This system accurately identified all target *Staphylococcus spp.* tested. No misidentifications occurred from cells grown in liquid culture. A single–blind identification experiment was also performed on human clinical isolates obtained from the Upper Peninsula Health System. Ninety blind–coded clinical bacterial isolates on Sheep Blood Agar were tested to determine if they were *Staphylococcus spp.* All of the *Staphylococcus spp.* were accurately identified, and no misidentifications occurred. This study demonstrates a novel system that can rapidly and accurately identify bacteria from pure culture based on cellular light scatter properties.

**Digital and Physical Terrain Modeling for Education**
Catherine Boileau, Sophomore – Secondary Education
Faculty Advisor: Dr. Carl Wozniak – Education, Leadership, & Public Service
Poster

Student understanding of geologic formations in the field is often hampered by inadequate view and feature size. In this proof of concept study, we used aerial drone photography to map geologic features and create digital and physical three–dimensional models to allow the features to be more fully studied back in the classroom. Technological advancements have brought prices down, improved equipment functionality, and reduced computer programming needs; making it realistically
possible for students to be directly involved in data collection, computer modeling, and 3D printing. In addition, new online tools are continually being developed to aid in three-dimensional modeling, limiting the need for costly, stand-alone, platform-specific applications. In our work we are using a DJI Phantom 4 drone, several different software packages, and online resources to stitch images and develop 3D visualizations. Also, a Monoprice Maker Select 3D printer is used to construct physical models. Models can be hand-painted or created with different colors of plastic to distinguish elevations or features. Created models produce real-world local examples of geological formations that can be added to by new students in subsequent years, developing growing data sets for student study. The technology also has significant potential in the areas of human–environment impact, weathering and erosion, public planning, and geographic or biotic change over time.

*Preparing Teacher Candidates as Leaders in Diverse Classrooms through a Classroom Interview Simulation*

Ryan Borges, Senior – Special Education
Faculty Advisor: Dr. Judy Puncochar – Education, Leadership, & Public Service
Oral Presentation – Jamrich 1311 at 2:15 p.m.

Teacher candidates took part in an interview simulation based on Attribution Theory to demonstrate the importance and usefulness of Attribution Theory to teachers as leaders in diverse classrooms. The research hypothesis was that teacher candidates who engaged in an interview simulation would demonstrate heightened awareness of the influences of teachers' perception on students' attributions of the effects of poverty on learning. Thirty-three participants reflected before the simulation and 32 reflected after the interview simulation on their ideas of how poverty and Attribution Theory were related to perceptions of poverty on education. The research consisted of a classroom interview simulation with reflections on how beginning educators perceived influences of poverty on learning. Data consisted of qualitative reflections on Attribution Theory in relation to the effects of poverty on learning. Results demonstrated that 87.5% of participants expressed a heightened awareness of the usefulness of Attribution Theory when teaching a diverse student population.

*The Effect of Ovarian Hormones on the Expression of TMEM35*

Anna Cameron, Junior – Biochemistry
Amanda Vanderplow, Graduate Student – Biology
Faculty Advisor: Dr. Valerie Hedges – Biology
Poster

Neuropeptides are small proteins that act on the nervous system and play roles in emotion, motivation and cognition. A recently discovered neuropeptide, TMEM35, shows high levels of expression in hypothalamic areas and the limbic circuit of the rodent brains. These areas are known to function in both sexual behavior and reward. Preliminary data from a study by Vanderplow et al. (in preparation) indicates that TMEM35 is expressed more dominantly in females than in males. The immediate goal of this study was to determine the effects of ovarian hormones on the expression of TMEM35 in female Syrian Hamsters. Ovarian hormones estradiol and progesterone are critical for sexual behavior in females and are known to modulate the release of neurochemicals to act on various brain areas. Therefore, this study aimed to determine whether ovarian hormones altered TMEM35 expression within the hippocampus, the ventromedial nucleus of the hypothalamus, the paraventricular nucleus, and the anteroventral periventricular nucleus. Animals were administered subcutaneous injections of either cottonseed oil (CSO) or a sequence of estradiol benzoate approximately 48 hrs and 24 hrs prior brain harvest, followed by a subcutaneous injection of progesterone 4–6 hours prior to harvest. The brains were processed immunohistochemically for anatomical localization of TMEM35 protein. This study determined that TMEM35 expression was significantly different between oil-treated and hormone-treated females in all of the brain areas measured, indicating a hormone-sensitive role for this neuropeptide within the brain. This pattern of expression better informs possible functions of TMEM35 that will require further study.
Effects of Winter and Summer Thermal Variability Regimes on Growth and Metabolism in Brook Trout (Salvelinus fontinalis)
Spenser Chicoine, Graduate Student – Biology
Faculty Advisor: Dr. Jill Leonard – Biology
Oral Presentation – Jamrich 1322 at 1:15 p.m.

Brook trout (Salvelinus fontinalis) are a cold water species with a narrow range of thermal tolerance. Climate change projections suggest that in addition to increases in average temperatures worldwide, we can expect to see greater temperature variability. Such conditions could prove challenging for brook trout and other ectotherms that are adapted to small temperature ranges. Our research investigates how the growth and metabolic capacities of brook trout respond to long term exposure to increased thermal variation. To achieve this, we reared groups of brook trout under constant temperature to serve as a control, a 4°C daily range as a low variability treatment, and an 8°C daily range as a high variability treatment, once in the winter centered on a 6°C average temperature, and once in the summer centered on a 12°C average. During each two–month treatment exposure, we regularly measured the mass and length of fish from each group to assess growth rates. We have been taking samples of plasma to measure cortisol and white muscle samples to measure citrate synthase activity. Results from our growth data show no significant effect of the variability treatments, and predictable differences between seasons. Cortisol is elevated in response to treatments under winter conditions, but not during the summer experiment.

At the end of each treatment exposure series, we subjected fish from each group to swimming respirometry tests to further assess the metabolic and energetic costs of prolonged exposure to a thermally variable environment. Early analysis of of this work suggests there are differences in metabolic rates expressed by fish between treatment groups.

Adaptations to Sprinting and Jumping After Training with a Resistance Harness in Track Athletes
Mindie Clark, Graduate Student – Exercise Science
Dr. Randall Jensen, Faculty – Health & Human Performance
Dr. Sarah Clarke, Faculty – Health & Human Performance
Ryan Meidinger, Graduate Student – Exercise Science
Faculty Advisor: Dr. Randall Jensen – Health & Human Performance
Oral Presentation – Jamrich 1322 at 11:45 a.m.

This study examined the effect of a resistance–inducing harness restricting leg movement on sprinting and jumping performance in young adult female athletes. Split times for 10, 20, 36.58 and 50 meters, kinematics of hip and knee angles during sprinting, forces of maximum countermovement jumps and dual–energy X–ray absorptiometry (DEXA) were measured prior and following five–weeks of training with the resistance device. Results showed significant improvement in 10 m sprint times and knee extension during sprinting following five–weeks training. No significant changes in jump or DEXA parameters were seen. The study was supported in part by the device creation company, Speedmaker. Findings of the current study indicate that the SpeedMaker device may improve the acceleration phase of sprinting and stimulate a larger range of motion at the knee joint. Future studies with the device should include longer training periods, greater sample sizes and a measurement of resistance.

Effects of Mild Traumatic Brain Injury on Attentional Bias to Threat: Preliminary Results from an NMU Prime Project
Scott Conger, Junior – Psychology
Keara Kangas, Graduate Student – Psychology
Faculty Advisor: Dr. Joshua Carlson – Psychology
Poster

Salient stimuli capture our attention within our environment. Fearful faces have been shown to orient attention at higher rates than neutral faces. This attentional bias to threat is heightened in affective disorders such as anxiety and depression. Attentional deficits are some of the most commonly reported cognitive impairments of mild traumatic brain injuries (mTBI). In addition to attention, mTBI is linked to deficits in emotional processing such as expression labeling and matching. Specifically, fearful expressions are poorly matched after mTBI. Increased levels of anxiety and depression are common symptoms of mTBI; however there is little to no research on attentional bias to negative emotional stimuli after a concussion. We tested for this relationship using NMU student athletes. There were two groups of participants, one group recently recovered from concussive incidents, and the second group was the control, who had not received a concussion within the past year. A common attentional bias task, the dot–probe task, was used to measure differences in reaction time between the
concussion and control groups. Participants were instructed to locate a target dot, which was preceded by face pairs. There were three trial types baseline (two neutral faces), congruent (dot appears behind the fearful face), and incongruent (dot appears behind the neutral face). The task measures the attentional bias of the participant. In our preliminary results, reaction times differed between the concussion and control groups.

Michigan’s Upper Peninsula: A Community and Economic Profile
Julie Curtis, Graduate Student – Higher Education in Student Affairs
Faculty Advisor: Dr. Hugo Eyzaguirre – Economics
Poster

This socioeconomic data for the U.P. is a product of the effort of the Sam M. Cohodas professor and Center for Economic Education and Entrepreneurship. Each year, over 200 employers across the 15 counties work with the Professor and Center. They provide data on their end–of–year employment counts. This data is combined with data from the United States government and State of Michigan. Every year the Community and Economic Profiles book is published, distributed, and posted to websites. The purpose is to help local businesses, business planners, economic developers, and government officials to get a good pulse on the health and wealth of the U.P. and all of its parts. The socioeconomic data for the U.P. is scarce. While the corresponding Federal Reserve Bank is usually a good source for local and regional data, in the State of Michigan only the U.P. is part of the Minneapolis Federal Reserve Bank, resulting in very limited or nonexistent information. This project is an effort to collect and process, even from primary sources, valuable socioeconomic data for the region. It is very telling that the information in the Wikipedia pages on each of the 15 counties is very poor and outdated. Part of the project is to revise those pages. Finally, this is the start of an ongoing effort, and as such, my hope is to invite people at the Celebration of Student Research to return to their U.P. counties and provide suggestions on what differentiates each county on the business, investment, and international fronts to further this work in the future.

The Comparison of a Conditioned Media Model and A Co–Culturing Model to Investigate Cancer–Associated Thrombosis in vitro
Dustin DeGrave, Senior – Biochemistry
Melanie Flaherty, Senior – Biology/Physiology & German Studies
Nicholas Shortreed, Sophomore – Neuroscience
Faculty Advisor: Dr. Johnathan Lawrence – Upper Michigan Brain Tumor Center
Poster

Venous thromboembolism (VTE) is the second leading cause of death in patients diagnosed with cancer, behind the malignancy itself. Statistically, patients with cancer are four times more likely to develop VTE. With nearly 2 million cancer patients being diagnosed every year, VTE and its associated complications create a challenge to physicians and their patients. Although cancer–associated thrombosis (CAT) has been documented since the 1800s, it has been studied almost exclusively in the clinical setting. A number of factors have been identified as playing a role in CAT, but even with the identification of key proteins upregulated in CAT patients, the complex molecular mechanisms underlying this phenomenon have yet to be fully understood. In order to better understand the pathways involved, a model must first be developed to replicate CAT in vitro. Herein, we present and assess two possible in vitro models as potentially effective models for replicating the physiological environment present in CAT. Specifically, these two models include treating endothelial cells with conditioned media from a glioblastoma multiforme (GBM) cell line and co–culturing endothelial cells with GBM cells via a trans–well system. The models were compared using a number of key points including: 1) ease of use, 2) thrombotic and inflammatory markers and 3) ability to isolate factors in order to determine their origin and role in the pathogenesis of CAT. The development of an effective in vitro model for cancer–associated thrombosis will enable the implementation and progression of future studies to decipher key mechanisms involved in this phenomenon.
**Effects of Soil Conditions on Cutaneous Bacteria of the Red–backed Salamander**

Tyler DeVos, Junior – Fisheries & Wildlife Management  
Faculty Advisors: Dr. Jill Leonard – Biology; Dr. Josh Sharp – Biology  
Poster

Nearly a third of amphibian species worldwide are currently in danger of extinction, and the parasitic chytrid fungus, *Batrachochytrium dendrobatidis*, has emerged as one of several factors contributing greatly to this decline in amphibian biodiversity. The chytrid fungus is capable of rapid spread, and once established grows on the skin of infected individuals and usually results in weight loss and eventual death. A few species, including the red–backed salamander, *Plethodon cinereus*, have shown resistance to the fungus. This resistance is facilitated by bacteria which live on the salamanders’ skin and produce compounds that inhibit *B. dendrobatidis*. While extensive research has been done on the ability of these cutaneous bacteria to provide resistance against the fungus, less is known about how environmental conditions affect the bacteria. To test this, red–backed salamanders were housed individually on either natural or sterilized soil. Bacteria were collected from the skin monthly and transferred to nutrient plates to grow for approximately 48 hours. Bacterial colonies were then categorized and counted using ImageJ software. We observed a dramatic increase in total colony count among salamanders housed on sterile soil; however, colonies of antibiotic–producing bacteria were found only on salamanders housed on natural soil from the second sample onwards. The data suggest that changes in the composition of soil bacteria have the ability to strongly influence the resistance of red–backed salamanders against the chytrid fungus.

**Electrocortical Responses Associated with the Potentiation of Attentional Bias to Fearful Facial Expressions by Auditory Distress Signals**

Brittany DiMaria, Senior – Psychology  
Jamie Sterr, Junior – Biochemistry  
Scott Conger, Senior – Psychology  
Sam McCullough, Freshman – Psychology  
Faculty Advisor: Dr. Joshua Carlson – Psychology  
Poster

Unimodal emotionally salient visual and auditory stimuli capture attention and have been found to do so cross–modally. However, little is known about combined influences of auditory and visual distress cues on directing spatial attention. Previous studies yielded evidence in multimodal emotional attention, and the experiment has since been developed to include electrocortical analysis of emotional audiovisual effects on potentiation. It was hypothesized that attentional bias to fearful faces would be enhanced when co–presented with auditory distress signals. To test this hypothesis, event related potentials (ERP) via N170 at occipito–temporal electrodes were measured during a dot–probe task. The electrodes are placed to measure locations corresponding to the participant’s spatial attention in the visual cortex. These electrocortical responses have shown support for emotional attention differences in distress and non–distress conditions.

**The Role of Renewable Energies on Climate Change Mitigation**

Kevin Dispensa, Senior – Environmental Science  
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences  
Poster

Since the 1800’s humanity has been polluting the atmosphere with greenhouse gases by burning fossil fuels for heat and electricity production. The more than 200 years of burning fossil fuels have caused a current worldwide climatic issue known as climate change. Around the world, the surface temperature has risen a few degrees Fahrenheit, which has caused a rise in surface temperature, increased effects of storms, and heat waves. The most effective solution today is to replace all current electricity production of burning fossil fuels with renewable energies (RE) like solar, wind, and hydropower. Renewable energies will confidently reduce the amount of carbon dioxide in the atmosphere giving earth time to recycle out the pollution before climate change becomes even worse. This paper presents a summary of how renewable energies will relieve earth of producing greenhouse gases while determining whether RE will be enough to reduce earth’s surface temperature and CO2 levels back to pre–industrial levels. I will come to my conclusion by reviewing others’ research on renewable energies contribution of mitigating climate change through current statistics and models. The current statistics and models I will use are such as those from The U.S. Energy Information Administration to do my own quantitative work that will include current numbers on energy usage and carbon emissions.
Lepidoptera Biodiversity Assessment along Agricultural Gradients in Castanhal, Pará, Brazil
Zach Dykema, Senior – Biology/Ecology
Faculty Advisor: Dr. Jill Leonard – Biology
Oral Presentation – Jamrich 1311 at 11:00 a.m.

Lepidoptera are key pollinators, herbivores, and prey items on all levels of the tropical rainforest stand. Consequently, the biodiversity of butterflies and moths accurately represents the biodiversity of many other communities within rainforests, including the Amazon ecosystem. While participating in the faculty–led study abroad class, *Fishery and Forestry Resources of the Amazon*, in Castanhal, Pará, Brazil, I categorized the biodiversity of Lepidoptera around the field station using photographs. I also compared the biodiversity in four areas of different agricultural use (monoculture, polyculture, clear–cut, fallow meadow) to look at the human disturbance impact on butterflies and moths. I identified 68 species around the field station. The fallow meadow, monoculture, clear–cut, and polyculture areas averaged 13, 9, 7, and 4 Lepidoptera species, respectively. This project not only added to the field station's biodiversity catalog, but it also describes the agricultural and silvicultural effects on the local fauna on site. This study also exemplifies the importance and potential for continued faculty–led, biology study abroad research trips.

Habitat Characterization and Vegetation Diversity Analysis of Flowering Rush (Butomus umbellatus) Infestations on the Au Train River
Zach Dykema, Senior – Biology/Ecology
Faculty Advisor: Dr. Jill Leonard – Biology
Poster

Flowering rush (*Butomus umbellatus*) is an aquatic, invasive plant that was found for the first time in Michigan's Upper Peninsula along the Au Train River in the summer of 2016. Due to its recent discovery, little is known about where else flowering rush could establish along the stream or potential effects on the riparian ecosystem. I compared habitat characteristics and vegetation diversity at points with and without flowering rush using 1 m² quadrats. The pH, temperature (°C), depth (dm), and flow (m/s) of the stream and the substrate sediment length (mm) were measured. All plants in each quadrant were identified, stem counted, and estimated for percent cover. There were no significant differences between points in regard to pH, temperature, depth, flow, and sediment length, though where flowering rush is present temperature and pH of the water are higher than sites without flowering rush. There is no relationship between percent cover of flowering rush and plant biodiversity. The Shannon biodiversity indices between the two data sets suggests a decrease in biodiversity when flowering rush is present, but it is not statistically significant. Though no strong conclusions can be made, continued observation and treatment is recommended to preserve the ecological integrity of the Au Train River.

Diversity Common Reader – Essay Contest
Faculty Advisor: Dr. Lisa Eckert – English
Oral Presentation – Jamrich 1322 at 4:00 p.m.

The winners of the Diversity Common Reader essay and creative writing contest will read their winning pieces, which explore the complex issues presented in *Citizen*, by Claudia Rankine, this year’s selected book for the program. The Diversity Common Reader Program (DCRP) is a semester–long initiative focused on embracing diversity by exposing a new cultural or ethnic idea at a campus–wide level. At the beginning of the academic year, The President's Diversity Committee selects a book that advances diversity. The selected book is then made available, free of charge, to all interested NMU students and faculty discussion leaders and the campus community is invited to participate in discussions with the author or other notable speakers visiting campus. In addition, the committee invites students to participate in writing and art contests reflecting the reading. *Citizen*, by Claudia Rankine, combines poetry, essay, and visual images into a gut–wrenching treatment of racism as it is experienced in everyday micro–aggressions.
Tourism Perceptions of Munising, Michigan Business Owners In Relation To Growing Visitation
Logan Eggerding, Senior – Environmental Studies & Sustainability
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Poster

Munising, MI is a tourist destination fueled by its close presence to the Pictured Rocks National Lakeshore. According to the National Park Service, visitation rates are up from 381,854 in 2004 to a record 777,428 in 2016, and there is a lack of information on how the tourism industry works in the area. The Tourism Area Life Cycle (TALC) model is used to determine the economic/social state of a tourism destination, and to give insight into a carrying capacity of visitation. Through surveying multiple business owners of Munising, Munising's stage of the Tourism Area Life Cycle model will be determined. In addition, the surveys will provide information on what ways, if any, the town could benefit from implementing a tourism carrying capacity. This data will provide information about the tourism industry of Munising, Michigan that will help business owners’ deal with an influx of visitors, and give local residents an understanding of how business owners perceive tourism in the area. Determining the stage of the TALC model a destination is in can provide insight into the future of the destination, and can be used to ensure a sustainable tourism industry.

Comparison of Conditioned Media and Co–Culturing as an in vitro Model to Investigate Cancer–Associated Thrombosis
Melanie Flaherty, Senior – Biology/Physiology & German Studies
Nicholas Shortreed, Sophmore – Neuroscience
Dustin DeGrave, Senior – Biochemistry
Faculty Advisor: Dr. Johnathan Lawrence – Upper Michigan Brain Tumor Center
Poster

Venous thromboembolism (VTE) is the leading cause of death, behind the malignancy itself, in patients diagnosed with cancer. Statistically, patients with cancer are four times more likely to develop VTE. With more than 1.7 million newly diagnosed patients in 2016, VTE and its associated complications create a challenge to physicians and their patients. First described by Trousseau in 1865, there is a well–documented link between VTE and cancer. This connection has been studied almost exclusively clinically and a number of factors have been identified as playing a role in cancer–associated thrombosis (CAT). Even with the identification of key proteins upregulated in CAT patients, the complex molecular mechanisms underlying this phenomenon have yet to be fully understood. In order to better understand the pathways involved, a model must be created. The aim of this research is to compare two possible in vitro models: conditioned media and co–culturing as effective models for replicating the environment in CAT. The models will be compared using a number of key points including: 1) ease of use, 2) thrombotic and inflammatory markers and 3) ability to isolate factors. The determination of a successful model will allow for the progression of future studies to decipher key mechanisms involved.

Unlocking the Mechanism of Resolvin D2 in Venous Thrombosis
Melanie Flaherty, Senior – Biology–Physiology & German Studies
Faculty Advisor: Dr. Johnathan Lawrence – Upper Michigan Brain Tumor Center
Poster

Deep vein thrombosis (VT) is a serious condition that affects nearly one million people every year. Current treatment for VT is anticoagulation medication, but even with the standard treatment of care only a third of patients experience complete resolution of the thrombus. Therefore, a more effective methodology for the treatment of VT is necessary. Resolvin D2 (RvD2) is an anti–inflammatory molecule derived from Omega 3. RvD2, although studied in a number of cardiovascular diseases, has yet to be looked at as a possible treatment for VT. The objective of this work was to develop an in vitro model using murine vein endothelial cells (B6MPVE) in order to investigate the effects of RvD2 on the resolution of VT. Preliminary in vivo testing done by the Diaz laboratories shows a significant decrease in thrombus weight following RvD2 administration. Following the successful creation of the model, key proteins identified through primary literature were studied to ascertain the role they played. B6MPVE cells were cultured in one of four different conditions 1) no treatment, 2) thrombin only, 3) RvD2 only or 4) thrombin and RvD2. RNA was extracted from the B6MPVE cells and their relative expression of numerous thrombotic and inflammatory markers were quantified via qRT–PCR. Following analysis of the data, it was concluded that RvD2 decreases pro–inflammatory proteins while increasing anti–inflammatory proteins through the GSK3-B pathway.
Pardoning Death: Death in Geoffrey Chaucer's The Pardoner's Tale
Elizabeth Fust, Junior – English Writing
Faculty Advisor: Dr. David Wood – English
Oral Presentation – Jamrich 1311 at 10:00 a.m.

Pardoning Death: Death in Geoffrey Chaucer's The Pardoner's Tale is a paper on the concept of Death in Geoffrey Chaucer's 1392 The Canterbury Tales, specifically in The Pardoner's Tale. In the paper I examine how The Pardoner's Tale deals with the theme of death regarding Catholic beliefs and as it relates to other medieval works that deal in some manner with death. Then I focus on the character of the Old Man and his interactions with the character Death and his role in the story, as well as the characters of the three hasardours as the heroes of the story. I look at the archetypes exhibited in The Pardoner's Tale, other medieval texts, and other works, specifically those that dwell on heroes and Death. Finally, I look at the origins of The Pardoner's Tale and other examples that include similar themes, including modern texts including a story from J.K. Rowling's The Tales of Beedle the Bard and Harry Potter and the Deathly Hallows.

Veiling in Islam
Rabab Gabasha, Senior – International Studies
Faculty Advisor: Dr. Tim Compton – Modern Languages & Literatures
Oral Presentation – Jamrich 1311 at 2:30 p.m.

The purpose of this research is to identify the different types of veiling practiced around the world. The word hijab is an Arabic word that means “to cover” and there are many stereotypes and misconceptions about the hijab. Did you know that veiling did not start out as a Muslim practice? According to religious scholar Reza Aslan, women in Iran and Syria covered their heads long before Islam as a sign of social status. My research uses primary and secondary resources to explain the different kinds of veiling that exist as well as the history and politics of this practice. It will help to clarify misconceptions of the hijab and eliminate the assumption that the hijab oppresses the women who wear it.

Exploring Methods of Separation, Purification and Derivatization of Isomers of B12H10(SMe)2
Ian Germaine, Graduate Student – Chemistry ACS
Faculty Advisor: Dr. Thomas Getman – Chemistry
Poster

Subjecting neat BH3SMe2 to pyrolysis in a pressurized reaction vessel yields the substituted icosahedral compound B12H10(SMe)2 as a mixture of isomers, where the dimethyl sulfide groups occupy 1,2; 1,7; or 1,12 positions. These isomers may replace the more expensive isomers of carboranes in research applications and may ultimately have applications in the area of hydrogen storage. A process which has been optimized to achieve >95% purity of the 1,7–isomer via complexation with β–cyclodextrin will be presented as well as discoveries made while trying to isolate the 1,12–isomer. The 1,7–isomer obtained via this optimized process was synthetically altered to yield [NMe4]2[1,7–B12H10(SMe)2], which can be alkylated and subsequently polymerized. Findings related to the purification process and any advances made toward polymerization will be presented.

Temperature Variability Along the Southern Coast of Lake Superior
Marissa Gillett–Behrens, Senior – Environmental Science
Faculty Advisor: Dr. Norma Froelich – Earth, Environmental, & Geographical Sciences
Poster

Lake Superior is the largest lake in the world by area and the most northern of all Great Lakes. Although lake–effect weather surrounding Lake Superior is more severe than smaller lakes, there has been little research and data collection for hydrologic and climatological processes. Past data collection used open water buoys in deep, central locations of the lake. Gathering accessible, nearshore data is important for local residents, tourists, students, and scientists who could utilize it for safe recreational preparations and future research. Northern Michigan University in Marquette, Michigan established a network of nearshore buoys in 2015 to compile a database of wave and weather variables during non–frozen months. I will analyze the buoy data with MATLAB to describe seasonal patterns for water and air temperatures in 2015 and 2016. For comparison, I
will gather documented ice cover data from the Great Lakes Environmental Research Laboratory's website and determine total annual coverage for 2014–2015 and 2015–2016 using ArcGIS. Previous research concludes regional temperatures have been warming in the last century. In turn, lake characteristics such as total annual ice cover and stratified season length have been affected. My findings will be useful for local scientists and cities to determine if future studies are necessary for changing lake processes, and what kind of regional climate change adaptation plans should be implemented.

**Ecological Drivers of Plant Community Composition in the Seney Wilderness Area, Upper Michigan**

Alex Graeff, Graduate Student – Biology  
Dr. R. Gregory Corace III – U. S. Fish & Wildlife  
Dr. Matthew Van Grinsven, Faculty – Earth, Environmental, & Geographical Sciences  
Faculty Advisor: Dr. Alan Rebertus – Biology  
Poster

Patterned fens are peatlands characterized by alternating hummocks (strings) and hollows (flarks), but often contain other landforms. Ecoregional differences in geomorphology, vegetation, landforms, and water chemistry give way to a variety of unique peatlands, and this variation necessitates studies in a variety of physiogeographic settings. The Seney Wilderness Area's (SWA) peatland is the second–southernmost patterned fen in North America and contains unique patterning associated with extinct dunes; yet, to our knowledge, no study has previously co–examined geomorphology, vegetation, and water chemistry among landform types in the SWA. The objectives of this study were to (1) characterize plant community composition of fen landforms and (2) examine the relationships between plant community composition and environmental variables. We estimated percent cover of vascular plant species in 298 relevé–style plots across 6 fen landform types: peripheral water tracks, featureless water tracks, swamp forests, strings, flarks, and ponded sedge lawns. At each plot, we measured peat depth and depth to water table (DWT) in addition to pH, specific conductance (S/cm), and Ca\(^{2+}\) (mg/L) for surface and subsurface water samples. Non–metric multidimensional scaling isolated four distinct vegetation groupings (p<0.01). Canonical correspondence analysis identified DWT, peat depth, surface conductivity, subsurface Ca\(^{2+}\) and subsurface pH as the most important variables (r\(^2\)>0.4) related to community composition. Variation in water chemistry and physical characteristics among fen landforms types were strongly related to plant community composition. This study reveals that plant communities and their physical and chemical properties, differ across fen landform types and within landform types across the landscape.

**Changes in Perceived Importance of Physical Activity and Nutrition for Health Following (S)Partners Intervention**

Rachel Greco, Graduate Student – Exercise Science  
Breanne Carlson, Faculty – Health & Human Performance  
Erich Petushek, Faculty – Michigan State University  
Karin Pfeiffer, Faculty – Michigan State University  
Joseph Carlson, Faculty – Michigan State University  
Faculty Advisor: Professor Breanne Carlson – Health & Human Performance  
Poster

Physical activity (PA) and nutrition are important components to prevent or reduce risk of cardiovascular disease (CVD) in youth. School based programs designed to promote nutrition and PA behaviors have shown some success in improving these health behaviors and health status. A factor related to adopting nutrition and PA behaviors is an individual’s perceived importance of the behavior on health. PURPOSE: To determine whether perceived importance of PA and nutrition improves greater in 5th grade students participating in a multi–level school and web–based nutrition and PA intervention versus students receiving lessons alone (active comparison). METHODS: Pre– and Post–data were collected from 1060 students from 14 schools in Michigan, from 2008–2015 who participated in the (S)Partners intervention (n=810; 8 lessons, web modules, and college mentors); or an active comparison (n=250; 8 lessons only). Participants completed a self–report survey on perceived importance of PA and nutrition on health (4 Point Likert scale). RESULTS: Repeated measures ANOVA results revealed there were no between group differences, though both the (S)Partners intervention and lessons only group had significant increases in perception of importance of both PA (p<0.05) and nutrition (p<0.05) in relation to health. CONCLUSION: Both groups improved their perception on the importance of health benefits regarding PA and nutrition. Future analysis will be conducted on this data to determine how these improvements in perception of the benefit of these nutrition and PA behaviors contribute to adopting or maintaining nutrition and PA behaviors throughout life.
**Design and Implementation of Operant Chambers for the Madagascar Hissing Cockroach**

Collin Hahn, Graduate Student – Applied Behavior Analysis  
Luke Whitehouse, Graduate Student – Applied Behavior Analysis  
Hannah Planinscheck, Senior – Psychology – Behavior Analysis  
Erin Wylie, Senior – Psychology – Behavior Analysis  
Alexandra Vacha, Senior – Psychology – Behavior Analysis  
Monica Jones, Junior – Biology/Psychology  
Callie Bergeron, Junior – Psychology – Behavior Analysis  
Faculty Advisor: Dr. Paul Andronis – Psychology  
Poster

Madagascar Hissing Cockroaches are an underexposed potential model organism in the experimental analysis of behavior. With their simple nervous system, ease of care and minimal oversight, they have the potential as effective candidates for behavioral research. However, very few researchers have developed effective hardware and procedures to deal with the idiosyncrasies of this organism. Such idiosyncrasies would include their relative lack of need for food and water, lack of certain avoidance behaviors present in other species of cockroach, rapid habituation to stimuli, and periods of inactivity. Presented is our work toward creating hardware designs and procedural implementations to enable future research with these challenging and fascinating organisms. Primarily reviewed are our efforts to create functional Skinnerian–style operant chambers for Madagascar Hissing Cockroaches, and our efforts to find reasonable and effective reinforcers and operandi. With the presented designs, we hope to open the gateway for more research with these novel subjects.

**Reasons Collegiate Athletes Are Dishonest or Deceptive about Injuries and Illnesses**

Janice Hamachek, Senior – Athletic Training  
Courtney LaFreniere, Senior – Athletic Training  
Holly Nieman, Senior – Athletic Training  
Michael Smithson, Senior – Athletic Training  
Justin Young, Senior – Athletic Training  
Faculty Advisor: Dr. Julie Rochester – Health & Human Performance  
Poster

The health and welfare of student athletes may be affected by their level of honesty and deception regarding injury/illness when working with their athletic trainer. The literature presents no previous research on dishonesty and deception of athletes toward their athletic trainer. The aim of this research is to determine the percentage of athletes who are dishonest or deceptive to their athletic trainer, the reason they are dishonest or deceptive, and how we can decrease the percentage of athletes who are dishonest or deceptive to their athletic trainer. This was accomplished by emailing 500 Northern Michigan University Athletes an open ended, multiple choice, and question matrix survey (Qualtrics). Participation by subjects was voluntary and responses were anonymous. We received 137 total responses with a response rate of 31%. Overall, 28% of subjects have been dishonest or deceptive to their athletic trainer about an injury or illness, with 41% of males and 34% of females reporting that they engaged in this behavior. Missing out on practice or competition and the fear of losing their position on the team is the main reason athletes were dishonest or deceptive. In order to increase honesty, athletes would like to be given more education about their injury, or a private examination space. Dishonesty and deception both occur by athletes to athletic trainers. While a majority of athletes do not participate in these behaviors, it is still important to have a good rapport in the athlete– athletic trainer relationship.

**Correlates of Balance and ImPACT After Return to Play Post Concussion**

Janice Hamachek, Senior – Athletic Training  
Justin Young, Senior – Athletic Training  
Faculty Advisor: Dr. Marguerite Moore – Health & Human Performance  
Oral Presentation – Jamrich 1322 at 10:15 a.m.

A sudden impact to the head can result in a mild traumatic brain injury (mTBI) also known as concussion. Currently, an increase in the allocation of resources and interest for the study of concussions is present due to media publicity. Post-concussion assessments are often subjective and rely on patients to accurately and honestly self-report symptoms. The need is currently present to find a better way to accurately diagnose concussions using a non-invasive, portable, and cheap
method. Neuroimaging tools are underutilized for diagnosis and research of concussions, creating a need for research across multiple neuroimaging measures. We specifically looked at the Immediate Post–Concussion Assessment and Cognitive Testing (ImPACT) and the Biodex Balance System. The ImPACT measures the neurocognition of the participants. We specifically looked at the compost scores of reaction time, processing speed, verbal memory, and visual memory. The Biodex Balance System uses Limits of Stability Testing and Clinical Test of Sensory Integration of Balance Tests were used on to measure dynamic and static balance and proprioception. We are comparing athletes who are post return to play concussed athletes to athletes in the same sport and same age who have not had a concussion within one year. We will be running a statistical analysis on the data in order to discover if a difference is present in athletes who are post return to play and athletes who have not had a concussion within one year.

**Biodiesel Degradation by Microbacterium Petrolearium**

Jenna Happach, Senior – Biology/Ecology
Faculty Advisor: Dr. Brandon Yoza – University of Hawaii at Manoa, Honolulu, HI
Poster

Biodiesel is a renewable energy alternative. The US Navy has implemented the use of this fuel in non–combat vehicle and watercraft. However, their use of compensated fuel ballast systems directly expose fuel to seawater. A contamination of biodiesel fuel due to the presence of water can result in a decrease in heat combustion, corrosion of system components, and growth of microbes, which degrade fuel and clog fuel systems. Previously, an eukaryote was characterized and tested for its potential to biodegrade biodiesel. This project aimed to follow in the footsteps of that preceding study by characterizing a previously isolated seawater prokaryote, *Microbacterium petrolearium*, and determining its potential to metabolize hydrocarbons. I characterized the microbe through DNA isolation, polymerase chain reaction (PCR), and gene sequencing. I measured cell growth and hydrocarbon degradation by UV/Vis spectroscopy and density comparison respectively, over a seven–day period. Results indicate a positive correlation between total hydrocarbon mass metabolized and estimated cell growth. The estimated cell count increased from 1.00E+08 to 7.00E+08. The total mass of biodiesel metabolized increased from 0 mg to 7 mg during the growth period. However, it is currently unclear if *M. petrolearium* has the potential to metabolize biodiesel. Cell growth might be due to residual carbon from the marine broth. In addition, a longer growth period was suggested to obtain data that are more significant. Eventually, this information will add to the growing knowledge of how seawater microorganisms affect the efficiency of renewable energy.

**Effects of Color Cues on Attentional Bias to Threat**

Elizabeth Harkema, Junior – Grad Prep Psychology
Ellyse VanDyke, Senior – Psychology
Faculty Advisor: Dr. Joshua Carlson – Psychology
Poster

Within our environment, salient stimuli capture our attention. In particular, humans display a strong preference or attentional bias for threat–related stimuli. One method of assessing attentional bias to threatening stimuli is the dot–probe task. In this paradigm, threatening and non–threatening stimuli are presented to the participant at the same time in the form of neutral and fearful faces while they fixate on the crosshairs in the middle of the computer screen. In addition to fearful faces, basic signals such as color—and the color red in particular—signal danger or threat. The purpose of this study is to examine if the color red enhances attentional bias to fearful faces. By doing so, the targets participants had to identify varied in color from green, red, and white. Participants were asked to identify the targets location by indicating if it was on the left or right side of the screen as quickly as possible. Color has a definite influence on participant’s response time. Specifically, the results show us that the colors red and green are enhancing our attention. This information may be useful for retrainingattentional bias in individuals with anxiety.
Student Motivation in Superior Edge: Examining Co–Curricular Engagement Using Self–Determination Theory
Gwyneth Harrick, Freshman – Public Administration
Faculty Advisor: Dr. Jon Barch – Psychology
Poster

Students involved in Northern Michigan University’s Superior Edge program, a student development program, differ greatly in the amount that they participate after joining, despite the program’s benefit to student development, resumes and transcripts. The study utilized Self–Determination Theory (SDT; Ryan & Deci, 1985), to examine the relationship between members’ participation in the program, motivational regulation, and engagement in the Superior Edge logging system. Superior Edge members (N = 310) completed an online survey, which measured perceptions and types of motivation for engaging in the program. Students from four different engagement levels participated in focus groups, which provided qualitative information regarding students’ perception of Superior Edge. The results indicate that there is a positive correlation between perceived program support and type of motivation, with more support leading to more intrinsic motivation. Additionally, greater intrinsic motivation corresponded with more program engagement. These results support the idea that student development programs can increase participants’ engagement by creating autonomy–supportive learning environments.

Pollen Preference of Osmia lignaria (Hymenoptera: Megachilidae) in a Commercial Blueberry Field
Margaret Hartman, Senior – Fisheries & Wildlife Management
Mario Pinilla–Gallego, Graduate–2nd year Masters at MSU – Entomology
Faculty Advisor: Dr. Rufus Isaacs – Michigan State University
Poster

Alternative pollinators such as the mason bee (Osmia spp.) are becoming increasingly important in agriculture as European honey bees (Apis mellifera L.) continue to decline. Osmia lignaria are especially important pollinators because they make contact with the anther and stigma during nearly every flower visit and are less likely to rob the plants of nectar without pollination. Previous studies indicate O. lignaria preferentially visit plants in the Rosaceae family, such as apple, cherry, pear and plum. This study was conducted in a commercial blueberry field in southwestern Michigan. Pollen samples from flowering plants and O. lignaria nests were collected with the objectives (1) to analyze pollen loads in relation to proximity of natural areas surrounding the blueberry field and (2) to determine their pollen preference in a blueberry monoculture ecosystem. Acetolysis was performed on all pollen samples, and pollen from lignaria nests was qualitatively and quantitatively analyzed. At this study site, O. lignaria collected pollen from white clover (Trifolium repens) and black cherry (Prunus serotina) most often. In spite of its availability, pollen collected from northern high bush blueberries (Vaccinium corymbosum) accounted for significantly less of the total pollen in each nest. These findings are useful in determining the viability of O. lignaria as blueberry crop pollinators. Based on the results, Osmia lignaria is not a good option for northern high bush blueberry pollination.

Characteristics of Sites Where Wolves Kill Fawns in Northern Minnesota
Austin Homkes, Graduate – MS Biology
Faculty Advisor: Dr. John Bruggink – Biology
Poster

White–tailed deer fawns (Odocoileus virginianus) are the primary summer prey of wolves (Canis lupus) in northern Minnesota. Wolf predation on fawns is most intense shortly after fawns are born in late May and June. Finding and documenting sites where wolves kill small prey, such as fawns, is challenging. Thus, little is known about where wolves kill fawns and few descriptions exist of these kill sites. To document the characteristics of sites where wolves killed fawns and the behavior of wolves at these kill sites, we fitted two wolves with 20–min–fix–interval GPS–collars in Voyageurs National Park, Minnesota, and visited clusters of GPS locations to identify fawn kill sites. From late May through September 2016, we located 50 fawn kill sites. Wolves spent an average of 3.5 hr ± 3.5 (SD; range: 0.3–13.7) at kill sites with carcass utilization ≥ 99%. Kill sites were most commonly found on meadow edges, in stands of aspen (Populus spp.) saplings with dense ground cover, and wetland edges below beaver (Castor canadensis) dams. There was no difference in cover density between kill sites and randomly–selected locations around the kill site, which suggests wolves rely on scent rather than sight when hunting fawns. We have provided a detailed description of fawn kill sites, which have not been well documented because of the challenges associated with identifying kill sites.
Field to Fork
Ellen Honkala, Freshman – Hospitality Management
Faculty Advisor: Chef Christopher Kibit – Technology and Occupational Sciences (Jacobetti Complex Programs)
Poster

There are many processes that take place from the point when your food is grown and harvested at the farm to when it reaches your fork. As a Hospitality Management major, I am interested in learning about this journey and informing consumers. Guided by NMU Chef Chris Kibit, I first visited a 4-H auction where we purchased a variety of livestock. I assisted with breakdown of the animal and its processing into sausage and other products, and provided the end result to consumers. I also studied food systems within restaurants including food purchasing and storage functions. Additionally, I was able to tour processing facilities to learn about how foods are processed. A full understanding of the entire food system will play a major role in my ability to be an informed member of the Hospitality industry.

Studying Titanium Dioxide with MuSR
Jarryd Horn, Junior – Physics
Faculty Advisor: Dr. Rick Mengyan – Physics
Poster

In this contribution, we introduce the Muon Spin Rotation, Relaxation and Resonance technique (MuSR) and discuss our current study focused on understanding the characteristics of Muonium—like states (as an analog to isolated Hydrogen) in Anatase Titanium Dioxide (TiO2). MuSR utilizes 100% spin polarized positive muons (charge +e; spin 1/2; mass 1/9 of proton), which upon being implanted in a material, precess in the local environment and decay with a positron emitted preferentially along the spin direction at the time of decay. The time evolution of the muon spin polarization is tracked as an ensemble of these decay events. The muon’s sensitivity to small magnetic field fluctuations and electronic interactions make it a great tool for studying the local environment in bulk materials. In some cases, the muon captures an electron after implantation to form Muonium (Mu): an experimentally accessible analog to an isolated Hydrogen impurity (H). Muonium is a factor of nine lighter than isolated H, but with nearly the same Bohr radius and ground state energy, it behaves very similarly to H. In rutile TiO2 specifically, Mu and H are both found with the same Oxygen bonding configurations and an identical electronic structure [R.C. Vilão, et al. PRB 92 (2015) 081202(R)]. The Mu configuration and any associated dynamics (e.g.: charge state cycles, local motion and diffusion) in the similar anatase phase of TiO2 are the focus of this investigation. Understanding H impurities in these materials is important since H is a common and unavoidable impurity that has a very significant effect on the electrical and optical properties of TiO2 [see e.g.: Lavrov et al., Phys Rev B 93 (2016) 045204; Erdal et al., J Phys Chem C 114 (2010) 9139]. TiO2 is of particular interest due to its broad range of applications – some examples are gas-sensing systems, H storage, electrochromic devices and for photocatalysis [See e.g.: Chen et al., Chem Rev 107 (2007) 2891; Diebold, Suf Sci Rep 48 (2003) 53; Zhang et al. Phys Chem Chem Phys 16 (2014) 20382]. Contributing authors: P.W. Mengyan (NMU), R.L. Lichti (Texas Tech University), J.S. Lord (Rutherford Appleton Lab, UK).

Measuring Student Perceptions on a Proposed Campus–wide Water Bottle Ban
Andrea Hunt, Senior – Environmental Science
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Poster

This study measures Northern Michigan University student perceptions on a proposed campus wide water bottle ban. Bottled water raises several environmental concerns including the fossil fuels used to make bottled water, over exploitation of water resources, and the plastic waste produced by the bottles. Many universities across America have taken steps to ban bottled water on local campuses. This research uses a survey to gauge student perceptions on a proposed campus–wide water bottle ban and evaluate overall water drinking habits on campus. Surveys were strategically distributed on various Facebook organization pages across campus. In addition, interviews with several students and faculty were conducted to further measure perceptions on the proposed ban of bottled water. A campus–wide water bottle ban would decrease plastic waste on campus, encourage the NMU community to engage in green drinking practices, and aid in future campus sustainability efforts.
The Association of Blood Lipids with Other Selected CVD Risk Factors in Michigan Adolescents
Ashlyn Jendro, Graduate Student – Exercise Science
Breanne Carlson, Faculty – Health & Human Performance
Dr. Erich Petushek, Faculty – Michigan State University
Dr. Karin Pfeiffer, Faculty – Michigan State University
Dr. Joseph Carlson, Faculty – Michigan State University
Faculty Advisor: Professor Breanne Carlson – Health & Human Performance
Poster

Cardiovascular disease (CVD) is the leading cause of death in adults in the United States. A concern in U.S. children is the increasing rates of CVD risk factors (obesity, dyslipidemia and low cardiorespiratory endurance (CRE)) which tend to track into adulthood and are related to premature morbidity and mortality. High levels of low-density lipoprotein (LDL), total cholesterol and blood pressure, alongside low levels of high-density lipoprotein (HDL) and CRE, have been identified as risk factors for CVD. PURPOSE: To identify the association of several CVD risk factors from a pediatric population participating in (S)Partners for Health Program. METHODS: This cross-sectional study included 248 (151 female, 97 male), 9–13 year-old students in 2008–2013, from Michigan, who participated in baseline measures for (S)Partners for Health. Pearson correlations were used to evaluate if LDL, HDL or total cholesterol were directly associated with body weight, percent body fat, waist circumference, body mass index (BMI), mean arterial pressure (MAP) and CRE (20-meter pacer scores). RESULTS: There were significant, but weak, correlations among HDL, LDL, total cholesterol and body weight, body fat, waist circumference and BMI. CONCLUSION: This study indicates that there was an association between lipid indicators and CVD risk factors measured in (S)Partners for Health. Future studies should investigate the modifiability of these variables and use factor analytic or profiling techniques to address the various measurement properties for this extensive CVD risk assessment battery to improve efficiency.

Performance and Biomechanical Changes Following Modification of Golf Swing Technique to Reduce Lower Back Injury Risk
Riley Jepkema, Freshman – General Biology
Sarah Clarke, Faculty – Health & Human Performance
Randall Jensen, Professor – Health & Human Performance
Faculty Advisor: Dr. Erich Petushek – Health & Human Performance
Poster

The lower back is the most commonly injured body region for participants in the sport of golf. Characteristics of swing technique have been proposed as the main contributing factor for lower back injury risk due to the large forces and range–of–motion. The lower body swing technique has qualities that may reduce these purported risk factors, but its effect on performance and biomechanical risk factors has yet to be assessed. Thus, the purpose of this study was to assess the performance and biomechanical changes following an acute lower body swing coaching intervention. Eighteen male and 9 female recreational golfers (mean age SD = 48.3 ± 14.23) performed 5 golf swings (using a driver for maximum distance) before and after a brief 10–minute lower body swing coaching intervention by a PGA professional coach. No change in maximum drive distance was found (Pre–Post change = –0.91 m; p = 0.82; Cohen’s d = 0.02). Very small changes in average drive distance across the 5 shots was found (Pre–Post change = –11.18 m; p = 0.04; Cohen’s d = 0.22). There was no difference in shot angle (p = 0.79), gender interaction (p = 0.91) or relationship between skill level and intervention effects (r = –0.27, p=0.18). Overall, the adoption of the lower body swing technique seems to not, or only slightly, impair performance across both genders and skill levels. Three–dimensional biomechanical data are currently being processed and analyzed to assess the lower body swing coaching effects on lower back biomechanical risk factors.

Listeria Rapid Identification with MIT Laser Technology
Zach Jodoin, Junior – Biology
Faculty Advisor: Dr. Josh Sharp – Biology
Oral Presentation – Jamrich 1322 at 9:30 a.m.

In America alone, food–borne pathogens cause approximately 3,000 deaths and cost the economy more than $15 billion. Of all the food borne pathogens, Listeria monocytogenes, is one of the most troublesome. Listeria targets the most vulnerable members of society resulting in more than 260 deaths of elders, infants, and pregnant women. Current methods used to detect
and prevent Listeria outbreaks are both expensive and extremely slow leading to misidentification and, consequently, extremely dangerous and expensive outbreaks. With the use of Micro Identification Technologies MIT1000 laser light scattering technology, Dynabead antibody microbead use, and selective media, we optimized an assay that drastically reduced the amount of time and resources required to accurately identify *Listeria* from a liquid culture. This new assay has the potential to save hundreds of lives and millions of dollars each year, while at the same time, holds significant potential for rapidly identifying various other bacterial species.

**Encouraging Sustainability Through Music**
Jeffrey Jonas, Senior – Environmental Studies
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Performance – Jamrich 1311 at 12:45 p.m.

This research examines how music can be used as a tool for social change, particularly around the issue of climate change. I want to explore how music can have an impact on people and inspire them to make a difference in the health and well-being of our planet by incorporating more sustainability into their lives. I propose that music can influence people to come together for a common cause in the name of our planet. I wish to learn more about how the new field of ecomusicology is constructed and implemented through my research (Titon, 2013). I am examining how music encourages sustainability through social organization. The area of my study lies within this connection of music and sustainability and how this method of communication can influence personal choices in becoming more sustainable. I feel this is extremely important for the future of many generations to come, as combating human-induced climate change calls for action and not just words. As an applied project, my research will include putting on a musical performance at the Ore Dock Brewery Company on Earth Day, with an event that centers around our environment. This will provide a chance for people to donate toward green causes, either toward a green roof for the Ore Doc building or Dr. Norma Froelich’s research on climate change and its effects on Lake Superior. To further my research, I want to conduct a survey of a portion of event attendees. I would ask questions with a five-point Likert scale, such as “How important do you think the music was for this Earth day event?” With this five point scale data, I want to conduct my own consensus on how a small portion of Marquette’s residents react to such an event that promotes sustainability through music. I also want to conduct interviews to further my research by hearing other musicians’ thoughts and opinions on how they feel about music and sustainability.

**Use of Self-relevant Stimuli in the Dot–probe Task**
Jailin Kaiser, Freshman – Neuroscience
Erin Wylie, Senior – Applied Behavior Analysis
Lydia Morgan, Junior – Psychology
Grant Dorian, Senior – Psychology
Faculty Advisor: Dr. Josh Carlson – Psychology
Poster

Attentional Bias Modification (ABM) is a therapy that utilizes computer–based training protocols to implicitly modify biased attention patterns in anxious subjects. The Dot–Probe Task is the most prominent in paradigms for studying the relationship between attention and anxiety. In this task, two stimuli are briefly presented; one of the stimuli is neutrally valenced while the other is threat–related. The stimuli disappear, and a dot then appears in one of the positions where the stimuli were. Faster reaction times when the target replaces threat–related stimuli are considered to be indicative of an attentional bias towards threat. Given the relative recency of the field, many questions regarding methodology remain unaddressed, particularly the test–retest reliability of the task and how to tailor it. In this study, the stimuli during "training" sessions were words chosen by participants in order to evaluate their effectiveness in the task relative to neutrally valenced words. There were 10 words the participant identified as causing anxiety and 10 of the same length that were identified as neutral. The speed of response increased over the 6–session period as participants acclimated to the task. After a warm–up session, participants displayed an attentional bias overall and strikingly consistent scores compared to past research.
**Hypoxia–regulated Expression Of Glut1 in Gbm Cell Lines**
Marissa Kane, Graduate Student – Biology
Faculty Advisor: Dr. Robert Belton – Biology
Oral Presentation – Jamrich 1311 at 3:30 p.m.

Unlike normal cells, most cancers can grow in low oxygen growth (hypoxic) environments. Changes in relative oxygen concentration can alter gene expression in tumors to allow for their selective growth. The result of such changes allows the tumor to adapt its cellular metabolism and promote tumor progression. Most notably, hypoxic conditions induce expression of the transcription factor hypoxia inducible factor 1 (HIF–1). HIF–1 is thought to directly affect glucose transporter 1 (GLUT1) expression levels in hypoxic conditions. This study sought to determine the relationship between HIF–1 and GLUT1 expression levels within normoxic and hypoxic environments utilizing an in–vitro GBM cell model. The data accumulated regarding HIF–1 and GLUT1 expression levels will help determine whether GLUT1 is a suitable target for future GBM treatments.

**A Comparison of Salivary and Serum Based BDNF Levels Following Mild Traumatic Brain Injury: Preliminary Results from an NMU Prime Project**
Amy Abel, Senior – Biology
Keara Kangas, Graduate Student – Psychology
Dr. Marguerite Moore, Faculty – Health & Human Performance
Faculty Advisor: Dr. Joshua Carlson – Psychology
Poster

Neurotrophins play an important role when recovering from brain injury. Brain–derived neurotrophic factor (BDNF) is a neurotrophin that is specifically essential for neurons to survive and flourish in the central nervous system. A limited amount of research indicates that BDNF levels are elevated following traumatic brain injury (TBI). In particular, research suggests BDNF has higher prognostic value as a diagnostic tool for mild TBI (mTBI) compared to moderate or severe TBI. To date, most research has used blood to measure BDNF levels in humans. Although BDNF can be measured in saliva, little to no research has assessed BDNF levels in athletes with concussions and little is known about the reliability of BDNF measurements obtained across both sampling techniques. To address these issues, we collected NMU student athletes’ saliva and blood to measure BDNF levels. There were two groups of participants, one group recently recovered from a concussion and the second (control) group which did not have a concussion within the past year. To collect saliva, two 1.8mL tubes were filled using a passive drool method from each participant. Saliva was then aliquoted into 1.5 mL centrifuge tubes and centrifuged for 15 minutes at 4 degrees Celsius at 4000 RPMs. Blood samples were drawn by phlebotomists from the Clinical Science Department. 50ml tubes were filled, processed to separate the serum, and then stored according to their laboratory’s procedures. All samples were then analyzed using an enzyme–linked immunosorbent assay (ELISA). The preliminary results showed BDNF levels differed when comparing concussed versus non–concussed individuals.

**A Comparison of Prefrontal Cortex Activity Across Emotional Stroop and Dot–probe Tasks of Attentional Bias: A Near–infrared Spectroscopy Study**
Keara Kangas, Graduate Student – Psychology
Faculty Advisor: Dr. Joshua Carlson – Psychology
Poster

Near–infrared spectroscopy (NIRS) research measuring prefrontal cortex (PFC) activity during emotional processing is limited. Functional Magnetic Resonance Imaging (fMRI) research indicates that the amygdala and PFC are involved in orienting visuospatial attention to emotionally salient stimuli. Two common tasks of attentional bias include the emotional Stroop and the dot–probe task. Both tasks appear to engage the PFC. However, research directly comparing attention–related PFC activation across these tasks is limited. Here, we examined PFC activity using NIRS while participants performed the dot–probe and emotional Stroop tasks in a counterbalanced order. In the dot–probe task, participants had to locate a target dot, which was preceded by face pairs. There were three trial types: baseline (two neutral faces), congruent (dot appears behind the fearful face), and incongruent (dot appears behind the neutral face). The emotional Stroop task consisted of threatening and neutral images surrounded by a border, and participants were asked to identify the color of the border. At a behavioral level, both tasks indicated that attention was captured by emotion. Reaction times were quicker for congruent (M = 361.07) compared to incongruent (M = 377.62) trials in the dot–probe task (t = −4.09, p= 0.01) and were slower for
threatening (M = 615.13) compared to neutral (M = 603.30) images in the emotional Stroop task (t = 1.81, p=0.05). At a neural level, both tasks elicited increased PFC activity. Thus by comparing these two tasks, NIRS data suggests the PFC is involved in emotional processing, along with the orienting visuospatial attention to fearful stimuli.

The Relationship Between BDNF and Prefrontal Cortex Oxygenation Following Mild Traumatic Brain Injury: Preliminary Results From An NMU Prime Project
Keara Kangas, Graduate Student – Psychology
Faculty Advisor: Dr. Joshua Carlson – Psychology
Oral Presentation – Jamrich 1322 at 2:00 p.m.

Impacts to the head, that are associated with sports related injuries, can result in a mild traumatic brain injury (mTBI) also known as a concussion. Previous research has assessed how concussions affect the brain, but these assessments are limited in their diagnostic capability. There is an increasing number of studies aiming to improve and develop new post–concussion diagnostic tools. Along with concussion assessments, only relatively few studies have used neuroimaging equipment to evaluate brain injury. This study utilized a neuroimaging technique that is cheap, non–invasive, and portable to measure brain activity post–concussion. In particular, near–infrared spectroscopy (NIRS) measured affective processes of attentional bias in the prefrontal cortex (PFC) during a rest condition. Brain–derived neurotrophic factor (BDNF) is essential for neuronal survival and helps prevent neuron death, especially after neural damage. BDNF is also related to frontal lobe activity, attention tasks, and affective processing. Thus, BDNF was measured from saliva and blood samples that were collected from NMU student athletes. The study included one group of participants who recently recovered from a concussion, and a second group (control) that had not received a concussion within the past year. BDNF levels differed when comparing the concussed verses control group. In addition, the concussed group showed overall decreased PFC activity during the rest condition when compared to the control. These measures help us better understand concussions, and potentially assist in improving and developing more efficient diagnostic assessments.

Trends in Green Frog (Lithobates Clamitans) and Wood Frog (Lithobates Sylvaticus) Body Size and Geographic Distribution in Relation to Climate and Interspecific Interactions
Anna Kase, Senior – Zoology
Faculty Advisor: Dr. Kurt Galbreath – Biology
Poster

Lithobates clamitans is a common species of amphibian found across a wide geographic range spanning the eastern half of the United States. Populations of L. clamitans have apparently experienced selection on body size based on climatological variation across the species range, with smaller individuals generally associated with warmer climates. Now, as environmental pressures are changing in association with the currently changing climate, it can be hypothesized that there may be an overall shift in the geographic range of this species. This change in the climatological gradient could also cause the average body size of individuals within local populations to shift (e.g., as local climate warms, individuals may become smaller). Such a shift could bring about new species interactions between L. clamitans and the similarly sized and related Lithobates sylvaticus where their ranges overlap. In this study, we investigated the relationship between climate and body size within and between the two frog species. We also built ecological niche models to predict where these two species are currently found based on specimen records and current climate data. Simulated climate data representing future conditions allowed us to predict how the geographic ranges of these species might shift in the future. These data provide insight into the potential for new interspecific interactions that could shape the futures of L. clamitans and L. sylvaticus.

A Brief Historical Framework of the Effects of Logging on Forest Composition
Libby Kennedy, Senior – Environmental Science
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Poster

Throughout the last 150 years, logging has been a predominant industry affecting the natural landscape of Michigan's Upper Peninsula, specifically altering forest composition and ecological cycles. The logging industry has eliminated a large percentage of the UP's extensive forests, shifting the presettlement pine dominance to aspen dominated communities, thus changing the entire composition of the forest ecosystem. By focusing on the Marquette and Ontonagon counties, my
The purpose of this research is to examine baseline levels of stress, sleep patterns, and activity levels among first semester baccalaureate nursing students to determine whether any relationships exist among these variables. Nursing students have been noted to experience high levels of stress that continue into the nursing profession. This study aims to provide evidence allowing for further understanding of the stress experienced by nursing students and the relationship stress has to sleep patterns and activity levels. This may provide students with useful coping mechanisms to carry throughout their professional careers. Lazarus and Folkman (1984) understand that stress is an inevitable aspect of life, but they have theorized that the manner in which an individual perceives and appraises the stressors is what determines if it is harmful or beneficial. Although it is known that the stress that nursing students and nurses are under every day is higher than that of an average person, how each perceives and copes with that stress determines if each stressor affects the person in a damaging or valuable way. This study uses a descriptive and exploratory approach with an online Qualtrics survey containing demographic questions to measure items associated with stress levels (i.e. current jobs held, attendance in extracurricular activities, whether the subject has children, etc.) and the modified 10–item Perceived Stress Scale (Cohen et al., 1983). Results are pending as data analysis is in progress. This research will potentially educate our team along with the nursing faculty at Northern Michigan University on the factors that affect stress levels. These results will in turn allow our research team to further examine what, if any,
interventions will decrease stress levels of nursing students in general.

**Aging Black–capped Chickadees (Poecile atricapillus) Using Photographic Records of Morphological Features**

Joseph Kurtz, Sophomore – Biology/Ecology  
Faculty Advisor: Dr. Alec Lindsay – Biology  
Poster

As part of the JP Chickadee Project, a large number of Black–capped Chickadees were caught and banded in a local woodlot. Part of the data collected for each bird included a photograph of the underside of the bird, which simultaneously created an archive of the bird’s unique color combination and the coloration on the outer tail–feathers of the bird. The coloration on chickadee tail feathers can be used to determine the relative age of a bird. For this study I analyzed 54 photos of the underside of birds and established that 18 were “Hatch Year” (HY) birds, and 36 were “After Hatch Year” (AHY) birds. These results will allow us to now analyze potential behavioral differences between young birds and older birds, such as which ones move further for food, which ones forage more frequently, how flocks are age–structured and much more.

**Don't Be a Hater, Save the Pollinator: Examining the Relationship Between Land Coverage Types and Honeybee Winter Mortality Rates in Michigan’s Upper Peninsula**

Rachel LaManna, Senior – Earth Science  
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences  
Oral Presentation – Jamrich 1311 at 11:15 a.m.

Since the massive amount of honeybee mortalities that enigmatically occurred in large parts of Europe, Asia, and North America during 2006–2007, increased research investigating factors that influence survival has become indispensable to preserve and protect this top pollinator. This research explores different statistical relationships between honeybee winter mortality rates in the Upper Peninsula and the landscape variation within a 5km radius around each apiary. Honeybee loss (% per apiary) suffered over the winter was related to the area encompassed by each land coverage type, the number of plots of each land coverage type, and the size of the largest plot of each land coverage type. Deciduous forests, wetlands, and planted/cultivated areas primarily cover Michigan’s Upper Peninsula, yet in the central region where many apiaries are located, the landscape is more developed. Areas heavily modified by human development have raised many concerns for beekeepers because they have been found to have the highest mortality rates, while areas with mixed forests have been found to be associated with lower amounts of loss. Beekeepers in the United States describe an acceptable annual amount of loss to be 16.9%. Contrarily, mortality rates experienced are consistently higher, reporting a current nine–year average of 28.6%. Particularly during the wintertime when bees are unable to forage for additional food, fatalities are the highest. The quality and quantity of colony’s winter stores (honey) is a direct product of the past season’s environmental composition.

**The Upper Peninsula’s Carbon Exchange**

Louis Lamberti, Senior – Env. Studies & Sustainability  
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences  
Oral Presentation – Jamrich 1311 at 10:30 a.m.

This research examines the net carbon exchange between citizens and forested areas in Michigan’s Upper Peninsula (UP). Anthropogenic activity is determined to raise levels of carbon dioxide in the atmosphere. Consumption rates, along with current global concentrations, is compared to the sequestration capacity of forests within the UP. Carbon produced through anthropogenic means is primarily based on population, along with socioeconomic status. The sequestration rate of a wooded area is based on two factors: age and species of vegetation. Mature, softwood groupings less than 100 years old contain greater carbon uptake than old–growth, hardwood forest older than 300 years. Due to the varying ages and variety of species which cover majority of the UP, I confer that this defined area sequesters more carbon dioxide from the atmosphere than is produced by its citizens. With a negative net carbon exchange, the UP is designated as a carbon–sink. Areas with carbon–sinks see sustainable levels of carbon in the atmosphere, reducing anthropological changes to Earth's environment.
Spatial Analysis of Land Use and Watershed Management within the Whetstone Brook and Orianna Creek Watershed Boundaries
Hillary Land, Senior – Geomatics
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Poster

In 1998, the Marquette Township and the Marquette County Planning Committee created a Watershed Management Plan for the Whetstone Brook and Orianna Creek watersheds. The plan shows an analysis of existing land features, wetlands, surface water resources, and ground water resources. This analysis revealed how uncontrolled stormwater runs off roofs, roads, and parking lots into the watersheds. Impervious surfaces allow run off into the watershed and uncontrolled stormwater can lead to contamination to the watershed and further contamination to Lake Superior. This project looks into how much impervious surfaces have increased and how much permeable surfaces have decreased over time. Through spatial analysis of the watersheds, the number of impervious surfaces was calculated. In addition, the variety of Green Water Management practices endorsed by the EPA has been researched. Statistics on how much stormwater would be captured using these practices was also calculated. The focus of this project is to discover what stormwater management practices would be suitable for the Whetstone Brook and Orianna Creek watershed areas. This project contributes to the efforts in protecting Marquette's main watersheds and keep Lake Superior clean.

Slave Dwelling Overnight in Wisconsin
Alex Legit–Clark, Graduate Student – Master of Fine Arts–creative nonfiction
Truman Jones, Freshman – Art and Design
Ian McGhee, Junior – Secondary English Education
Lucy Meyer–Rasmussen, Sophomore – Biology
Elizabeth Michael, Graduate Student– Writing
Greg Beamish, Graduate Student – English Literature/Pedagogy
Faculty Advisor: Dr. Rachel May – English
Oral Presentation – Jamrich 1311 at 9:45 a.m.

The weekend of March 30–Apr. 2 found six NMU students, graduates and undergraduates, sleeping in the Dodge cabin in Wisconsin, where a man named Toby, enslaved by Governor Henry Dodge, probably slept in 1828. Henry Dodge came to Wisconsin from Missouri and brought with him a group of enslaved people who built this cabin and served the governor and his family. Led by Dr. Rachel May and Dr. Wendy Farkas, our group traveled to sites in Wisconsin and Illinois to learn about enslaved people in the midwest, as well as a community of free African–Americans in Pleasant Ridge, WI, before and after the Civil War. This was an experiential learning journey that brought us into contact with different versions of history — some of our contacts wouldn't acknowledge slavery, while others had researched it thoroughly. Before settling down for a night in the Dodge cabin (20 of us in a 20–foot square cabin), we talked about the ways that history is remembered and mis–remembered, and how we can find and tell the stories of people whose lives have sometimes been erased from our national record.

The Affective Images of Climate Change Database
Betsy Lehman, Graduate Student – Psychology
Faculty Advisor: Dr. Joshua Carlson – Psychology
Poster

Climate change has been recognized as a serious risk for our planet, both from an environmental and economic standpoint. The aim of this study was to collect data on the pertinence and emotional qualities of images with relation to climate change. Previously we amassed a database of 321 images (labeled for reuse) from Google search terms associated with climate change. In this study, participants were shown each image and asked to rate it on a scale of 1 – 9 in terms of the image being irrelevant or relevant to climate change, how calm or exciting it was, and how negative or positive it seemed. Preliminary results from participants (N = 40) show that the 25 images rated as most relevant to climate change primarily contain icebergs and industrial plants as subjects, with mainly neutral arousal ratings (M = 5.22, SD = 0.36) and low valence ratings (M = 3.65, SD = 1.55). The 25 images rated as least relevant to climate change primarily contain landscapes and people as
subjects, with slightly lower arousal ratings (M = 4.02, SD = 0.63) and higher valence ratings (M = 5.14, SD = 1.25). The relevance, arousal, and valence ratings of images all showed high correlations with one another. From these results, it seems that participants were more likely to find negative images of icebergs that were neither calming or exciting to be the most relevant to climate change.

**A Statistical Analysis of the Profitability and Popularity of Broadway**
Chloe Lewis, Junior – Math and Chemistry
Faculty Advisor: Dr. Linda Lawton – Math and Computer Science
Poster

Recently, the staging of enormously profitable theatrical productions has highlighted what a powerful business Broadway can be. As it continues to take in nearly $3 million a week, the blockbuster musical *Hamilton* demonstrates the huge economic potential that lies in the musical theater industry. However, National Public Radio reported in 2017 that one in four Broadway shows will fail. In this project, a statistical analysis is used to determine which factors have the potential to influence the success of a Broadway show, as measured by its popularity and profitability. In addition, long–term trends in the popularity of Broadway are examined by statistical model. This project seeks to demonstrate concepts and skills learned in MA 472: Advanced Applied Statistics.

**Colorimetric Loop–Mediated Isothermal Amplification (LAMP) Assay for the Identification of Staphylococcus aureus in Clinical Specimens by Detection of the Nuc Gene**
Aaron Lewkowicz, Senior – Clinical Lab Science
Faculty Advisor: Dr. Paul Mann – Clinical Lab Science
Oral Presentation – Jamrich 1322 at 11:00 a.m.

The rate of *Staphylococcus aureus* infections is increasing and this bacteria in now a leading cause of both hospital and community acquired infections. It is a major contributor to rising health care costs, and rapid identification of *S. aureus* infections allows for treatment that is more expedient. Conventional detection of this organism uses time–consuming culture and biochemical methods or resource intensive polymerase chain reaction (PCR) for detection of *S. aureus* DNA. Loop–mediated isothermal amplification (LAMP) is an alternative nucleic acid amplification technique used to detect the presence of pathogens. LAMP assays are three times more specific than PCR and are as much as 10 times more sensitive. LAMP requires fewer technological resources and can be performed using crude cell lysates rather than extracted DNA. This makes LAMP a well–suited method for mobile analysis and point of care testing. The majority of previously described LAMP assays utilize fluorescence or turbidity to detect a positive reaction. In this study, we developed and evaluated a colorimetric LAMP method for the identification of *S. aureus* in clinical samples by detecting the nuc gene as the DNA target. The results of this study show that this method is able to specifically detect the presence of *S. aureus* DNA at levels lower than 1000 copy numbers, and can detect the bacteria in crude cell lysates in as few as 30 minutes. The results of this study suggest that the colorimetric LAMP detection method may be useful for the rapid visual detection of a pathogen with basic laboratory equipment.

**Developing the Next Generation of STEM Students**
Chris Lodge, Freshman – Computer Science & Mathematics
Faculty Advisor: Chris Standerford – Seaborg Science Center
Oral Presentation – Jamrich 1311 at 2:00 p.m.

Science, technology, engineering, and mathematics (STEM) related topics are becoming increasingly important to many roles throughout today's society. Due to this increase, schools are looking at ways to increase the amount of STEM education that their students get. This prompts the question of how to teach such a diverse and hands on field. I worked with The Seaborg Center to answer that question, more specifically within their Coder Dojo program. This program contains kids ranging from elementary school age to high school age and topics such as 3D printing, Lego Ev3 Robots, basic block style programming, HTML, JavaScript, and Python. It takes place for two hours every other week. After each session, we considered how the children responded to our lesson plans, and proceeded to tweak them to better approach their respective topics. We also added and removed categories, such as either a different programming language or a hardware kit, as we saw the excitement/boredom for it fluctuate. Through this process, we developed three different tracks within Coder Dojo, one
focusing on hardware such as Lego robots and 3D-printing, one focusing on lower level block based programming, and one focusing on higher-level language based programming. This fundamental change in our design has caused the students to be more attentive and has increased the diversity of what they take away from the sessions, providing them with the knowledge that they need for their future careers.

FBessence and the Effect on GBM Cell Growth and Morphology
Olivia Manganello, Freshman – Biology with a Physiology concentration
Katja Olari, Freshman – Nursing
Barbie Slagle, Freshman – Pre-nursing/Pre-medicine
Faculty Advisor: Dr. Johnathan Lawrence – Upper Michigan Brain Tumor Center
Poster

Glioblastoma multiforme (GBM) prognosis has not improved since the introduction of Temozolomide and it warrants in vitro research to discover new therapies and therapeutic targets. Unfortunately, cell culture capabilities of researchers are limited due to the increased cost of fetal bovine serum (FBS). A suitable replacement might be FBEssence, a more affordable mixture of sera and synthetic growth factors, but comparisons with FBS are lacking. We tested FBS and FBEssence and hypothesized that FBEssence would not change cell morphology but would alter proliferation rates as compared to FBS. Three different GBM cell lines were plated and treated with both FBS and FBEssence containing media. The researchers were blinded and did not know which medium was added to each experimental group. After 3 days, the cells were imaged and counted. The number of dead cells and the percent change of living cells were calculated, then determined different using a T-test. Imaging revealed no change in morphology, but the experiments to date suggest that these factors produced no difference in growth rates. The number of dead cells was also not different. Knowing if FBEssence affects the growth and morphology of cells can determine whether it is an appropriate substitute for FBS. However, more research is needed, including genomics and proteomics to make this conclusive.

Perceived Preparedness of Newly Certified Athletic Trainers
Halie Marmalick, Senior – Athletic Training
Jordan Devenney, Senior – Athletic Training
Ryan Schiller, Senior – Athletic Training
Duane Bair, Senior – Athletic Training
Faculty Advisor: Dr. Julie Rochester – Health & Human Performance
Poster

Context: The ability of newly certified athletic trainers to confidently respond to their first acute traumatic injury can be determined by multiple factors. The preparedness of athletic training students in terms of confidence in necessary skills is not often realized before graduating from Certified Athletic Training Education (CAATE) accredited undergraduate programs. OBJECTIVE: The purpose of this study is to determine if graduates are mentally prepared to perform to the standard of care expected of an athletic trainer. Results identified areas of weakness within Great Lakes Athletic Training Association (GLATA) programs so changes could be made to enhance future education. DESIGN: The research was conducted using an anonymous quantitative survey in a cross-sectional study format, aimed at reaching a large population of recently certified athletic trainers. SETTING: A survey was conducted through the use of Qualtrics, an online survey program. PATIENTS AND OTHER PARTICIPANTS: Recent graduates from 28 GLATA undergraduate programs were surveyed. Program directors were asked to forward the survey to their 2015–2016 graduates. As such, several assumptions were made: 1) each school's average number of graduates was 15; 2) 15 graduates from 28 programs gave a possible participant pool of 420; and 3) there were 52 responses, a 12.4% response rate. MAIN OUTCOME MEASURES: Dependent variables include the participants’ perceived preparedness level and the factors affecting preparedness. The survey was developed around situation-based qualitative and quantitative questions, allowing for further inquiry about steps taken in the participant's experience. Participants rated their level of preparedness on a scale of 1 to 10, and demographic information was also collected. RESULTS: Participants indicated their preparedness level on a Likert scale of 0–10 (0 = not prepared, 10 = highest preparedness level possible). From 52 responses, 35.29% indicated their level of preparedness as 8, 21.57% were 9, 19.61% were 7, 15.69% were 10, 3.92% were 6, and only one 3 and one 4 which accounted for 3.92%. The standard deviation was 7.9. Primary reasons why participants felt unprepared were lack of experience (55.81%) and lack of confidence (46.51%). The most common reason for preparedness was adequate education (90.20%). Those who did not feel prepared responded to a “select all that apply” question design, which revealed that they have since taken adequate measures to further prepare
themselves such as: seeking out mentors (35.29%), furthering their education (54.90%), and developing better relationships with emergency personnel/staff (31.37%). Unprepared students responded in a qualitative short answer format that more autonomy, realistic role play, and clear a transition between student and professional would be beneficial. CONCLUSIONS: Recent graduates were significantly prepared for their first on–field scenarios. To increase general post–graduation preparedness, students should be given more autonomy and realistic on–the–field scenarios to practice. PRACTICAL APPLICATIONS: This information can be utilized by athletic training programs to increase awareness of factors causing a lack of confidence in new athletic trainers. This will allow programs to restructure their curriculum to improve the care patients receive from recent graduates.

**Correlation Between Screen Time and Blood Pressure In Early Adolescence**

Gabrielle McAlary, Graduate Student – Exercise Science  
Breanne Carlson, Faculty – Health & Human Performance  
Dr. Erich Petushek, Faculty – Michigan State University  
Dr. Joseph Carlson, Faculty – Michigan State University  
Dr. Karin Pfeiffer, Faculty – Michigan State University  
Faculty Advisor: Professor Breanne Carlson – Health & Human Performance  
Poster

High blood pressure (or hypertension) is a significant cardiovascular health risk factor, yet blood pressure (BP) is often unrelated to screen time in early adolescence. The purpose of this study was to determine the relationship between screen time (ST) and blood pressure measurements in fifth graders. Fifth grade students from the state of Michigan (N = 872) aged 9–13 completed lifestyle surveys indicating their ST. Trained research assistants assessed BP according to standardized procedures. A Pearson correlation coefficient showed that there was a low and non–significant correlation between the total amount of ST and BP (SBP: r = 0.055, DBP: r = 0.047, MAP: r = 0.056; p > 0.05). The participants were then categorized into three different groups by amount ST per week (0–9.75 h, 9.75–18 h, >18 h). A one–way ANOVA was used to compare the means of BP among the three groups. The compared means showed no significant difference between BP and the three ST groups (p > 0.05), thus warranting further investigation into the clinical meaningfulness. The results of this study suggest that there is no relationship between ST and BP in early adolescence. However, further research is needed to determine the effects of modifying screen time, through interventions, and its effect on blood pressure.

**Comparison of Water Quality Parameters among Contrasting Landforms in a Patterned Peatland**

Robert McCormick, Senior – Environmental Science  
Alex Graeff, Graduate Student – Biology  
Dr. R. Corace III – Seney National Wildlife Refuge  
Dr. Alan Rebertus, Faculty – Biology  
Faculty Advisor: Dr. Matthew Van Grinsven – Earth, Environmental, & Geographical Sciences  
Poster

Peatlands cover approximately 3% of the Earth's land surface, make up 50% of the total wetland area, and are globally significant due to their tremendous accumulation of soil carbon. Seney National Wildlife Refuge (SNWR) in Michigan’s Upper Peninsula contains the 4,000 ha Strangmoor Bog, a National Natural Landmark that is characterized by rare patterned peatlands. Patterned peatlands are composed of contrasting landforms, including strings, flarks, swamp forests, ponded sedge lawns, and peripheral water tracks that each support distinct plant communities associated with both bog– and fen–wetlands. Very little is known about patterned peatlands, and to our knowledge no studies have previously characterized the physiochemical conditions among landforms in SNWR, subsurface and surface water quality parameters (e.g., pH, temperature, and specific conductance) were collected for each landform May through August of 2016. Results show the 177 ÅmS cm−1 mean subsurface specific conductance and 6.8 mean surface pH for peripheral water tracts were significantly greater when compared to all other 4 landforms. Furthermore, the 116.6 ÅmS cm−1 mean subsurface conductance and 6.2 mean surface pH for ponded sedge lawns were significantly greater when compared to swamp forests, featureless water tracts and strings, respectively. Fen–wetlands are generally well–supplied by groundwater recharge, have larger specific conductance values, higher pH, and a greater abundance of Carex species when compared to bog–wetlands. These data suggest the location and extent of peripheral water tracts and ponded sedge lawns are associated with localized areas of groundwater recharge within the patterned peatland.
Exploring High School History Methodology in Michigan
Erin McNabb, Senior – Secondary Education Social Studies & French Education
Faculty Advisor: Professor Kathryn Johnson – History
Oral Presentation – Jamrich 1322 at 3:45 p.m.

This research project aimed to investigate the issues that students face in regard to social studies education as it prepares them for university–level courses. In order to assess where the issue originates the project focuses on high school methodology and the learner. The project used survey–based research to assess the reliability, validity, and overall effectiveness of social studies education in Michigan. The study included current students, graduates, and faculty of Michigan high schools. Surveys allowed for first–hand accounts of the correlating effects of the implemented methodology. The project aimed to look at history teaching methods from the student point of view to evaluate the use of primary–source analysis, active learning strategies, and differential perspective in high school classrooms. Upon examination of survey results, most students were found to be dissatisfied with the amount of higher level thinking skills promoted in their courses and the focus on memorization.

The Trail Blazers; A Cooperative Program Between Northern Michigan University and Marquette, Michigan’s Trail Systems.
Jacob Mick, Senior – Environmental Studies & Sustainability
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Poster

The purpose of this research is to lay down a framework for a mutually beneficial cooperation between Northern Michigan University, its students and the local trail network. Every year, NMU targets thousands of new students with their “Northern Naturally” campaign. Through various interviews and a survey of the student population, this research will hope to unveil the need for university–based trail maintenance. In offering a “Trail Blazers” certificate, the University could provide the students an opportunity to work on the trail systems while earning college credit towards the certification. This program would be a great incentive to get the students to maintain and build trails, and play a more active role in the Marquette community. It will also foster a healthier relationship between Northern Michigan University and its local trail community, resulting in a sustainable trail system for future student generations to walk, run, or ride, for decades to come.

What Makes You Click: The Crossroads of Science and Social Media
Allison Opheim, Freshman – Public Relations, Pre–Law
Faculty Advisor: Dr. Johnathan Lawrence – Upper Michigan Brain Tumor Center
Oral Presentation – Jamrich 1322 at 11:30 a.m.

In an increasingly tech–savvy society, the ability for organizations to be properly represented on social media and the web is more important than ever. As a research entity within Northern Michigan University, the Upper Michigan Brain Tumor Center is a unique opportunity for public image, science, and students to interact in a learning environment. The Upper Michigan Brain Tumor Center is a unique collaboration between Upper Peninsula Health System – Marquette and NMU, and before this year, had a very limited internet presence. In 2016, the Freshman Fellows Program supplied a Public Relations student to the Upper Michigan Brain Tumor Center, allowing for students and faculty in the laboratory, as well as the Public Relations Fellow, to learn about the crossroads of science and social media. In a society that spends hours online a day, proper representation and public support are necessary for research institutions to grow and prosper.

Impacts from Ice Cover and Other Winter Variations on Shoreline Movement Near Lake Shore Boulevard in Marquette, Michigan
Elise Oswald, Senior – Environmental Science & Sustainability
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Oral Presentation – Jamrich 1322 at 3:00 p.m.

Impacts from ice cover and other winter variations on shoreline movement near Lake Shore Boulevard in Marquette, Michigan has changed dramatically from a breakwater that was built in 1939 and is threatening the road it parallels: Lake Shore Boulevard. In this study, I am researching the effects that winter has on the
The Relationship Between Screen Time and Pediatric Sleep Duration

Nara Paulsen, Graduate Student – Exercise Science
Breanne Carlson, Faculty – Health & Human Performance
Dr. Erich Petushek, Faculty – Michigan State University
Dr. Joseph Carlson, Faculty – Michigan State University
Dr. Karin Pfeiffer, Faculty – Michigan State University
Faculty Advisor: Professor Breanne Carlson – Health & Human Performance

Screen time (ST) and sleep duration (SLP), along with physical activity, are lifestyle risk factors for childhood obesity. Excess screen time has been associated with poor sleep quality and shorter sleep duration. PURPOSE: To determine the relationship between average daily screen time (ST) and sleep duration (SLP) among children who participated in (S)Partners for Health. METHODS: This cross-sectional analysis included Michigan fifth grade students (N=742) ages 9–13 years that participated in the baseline assessment in 2008–2016 as part of the (S)Partners for Health program. Participants self-reported their minutes of ST during the week and weekend, and the times they went to bed and awoke on a typical day. Average daily ST was ranked into three groups: “low” (< 2.47 hrs/day), “moderate” (2.47 – 4.357 hrs/day), and “high” (> 4.357 hrs/day).

RESULTS: A Pearson correlation coefficient showed that there was a significant, but small, negative correlation between ST and SLP (r = −0.13, p < 0.01). A one-way ANOVA comparison between “low”, “moderate” and “high” ST showed a significant difference in SLP between groups (F(2,739) = 6.82, p < 0.001). Post hoc comparisons using the Tukey HSD test indicated that the mean SLP for the low ST group (M = 10.17, SD = 1.20) was significantly different (p < 0.001) than the mean SLP for the high ST group (M = 9.77, SD = 1.29), but the Cohen’s effect size value (d = 0.34) indicates that the
difference is small in magnitude. CONCLUSION: The inverse relationship between ST and SLP suggests that more ST is related to less SLP. Based on this finding, future interventions should consider including education not only for limiting screen time and promoting physical activity, but also on the importance of sleep.

**Effects of Climate Change and Interspecific Interactions on the Distribution of North American Flying Squirrels**
April Payne, Senior – Zoology
Faculty Advisor: Dr. Kurt Galbreath – Biology
Poster

Climate change and interspecific interaction (e.g., competition) are two major factors influencing species distributions. This study focuses on the northern flying squirrel (*Glaucium sabrinus*) and southern flying squirrel (*G. volans*) of North America. We investigated the degree to which climate and interspecific interactions may be responsible for shaping the distributions of these ecologically similar species. We tested hypotheses regarding the location of refugial zones during the Last Glacial Maximum (LGM), the relative influence of climate vs interspecific interactions in limiting contemporary distributions, and the potential impact of future climate change on distributions for both species. Locality data from more than 4,000 specimen records was used within an ecological niche–modeling framework to develop predictions for the geographic distributions of these two species under past, present and future climate scenarios. Our results support past inferences of a northward distribution shift from the LGM to the present for both species. Likewise, both species demonstrated a northward range expansion from current climate to future climate projections. In the zone of interspecific overlap, which falls across the Great Lakes Region, our results are most consistent with climate being a more important factor limiting geographic distributions of the species rather than other factors such as competition or transfer of parasites.

**Sex Genetics of Long–eared Owls**
Samantha Phillips, Good – Biology
Faculty Advisor: Dr. Alec Lindsay – Biology
Poster

Northern long–eared owls are a medium sized raptor that prey upon voles and other small rodents. They reside in temperate regions of the northern hemisphere, seasonally ranging to subpolar and subtropical regions. Their population has remained stable throughout the past decade with no fragmentation. Raptor banding stations across the country capture owls on a regular basis, but Whitefish Point Bird Observatory arguably captures more long–eared owls than any other station in North America. Despite this fact, it has been nearly impossible to determine the sex of individual owls, except from using a recently published heuristic technique that evaluates coloration and morphology of a bird in the hand. This study aimed to assess the reliability of the morphology/coloration heuristic techniques by additionally assaying sex with a molecular genetic assay. We used DNA extracted from 170 feather samples of birds that were sexed in the field and analyzed them using a PCR–based molecular genetic sexing assay. We present here the results of this assay, showing the limits of its reliability.

**Effects of Ph and Temperature on the Harpacticoid Tisbe Biminiensis Growth, Survivorship, and Morphology**
Nicole Pittoors, Senior – Biology– Ecology
Faculty Advisor: Dr. Jill Leonard – Biology
Oral Presentation – Jamrich 1322 at 10:00 a.m.

Ocean warming and ocean acidification are altering the physiology of marine organisms, thus changing the ecology of marine ecosystems. This study investigated the effects of altered pH and temperature on growth, survivorship, and morphological plasticity of the harpacticoid copepod *Tisbe biminiensis*. Individuals were reared the laboratory, in artificial seawater at combinations of temperatures (26°C and 32°C), and pCO2 conditions (~400 utm and ~1000 utm). Post–hatch measurements for growth and morphology were obtained at intervals of 12 hours using microscopy and thin plate spline morphometric techniques. Warm temperatures and the interaction of warmth and acidification (low pH) had a significant negative effect on survivorship, while acidification alone had a negligible effect. Stage transition timing was not affected by warming, acidification or their combination. Acidification significantly increased mean final prosome length, while the interaction of warming and acidification significantly decreased length. These results suggest that elevated temperatures associated with climate change are likely to negatively impact harpacticoid copepod populations, which could influence intertidal population dynamics through trophic cascades.
Disease, Wild Beasts, and Wilder Men: The Plymouth Brethren Medical Mission to Ikelenge, Northern Rhodesia
Sarah Ponzer, Junior – Biology and Spanish
Faculty Advisor: Dr. Alan Willis – History
Poster

The Plymouth Brethren medical mission to Ikelenge, Northern Rhodesia established Kalene Mission Hospital in 1905. Today, it still provides most of the healthcare for the region. From a rebellious Christian sect in England, the Brethren physician, Dr. Walter Fisher, and his colleagues in Northern Rhodesia implemented healthcare in a truly unique fashion among the Lunda people. They chose to oppose western logic of the period, and integrate local culture and medicine into their lives and medical practices. This case study looks at the backgrounds of the Brethren and Lunda, the establishment of Kalene hospital, historical and current issues, as well as the author's personal experiences at persisting Brethren missions in Ikelenge. In evaluating the effectiveness of Brethren missions and what made them both distinctive and sustainable, the study inevitably comes to the question of whether or not this style of missionary medical aid is effective in current times. Through the evaluation of modern and persisting issues, it finds that the integration of western and Lunda culture was key to the Brethren's medical aid successes. However, as Zambia continues developing their infrastructure and government, the time for permanent western medical aid to withdraw should be imminent.

Small Scale Synthesis of trans–bisethylenediaminedichlorocobalt(III) chloride
Julia Quinn, Freshman – Chemistry
Faculty Advisor: Dr. Lee Roecker – Chemistry
Poster

The complex trans–dichlorobis(ethylenediamine)cobalt(III) chloride is a useful starting material for the preparation of a variety of coordination complexes. The original procedure was published by J.C. Bailar in Inorganic Synthesis in 1946. Not only is it a large-scale preparation (about 80 grams of product produced), it also requires 10 – 12 hours to complete. Given the usefulness of the compound, we wanted to explore whether or not the reaction could be scaled-down in size and decreased in time in order to fit into a 3-hour undergraduate laboratory block. We report here on a preparation of trans–dichlorobis(ethylenediamine)cobalt(III) chloride that produces 1 gram of product in about two hours. This should be a useful starting point for the development of additional undergraduate laboratory exercise in advanced inorganic chemistry courses.

Evaluating the Effect of Gold Nanoparticles on MALDI–MS Analysis of Biological Molecules
Biidaaban Reinhardt, Senior – Physics and Native American Studies
Faculty Advisor: Dr. Dave Donovan – Physics
Poster

During the summer of 2016, researchers in the Vachet Lab at the University of Massachusetts Amherst engaged in testing and evaluating the effect of gold nanoparticles (AuNPs) on organic tissues. The experiment was designed to help determine the potential impact of certain materials associated with imaging and solar storage on biological systems such as animals and human beings. Using Matrix Assisted Laser Desorption/Ionization Mass Spectrometry (MALDI–MS), researchers tracked the distribution of multiple concentrations of AuNPs in various lipid samples that closest resembled organic tissue to evaluate whether the presence of AuNPs changed the physical lipid composition of the tissues, or simply increased the measured signal. Although, the outcomes of the tests were inconclusive, at this time, and will require further testing, results indicated that the biological samples are unlikely to be influenced by the presence of the AuNPs. Further testing will involve certain controls in place that will be used to prove that fragmentation of the ions does not affect the change in measured signal.

Mudpuppy Survey in the UP: Current Results and a Call to Action
Collin Richter, Senior – Zoology
Faculty Advisor: Dr. Jill Leonard – Biology
Oral Presentation – Jamrich 1322 at 10:30 a.m.

The common mudpuppy (Necturus maculosus) is an aquatic salamander found throughout eastern North America. Mudpuppies are a species of concern, with populations declining notably in the Great Lakes region, and it was listed as a Species of Special Concern in Michigan in 2017. Information on this salamander is lacking in the Upper Peninsula. As
amphibians, mudpuppies are sensitive to water quality and their presence models the health of the watershed that they occupy. In the Upper Peninsula, watershed health is a vital part of the economy, and declining populations of salamanders may be attributed to degraded watershed health, as well as pressure from the USFWS Sea Lamprey Control Program. Mudpuppies are sensitive to the lampricides used to manage sea lampreys in many of the watersheds across the Upper Peninsula. To determine which watersheds these salamanders inhabit, I travelled across the Upper Peninsula using techniques from by Craig et al. 2015 for surveying for mudpuppies. Mudpuppies are notoriously difficult to survey for and monitor, and only one individual was captured from June 2016 to March 2017. The captured individual, as well as several individuals found in previous years, were logged in the Michigan Herp Atlas; a project designed to examine current presence of Michigan's herpetofauna and to use that information in policy–making. Continued work on my project and additions to the Michigan Herp Atlas will allow us to better understand mudpuppy distribution and their ecological role in streams in the Upper Peninsula.

**Sexual Dimorphism and Morphometrics in Marine Toads (Rhinella marina)**
Collin Richter, Senior – Zoology
Faculty Advisor: Dr. Jill Leon – Biology
Oral Presentation – Jamrich 1322 at 1:30 p.m.

Identifying growth rates and morphological differences between sexes is a critical to understanding the life histories of species, especially invasive species in need of management practices. The marine toad (Rhinella marina) is native to South America, but has been introduced to the United States, Australia, and numerous Islands in the South Pacific. It can survive in a wide variety of habitats. These toads are highly invasive and commonly outcompete native anurans. To observe changes in growth and test current methods of sexing, we measured and photographed 60 marine toads of varying age classes (young–of–the–year (YOY), one year (1+), and 2 or more years (2+)) and sex in Para, Brazil in March, 2017. Each toad was sexed, measured for length and mass, photographed, and marked by toe tip to ensure no sampling duplication of individuals. Three photographs were taken for each individual: lateral left side, dorsal, and the left manus. Photographs were analyzed in TPS series Geometric Morphometric software. Older individuals (2+) were accurately sexed and compared between sexes and ages classes. Female toads (2+) exhibited larger average weights and lengths, as well as larger parotoid glands. These data can be used to accurately sex toads and predict changes in growth rate over time, and can be used in management decisions in areas where these toads are invasive.

**Changes in Lateral Prefrontal Cortex Oxygenation as a Function of Oddball Task Difficulty: A Near–infrared Spectroscopy Study**
Will Rizer, Graduated – Psychology
Jacob Aday, Graduate Student – Psychology
Scott Conger, Junior – Psychology
Faculty Advisor: Dr. Josh Carlson – Psychology
Poster

The detection of goal–relevant stimuli in the environment is important for survival, but not all stimuli are easy to detect. Research on the P300 event–related potential indicates that as targets become more difficult to detect the posterior P300 attenuates. Functional Magnetic Resonance Imaging (fMRI) research suggests that target detection involves attention processes supported by the prefrontal cortex. However, the extent to which target difficulty differently activates the prefrontal cortex is unknown. We addressed this knowledge gap by collecting oxygenated (HbO) and deoxygenated hemoglobin (HbR) concentrations during an oddball task, which contained easy and difficult conditions, using a near–infrared spectroscopy (NIRS) optode array affixed above 10–20 coordinates Fp1 and Fp2 (N = 20). Reaction times were faster in the easy (M = 484.06) compared to difficult condition (M = 558.63), additionally participants missed fewer targets in the easy (M = 1.55) compared to difficult condition (M = 7). NIRS data was time locked to target onset and data from 5–10s post–target was averaged and analyzed. Both HbO and HbR had main effects for optode with lateral increases in HbO (p = 0.04) and lateral decreases in HbR (p = 0.012). An interaction between optode and condition approached significance for HbO (p = 0.082) and was significant for HbR (p = 0.001) with lateral optodes in the difficult condition recording the lowest HbR. The data indicates that lateral prefrontal regions (covered by the array) use more oxygen than medial prefrontal regions during both oddball tasks, but to a greater extent in the difficult condition.
**Impact of Legislation on Effluent in Ishpeming**

Chelsey Robinson, Senior – Environmental Studies & Sustainability  
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences  
Oral Presentation – Jamrich 1322 at 9:45 a.m.

The purpose of this research is to determine which legislation has been most influential in maintaining water quality along the Carp River in relation to the Ishpeming Area Wastewater Facility (IAWF). Wastewater has caused major issues; from the eutrophication of Deer Lake, to 12.5% of Chicagoans dying in 1885 from sewer contaminated drinking water. The start to fix these types of problems began with the Federal Water Pollution Control Act of 1948, which is now the Clean Water Act (CWA). The IAWF was constructed in 1983 with major funding from an extension of the CWA, public act 92–500. The EPA required that all plants had two levels of treatment. The first level includes removal of solid waste and chloride treatment. The second level ensured that phosphorus, total suspended solids, ammonia, and biochemical oxygen were all at least 80% removed. This improved water quality significantly as nutrients were being removed. In Michigan, the EPA creates the laws that the state’s facilities follow, and hands down the enforcement of those laws to the state, in this case the Department of Environmental Quality (DEQ). Michigan adds to the laws created by the EPA, because of the Great Lakes Initiative (GLI), which protects the Great Lakes.

**Eurocentrism and Environmental Justice: Multicultural Capacity Building Recommendations for the Michigan Department of Environmental Quality**

Maria Rockett, Senior – Environmental Science  
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences  
Oral Presentation – Jamrich 1311 at 10:15 a.m.

In April of 2014, the decision to switch Flint, Michigan's water supply resulted in the lead–poisoning of nearly 100,000 predominantly black low–income community members. Since this crisis, questions of implicit and institutional racism have been raised. In response, the Michigan Civil Rights Commission reported findings of implicit racism in the functioning of the Michigan Department of Environmental Quality (MDEQ). Shortly afterwards, the U.S. Environmental Protection Agency's External Civil Rights Compliance Office closed the Genesee Complaint, filed in 1992, also accusing the MDEQ of racial discrimination in their public participation processes. The EPA suggests that the MDEQ has failed to implement a successful non–discriminatory policy for over thirty years, despite EPA regulations. This research aims to analyze the Flint Water Crisis as a pinnacle of injustice for Michigan's marginalized communities as a result of Eurocentric policy. This policy includes Emergency Management Laws, the 1934 National Housing Act, as well as employment, housing, and schooling segregation, allowed through the U.S. Supreme Court's Plessy v. Ferguson. It then aims to make suggestions to the MDEQ on implementing a multicultural capacity building program. This program aims to educate MDEQ employees on the multitude of discriminatory barriers that different U.S. communities face, the political background of discriminatory outcomes, and how these outcomes can be mitigated and prevented. The program will be assessed through case study analysis and by applying Robert Chaskin's community capacity building framework. In order to refuse the allowance of another Flint Water Crisis, capacity for inclusion and multiculturalism must be systematically implemented.

**The Influence of Biomass Allocations on Health of Poplar and Willow Hybrids used for Phytoremediation**

Elizabeth Rogers, Senior – Environmental Science & Elementary Education  
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences  
Oral Presentation – Jamrich 1311 at 10:45 a.m.

Increasing levels of human–induced pollution are prompting the cleanup of contaminated sites through strategies like phytoremediation, the use of woody green plants to clean up soils or water. Root–shoot allocation of biomass is an underrepresented criterion that could be used for tree selection in phytoremediation. We evaluated how root–shoot allocations contribute to biomass production and health of hybrid poplar and willow grown in landfill soil treatments. We grew 15 poplar clones and nine willows in greenhouse for 65 days in soils from five Wisconsin landfills. We tested for treatment, clone, and interaction differences in root–shoot ratio (RSR) and health, and for relationships between RSR with health, height, diameter, and total dry biomass. Treatments, clones, and their interactions exhibited differences among willow RSR (P = 0.0049), but not in poplars. Health significantly varied among willow clones (P < 0.0001), while the treatment × clone interaction significantly affected poplar health (P = 0.0196). Correlation analyses revealed positive relationships of RSR with height (r = 0.36, P <0.0001), diameter (r = 0.45, P < 0.0001), and total biomass (r = 0.56, P < 0.0001) in poplars, and with
diameter ($r = 0.20, P = 0.0143$) and total biomass ($r = 0.22, P = 0.0068$) in willows. Regression analysis highlighted positive
influences of RSR for health, height, diameter, and total biomass of both genera. Overall, root–shoot allocation is a useful
criterion for phyto–recurrent selection that may be used to inform deployment of superior clones for satisfying
phytoremediation and phytotechnology–related ecosystem services objectives.

**NADH Dehydrogenase Subunit 5 Analysis for Ochotona princeps**
Alex Roggow, Sophomore – Biochemistry
Faculty Advisor: Dr. Katherine Teeter – Biology
Poster

The American Pika, (*Ochotona princeps*) is a small alpine mammal that lives in cold, hypoxic environments. *Ochotona princeps* is of significant interest because it provides a good candidate for studies of genomic adaptation in response to changing environments. This is due to its relatively low tolerance for higher temperatures and inability to migrate. The purpose of this poster is to demonstrate inter– and intraspecies variation among sequences from the mitochondrial gene *NADH dehydrogenase subunit 5 (ND5)* from *O. princeps*. NADH dehydrogenase plays a key part in the energy metabolism of the cell. Research was conducted in two stages. The first stage involved utilizing GenBank, an online database of genetic sequences, to compile a list of mitochondrial gene sequences for *Ochotona princeps*, as well as several comparison mammalian species. These sequences were then aligned using Molecular Evolutionary Genetic Analysis (MEGA). From these sequence alignments and the scientific literature, we selected the ND5 genes as good candidate to have sequence differences between *O. princeps* and other mammal species, and to have polymorphism within *O. princeps*. In the second phase of the study, we sequenced a portion of the ND5 gene, using *O. princeps* individuals from across the range of the species, and analyzed these sequences for polymorphism.

**Human Knowledge of the Asian Carp Invasion of the Great Lakes**
Jesse Ross, Senior – Environmental Studies & Sustainability
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Poster

My research focuses to determine what people know regarding the threat Asian carp pose on the Great Lakes. Asian carp could easily ruin a multi–million dollar fishing industry which will hurt the state, anglers, and any businesses who depend on the waterways for income. The carp have reached the Chicago waterways, which provide a direct route into the Great Lakes. I will be conducting an online survey to collect information on what people know about invasive fish species Asian carp. I will be asking topic–specific questions and will have an open comment box if the surveyee has any additional information they would like to share. This will give me a baseline for what people do not know, and will also inform people of the situation which will hopefully draw interest to the subject. I will target outdoorsmen, but will allow anyone to take the survey which I will be posting on online fishing forums and Facebook. It is my hope that making people aware of this situation will get them involved any way they can. All people from the Great Lakes region should be aware of this topic because of the adverse effects it poses to our ecosystem and people.

**Inter–Comparison of Off–Shore Weather Buoys: An Analysis of Weather and Wave Data Collection Equipment off the Southern Shores of Lake Superior**
Holly Roth, Junior – Environmental Science
Faculty Advisor: Dr. Norma Froelich – Earth, Environmental, & Geographical Sciences
Poster

In 2015, Northern Michigan University gained ownership of three off–shore buoys that monitor wave and weather conditions. The three buoys are located five miles off the southern shores of Lake Superior in Marquette, MI; Munising, MI; and Grand Marais, MI. For six weeks, two of the buoys were stationed at Granite Island; one was attached approximately 150 meters off of the southern end of Granite Island, while the other was 400 meters off the northern end of the island. Utilizing real–time data and MatLab coding software, statistical analysis including regression and time comparison was conducted to determine the correlation of variables such as air and water temperature, wind speed and direction, and wave height between the two buoys. The goal of this research was to ensure the two off–shore weather buoys are collecting and reading the same data while in the same general location; guaranteeing the accuracy of both instruments. Slight variations were found between
data sets, most likely due to the differences in location of each buoy. This research was able to prove that the buoys have been and will continue to produce reliable and credible data that can support scientifically sound research in the future.

**An Investigation of the Correlation and Time–lag between Strong Wind Events and Increased Wave Heights along the Southern Shores of Lake Superior during the November 2016 Storm**

Holly Roth, Junior – Environmental Science  
Faculty Advisor: Dr. Norma Froelich – Earth, Environmental, & Geographical Sciences  
Poster

The largest storm over Lake Superior in 2016 occurred from November 16 to 20. This storm generated wave heights reaching 9 meters (m) and wind speeds that were recorded between 5 and 25 meters per second (m/s). Utilizing three off–shore weather buoys located approximated five miles off the shores of Marquette, MI; Munising, MI; and Grand Marais, MI as well as MatLab coding software, real time data was collected and analyzed to investigate the influence of winds on the wave behavior along the southern shores of Lake Superior. Statistical analysis including time comparisons and regression were conducted to determine the time lag between strong wind events and increased wave heights. This research was able to define a specific time lag between strong wind events and responses from Lake Superior, as well as provide a greater understanding of the interaction between atmospheric and hydrological systems.

**Tartaric Acid in Wine**

Sophia Sachs, Sophomore – Forensic Biochemistry  
Lindsay York, Senior – Zoology  
Faculty Advisor: Dr. Brandon Canfield – Chemistry  
Poster

The taste and appearance of wine is very important to both winemakers and consumers. The purpose of this research was to quantitatively describe the equilibrium system of tartaric acid in wine, one of three major acids present. Tartaric acid is a polyprotic acid which can exist in three different conjugate forms depending on the pH of the solution, affecting its overall appearance and flavor. Concentrations of each tartaric acid conjugate were calculated based on reported pH and total acidity values for a 2011 *Campanha Merlot* wine. Impacts of tartaric acid conjugates on flavor, appearance, and wine stability, are also explored.

**Analyzing the Behavior of a Backpropagation–Based Neural Network When Learning 40–Bit Binary Palindromes**

Paul Sampson, Computer Science – Junior  
Nicholas Nowak, Computer Science – Junior  
Matthew Trefilek, Computer Science – Senior  
Faculty Advisor: Dr. Jeffrey Horn – Math & Computer Science  
Oral Presentation – Jamrich 1322 at 12:45 p.m.

A backpropagation–based neural network was trained to recognize 40–bit binary palindromes. Research was conducted on the ideal number of hidden layer nodes. The network was able to achieve greater than 95% accuracy with an ideal number of hidden layer nodes. Analyzing the behavior of the neural network helps explain how neural networks solve problems, and why certain numbers of nodes prove more effective.

**Antibacterial Activity of Six Different Essential Oils**

Theresa Schulz, Sophomore – Post–Secondary Biology Education  
Jennifer Klemm, Senior – ICP in Anthropology  
Faculty Advisor: Dr. Donna Becker – Biology  
Poster

With antibacterial resistance growing ever more prevalent, there is a push to discover new antimicrobial chemicals. Some plant secondary metabolites, such as essential oils, have inhibitory abilities. The purpose of this research was to test the effects of six essential oils against five opportunistic pathogenic bacterial species. The six oils which were tested were clove
(Syzygium aromaticum), lemon (Citrus limon), cinnamon (Cinnamomum zeylanicum), eucalyptus (Eucalyptus radiata), rosemary (Rosmarinus officinalis), and Thieves®, which is a combination of these oils. Agar plate bioassays were used to test the oils in different concentrations (100%, 10%, 1%, and 0.1%) for their ability to inhibit or reduce bacterial growth of Escherichia coli, Staphylococcus aureus, Streptococcus pneumoniae, Streptococcus pyogenes, and Pseudomonas aeruginosa. Two methods were used: the disc contact assay and a vapor contact assay. Individual bacterial suspensions were spread across the surface of agar plates (nutrient agar or blood agar media) and allowed to soak into the agar. For the disc contact assay, 5 mm paper filter discs were soaked in the individual essential oils and applied to the agar plates. For the vapor filter discs were soaked in the individual essential oils and applied to the agar plates. For the vapor contact method, filter discs were placed onto the inner lid surface and the bottom plate containing the spread bacterial suspension was inverted over the lid. Plates were incubated for two to four days at 37°C. To date, the Streptococcus species (which are known respiratory pathogens) have shown the greatest inhibition profile, especially with cinnamon, clove, and Thieves® oils. The results are promising for use of essential oils as a means to inhibit the growth of human bacterial pathogens.

**Improved GC–MS Analysis of Rubus parviflorus using Solid–Phase Microextraction (SPME)**

Taylor Sharp, Senior – Forensic Biochemistry  
Faculty Advisor: Dr. Brandon Canfield – Chemistry  
Poster

*Rubus parviflorus*, also known as the thimbleberry, is a berry native to North America, and it obtains its name from its "thimble" shape and size. With its red color and thorn–less bush, the thimbleberry is similar in appearance to its more common relative, the raspberry, *Rubus ideaus*, and is best when harvested in mid–to–late July and early August. Little research has focused on its chemical composition, and there is currently no reported research focusing specifically on the volatile compound composition of *R. parviflorus*. This research focuses on Solid–Phase Microextraction (SPME) of the volatile compound composition within/released by fruit and leaf tissues of the thimbleberry plant using Gas Chromatography–Mass Spectrometry (GC–MS), following protocols established in research reported for volatile analysis of *R. ideaus*, and improved upon in this work for applications specific to *R. parviflorus*. Various thimbleberry fruit and leaf tissue samples were collected at multiple locations around Marquette, MI, and compared to other fruit samples (blackberries and raspberries). SPME–GC–MS protocols were also applied to analytical reference standard compounds, which were used to positively identify multiple compounds in the thimbleberry samples by comparison to retention time and mass spectra.

**A Deeper Look into Lake Superior**

Morgan Shewmaker Freshman – Nursing  
Faculty Advisor: Dr. Norma Froelich – Earth, Environmental, & Geographical Sciences  
Poster

Lake Superior is a huge part of everyday life in the Upper Peninsula. Not only is it used for recreation on hot summer days, but is also home to many species of fish and is a huge source of freshwater. Lake Superior is very unpredictable and can be dangerous. In order to better understand this large resource, we must study its diverse aspects. There are three buoys on the shoreline of the lake in three different spots: Granite Island, Munising, and Grand Marais. These buoys collect data on air temperature, water temperature, wave height, wind speed, wind direction, and more. I focused my research on three of these: wave height, wind speed, and wind direction. I also looked into how each of these affected the others. The data that I used was collected in 2015, and included sets of data for everyday the buoys were in the water and it collected data every ten minutes. My findings showed a strong correlation between wave height and wind speed, but surprisingly, I could not find a pattern when I added the wind direction into the picture. In order to correlate the two, I graphed data for each month and merged the graphs. This gave a clear view of how the two were related. This type of research gives a better understanding of how to more effectively predict whether the wind patterns and speed could potentially affect daily routines for workers or leisure activities. My research and findings is only a scratch on the surface of what could be studied. A single person cannot accomplish and discover everything there is to know about our beloved and unpredictable Lake Superior.
**Investigating The Phenomenon of Cancer Associated Thrombosis in vitro Utilizing a Conditioned Media Model**

Nicholas Shortreed, Sophomore – Cellular & Molecular Neuroscience
Melanie Flaherty, Senior – Biology/Physiology
Dustin DeGrave, Senior – Biochemistry
Faculty Advisor: Dr. Johnathan Lawrence – Upper Michigan Brain Tumor Center
Poster

Venous thromboembolism (VTE) is the leading cause of death, behind the malignancy itself, in patients diagnosed with cancer. Statistically, patients with cancer are four times more likely to develop VTE. With more than 1.7 million newly diagnosed patients in 2016, VTE and its associated complications create a challenge to physicians and their patients. First described by Trousseau in 1865, there is a well-documented link between VTE and cancer. Modern work such as the 2005 Multiple Environment and Genetic Assessment (MEGA) study has reiterated the connection between VTE and cancer. Although the risk of cancer associated thrombosis (CAT) is well established, the complex molecular mechanisms underlying this phenomenon have yet to be fully understood. The aims of this research were to develop and test an *in vitro* model of cancer associated thrombosis in order to better understand and isolate the molecular mechanisms involved. We hypothesized that various factors secreted by cancerous cells are directly responsible for the increased rates of VTE observed in cancer patients. Relative expression levels of thrombotic and inflammatory markers were monitored in murine venous endothelial cells (B6MPVE) treated with media conditioned by a murine glioblastoma multiforme (GBM) cell line (GL261) at time points of 1, 3, 6, 9, 12, 24, 48, and 72 hours. RNA was extracted from the B6MPVE cells and their relative expression of numerous thrombotic and inflammatory markers were quantified via qRT–PCR. Upon analysis, treating endothelial cells with conditioned media from GBM cells resulted in a significant upregulation of several biomarkers of interest. This *in vitro* model will help facilitate future studies to understand the CAT phenomenon.

**The Characterization Of LN229/mKate Glioblastoma Multiforme Cells Cultured in vitro Utilizing Artificial 3D Chitosan–Alginate Scaffolds**

Nicholas Shortreed, Sophomore – Cellular & Molecular Neuroscience
Faculty Advisor: Dr. Johnathan Lawrence – Upper Michigan Brain Tumor Center
Poster

Glioblastoma multiform (GBM) is the most malignant form of primary brain tumor with a median life expectancy of only 15–17 months. Studies suggest a population of cancer stem cells (CSCs) are directly responsible for tumor occurrence. Developing therapies targeting CSCs may be clinically effective, as CSCs are difficult to target and are resistant to current treatments. There are many limitations to research involving CSCs, including associated costs and a slow rate of growth. Recent work demonstrated that populations of GBM cells cultured on artificial 3D chitosan–alginate scaffolds increase expression of biomarkers associated with CSCs. Previously, we detailed a refined synthesis method for 3D chitosan–alginate scaffolds and demonstrated their efficacy for *in vitro* cell culture. The aim of this project was to characterize the properties and phenotype of LN229/mKate cells cultured on artificial 3D chitosan–alginate scaffolds. We hypothesized that cells cultured on 3D chitosan–alginate scaffolds would exhibit a CSC–like phenotype. The proliferation rates and relative expression levels of several CSC–markers were quantified in cells recovered from culture on artificial 3D chitosan–alginate scaffolds. Cells previously cultured on 3D scaffolds were seeded under adherent and suspension conditions. The rate of cellular proliferation in adherent cultures was monitored via a hemocytometer, and in suspension cultures via photomicroscopy at 1, 3, 5, and 7 days. Additionally, RNA was harvested from scaffold–cultured cells and assessed for relative expression levels of CSC–biomarkers using qRT–PCR. Upon analysis, we concluded that LN229/mKate cells cultured on artificial 3D chitosan–alginate scaffolds morphologically and phenotypically resembled CSCs. With additional testing, artificial 3D chitosan–alginate scaffolds may support and expand future studies involving CSCs.

**Campus Sustainability Initiatives & Effects on Enrollment and Retention at NMU**

Ella Skrocki, Senior – Environmental Studies & Sustainability
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Oral Presentation – Jamrich 1311 at 1:15 p.m.

Sustainability in higher education is expanding, and environmentalism is a growing trend amongst young people. Data from a campus–wide survey in 2016 shows that students are inspired to attend Northern Michigan University because of the natural
wonders that surround the campus. However, this current research examines the relationship between Northern’s commitment to sustainability as well as enrollment and student retention. Data compiled via two surveys directed toward visiting prospective students as well as the current student body provide conclusive data as to how sustainability initiatives play a role in determining a student’s choice whether to apply to, enroll in or re-enroll in Northern Michigan University. The data has been analyzed via percent distribution and cross tabulation in order to compare how students of various backgrounds may value a university’s commitment to sustainability differently. I hypothesize that this data will help to improve enrollment and retention rates through effective advertising of sustainability and encourage the university's financial commitment to sustainability initiatives in the future.

**Prediction of Future Web Browsing Patterns**
Benjamin Slater, Senior – Computer Science  
Cody Malnor, Senior – Computer Science  
Lucas Ammel, Senior – Computer Science  
Connor Laitinen, Senior – Computer Science  
Faculty Advisor: Dr. Randy Appleton – Math & Computer Science

Poster

Web browsing speed is essential in today’s world. Many simple methods for increasing speed include increasing bandwidth, distributing server load across multiple servers, and caching. A less explored method of increasing speed is through prefetching of assets which will be used in the near future. If one could predict future requests, it would be possible to make a user’s web browsing experience faster. This research evaluates and compares different prediction algorithms. To test the prediction algorithms, log files from different web servers were collected. This data contained IP addresses and web sites for each request made to that server. The data used in our test came from two sectors, business and academic. A program was written to test the algorithms against the collected data. The test program was designed to use the algorithms to predict future URL requests using the client IP address, and previous history of requests. The predicted URL was then compared with the actual future requests found in the log file. The test program scored the solutions on correct predictions, erroneous predictions, and prediction rate. Utilizing predictive algorithms will allow a web server to predict which URL a web client will access in the near future. With this knowledge, resources from the URL can then be sent to the web client before the client asks for them, and do so with high probability (~75%) that the resources will actually be needed.

**Traditional Ecological Knowledge in Michigan's Upper Peninsula and Beech Bark Disease**
Maureen Smith, Senior – Environmental Studies  
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences

Poster

The purpose of this research is to look at how the utilization of traditional ecological knowledge can assist in efforts to limit occurrence of beech bark disease in the Great Lakes region, specifically in the Upper Peninsula of Michigan. Literature on beech bark disease in the region as well as TEK in the Upper Peninsula have been examined to determine where the gap in research lies. This research primarily uses documentary analysis to assert what kind of TEK exists in the Upper Peninsula. Information on local TEK has also been gathered through informal interviews from professors at NMU’s Native American Studies center. The results of this research intends to show how TEK can be beneficial to the ongoing issue of beech bark disease.

**Effect of Organic Soil Amendments on Crop Nutritional Value**
Veronica Snow, Senior – Biology  
Kate Meade, Senior – Biology/Ecology; & Environmental Studies & Sustainability  
Faculty Advisor: Dr. Donna Becker – Biology

Poster

Inorganic soil amendments have been shown to increase plant survival and production rates but at a cost to the surrounding environment. As we evaluate our environmental situation and look for ways to improve farming techniques, use of organic amendments may be a step in the right direction. Studies show that organic matter can improve soil structure, release beneficial nutrients, and increase beneficial microbial activity. Our experiment examined organic amendments (worm
castings, bio-char, and GJ2) as beneficial replacements to inorganics. Seeds of smooth Leaf Red Cardinal F1 Spinach (*Spinacia oleracea*) were planted in 4x4 inch pots containing poor quality, sandy agricultural U.P. soil. Pots were placed in the greenhouse. Five mixes were tested, plain soil (control), soil+GJ2, soil+GJ2+biochar+wormcastings, soil+biochar, and soil+wormcastings. Soil amendments were added at the following concentrations, 10% biochar by total volume, 25% worm castings by total volume, and 2 ounces/gal initial application of GJ2 followed by 1 ounce/gal bi-weekly. GJ2, a liquid, was "watered in". Preliminary observations show significant differences in size and morphology among test groups. Compared to plain soil, the soil+biochar+wormcastings produced plants with the largest diameter, leaf number, and leaf area. Plant biomass—root and shoot weights, soil microbial populations and diversity, nutritional content of edible leaf tissue including protein content and assessment of key minerals (such as Ca, P, K, Mg, Fe) are examined. This experiment aims to improve farming techniques, in turn improving soil quality, reducing detrimental farming practices, and producing nutrient–dense food.

**A Process for Delineating New Boundaries for the Allegheny–Cumberland Dry Oak Forest and Meadows LANDFIRE BPS Zones**

Tom Sofka, Senior – Geomatics
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences

Poster

The Allegheny–Cumberland Dry Oak Forest and Meadows region, abbreviated ACDOS, is a biophysical settings (BPS) layer produced by LANDFIRE also known as Landscape Fire and Resource Management Planning Tools Project, that is in need of review. ACDOS ranges from Pennsylvania and Ohio, through the Appalachian Mountains to Tennessee and Alabama and is currently arbitrarily divided into 5 zones according to personal correspondence with a researcher from the Nature Conservancy. I plan to investigate whether ACDOS zones could be more accurately delineated, using level IV Ecoregion data as well as with ecological data such as species distribution. I will find evidence supporting the proposed correlation with level IV ecoregion data. This will involve doing map algebra with many different attributes, and using the weight–of–evidence approach. Data for these attributes comes in the form of tables that will be joined to the ecoregions shapefiles in ArcGIS and spatially represented. These tables include data concerning average relative humidity, average precipitation, average snowfall, monthly average maximum temperature, other climatic data, and other data. The spatial representations of this data will be converted into raster format to conduct map algebra. Then if map algebra suggests appropriate, I will delineate new boundaries for ACDOS with documented methods detailing the boundary reasoning.

**A Spatial Assessment of Soil Properties around the South Trails in Marquette, Michigan**

Cole Surman, Senior – Environmental Studies & Sustainability
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences

Poster

The purpose of this research is to identify the erosion rates of soil types around mountain biking trails in the Marquette county area. Some soil types erode quicker than other types and it is important to know so that we can properly plan further trail construction without drastically damaging soil types. In order to determine what soil types erode quicker than others, I gathered maps that portray the Marquette County South Trails and looked at the surrounding areas and what types of soil inhabited those trails. To gather this information, I used the NRCS Web Soil Survey with compiled data from 2016. From this survey, I was able to see the erosion classes of the different soils and other factors that contribute to erosion such as slope, runoff, and drainage. After gathering all of this information, I will make a GIS map displaying the most vulnerable soils and the soils that have the lowest rates of erosion. This research will provide information to the Noquemanon Trail Network that could influence how they construct and maintain mountain biking trail systems in the future.
Near–infrared Spectroscopy Measures of Prefrontal Cortex Oxygenation Following Mild Traumatic Brain Injury: Preliminary Results from an NMU Prime Project
Taylor Susa, Junior – Neuroscience
Autumn Palmer, Senior – Psychology/Behavior Analysis
Keara Kangas, Graduate Student – Psychology
Dr. Marguerite Moore, Faculty – Health & Human Performance
Faculty Advisor: Dr. Josh Carlson – Psychology
Poster

Concussion, or mild traumatic brain injury (mTBI), is common in many contact sports, yet little is known about the neural consequences of concussion. Research on the effects of concussions has spiked since 2010. This recent interest has led to an improved understanding of mild traumatic brain injury and how it affects behavior. However, only a small proportion of concussion studies include a neuroimaging component and, in particular, very few studies have assessed the effects of mild traumatic brain injury using functional neuroimaging. This study aimed to fill this knowledge gap by examining prefrontal cortex oxygenation levels during a non–task (i.e., resting) state after mTBI using near–infrared spectroscopy (NIRS). The experimental participants of the study recently experienced a concussion and cleared to play for their sport, controls were matched based on age, gender, and sport. We recorded using a 16–channel array that was placed over the participant's frontal/prefrontal cortex. NIRS was a TechEn system, and the program used to record the participant's brain activity was CW6 during a five–minute rest session. Preliminary differences in brain activity were observed across the mTBI and control groups. In general activity was decreased in the mild traumatic brain injury group. If the preliminary results hold in a larger sample then the use of portable NIRS could be vital in examining mild traumatic brain injuries.

JP Chickadee Project: Big Data from a Little Bird
Ivan Swart, Senior – Zoology
Faculty Advisor: Dr. Alec Lindsay – Biology
Poster

The use of RFID (radio–frequency identification) tags is a relatively recent development in studies of animal ecology and behavior. In the fall of 2016, with the launch of the JP Chickadee Project, we captured and banded 67 individual Black–capped Chickadees in our study area. Each bird was given a unique combination of a US Fish and Wildlife aluminum band, a Darvic color band, and plastic color band containing an embedded RFID chip. We have constructed custom bird feeders that read the RFID tags each time a bird lands on the feeder perch and then record the unique ID along with a time and date stamp. With these very basic data, the possibilities for analysis are massive. The tags allow us to analyze daily feeding patterns, group structure and movement, sex–specific behavior, age–specific behavior, the effects of habitat geography on behavior, and much more. The feeders have been deployed for six months, and we have accrued more than 75,000 records, requiring new training in data analytics. In this poster, I describe much of the foundational work on the establishment of the field and computational analyses involved with the JP Chickadee Project.

A Revisit of Jared Diamond's "Collapse" Using Meta–analysis
Melissa Switzenberg, Senior – Biology/Ecology
Faculty Advisor: Dr. Patrick Brown – Biology
Poster

Jared Diamond (2005) suggested in his book “Collapse” that past societies failed for the following reasons: climate change, hostile neighbors, trade collapse, environmental damage, and irresponsiveness to the environment. I searched for papers published after Diamond’s book to find support or rejection of his hypothesis. I conducted a meta–analysis to determine if his hypothesis was supported by more recent research. I hypothesized that there would be more articles in support of his claims than what would be expected randomly. I conducted a literature review and included papers that met the following criteria: included key words “collapse” and the names of study sites cited by Diamond, peer–reviewed, and published 2006 or later. Only papers available through Northern Michigan University’s Library and articles that cited human societal collapse were cited. Fifteen articles were found. The fifteen articles were classified to whether they agreed with Diamond’s reasons for societal failure. Twelve articles provided significant support for his hypothesis. Three lacked support (Sign Test, 2014). I performed a sign test on the data collected and found statistical evidence for support (Sign Test, p=0.035). Climate change,
environmental damage, and society’s irresponsiveness to the environment were the most common drivers of societal collapse.

**Duration and Variation in the Metabolic Response of Juvenile Lake Sturgeon Exposed to Sub–lethal Concentrations of the Lampricide, TFM**

Matthew Symbal, Graduate Student – Biology  
Faculty Advisor: Dr. Jill Leonard – Biology  
Oral Presentation – Jamrich 1322 at 1:00 p.m.

The lampricide 3–trifluoromethyl–4–nitrophenol (TFM) can be lethal to juvenile lake sturgeon (*Acipenser fulvescens*) at the high concentrations used to control invasive sea lamprey (*Petromyzon marinus*); however, little is known about the effects of sub–lethal TFM exposures more typically encountered by sturgeon. This study assessed the effects of TFM on the metabolic rate of juvenile lake sturgeon over a one month period. Juvenile lake sturgeon were exposed to three concentrations of TFM for 12 hours and then reared in clean water. Standard metabolic rate (SMR) was estimated using oxygen consumption for individuals at one day, one week, two weeks, and four weeks post exposure to the TFM. Results of this study demonstrate an increase in SMR early on for fish exposed to TFM; however, SMR decreased to levels below that of the control group two weeks after exposure. The SMR of fish subjected to the TFM had returned to levels equal to those of the control group four weeks after exposure. These results demonstrate that a short–term exposure to sub–lethal TFM concentrations disrupts juvenile lake sturgeon metabolism which requires weeks to resolve.

**Environmental Impacts of Urbanization on Marquette, MI**

Nicole Taylor, Senior – Environmental Studies & Sustainability  
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences  
Oral Presentation – Jamrich 1332 at 2:15 p.m.

Marquette, MI is a crossroads between urban and rural life. It is the greatest urban area in the largely rural Upper Peninsula of Michigan. Michigan and the Upper Peninsula in particular are experiencing population loss. The question of whether Marquette follows this pattern or follows a trend of urbanization “migration from rural to urban areas” could have significant impacts on Marquette residents and their use of resources. The purpose of this research is to determine if and how the city of Marquette is impacted by urbanization and to what extent the phenomenon is perceived to be affecting the environment. This research proposal outlines methodologies which will answer the following question: What are the perceived environmental impacts on Marquette due to urbanization? Before diving into these impacts, data samples provided by the US Census Bureau are used to analyze Marquette's population over the past decade. This helps the researcher gain a better understanding of Marquette's size and how it may have changed. To answer the research question, semi–structured interviews of varying local organizations are used. These organizations include Noqumemnon Trail Network, Marquette County Solid Waste Management Authority, and Superior Watershed Partnership. The results produced from this research will benefit the Marquette community, allowing for them to plan for changes in population and foreseeable impacts of urbanization.

**Becoming a Teacher: Understanding the Phenomenon from the Student Perspective**

Brooke Tharp, Freshman – Secondary English Education  
Faculty Advisor: Dr. Christi Edge – Education, Leadership, & Public Service  
Poster

This longitudinal study investigated the phenomenon of education students becoming teachers during their methods courses in attempt to show their perspective of their lived experiences. Participants (n=10) were drawn from a larger sample, using random purposeful sampling strategies, in order to understand the phenomenon from different disciplinary perspectives. Data included the students' written syntheses of learning two–thirds of the way through the academic semester during methods courses. Systematic qualitative data analysis procedures were used to identify patterns conveying participants' perceptions of progression and growth toward being a professional teacher. Initial themes were then used by the researchers to further examine a possible relationship between students' statements about their independent learning developments and indicators of confidence. The perspective of how education students view their own transition addresses a gap in the knowledge base and will help to transform the way teacher education is constructed.
The Socioecological Impacts of Eagle Mine
Elise Tillema, Senior – Environmental Studies & Sustainability
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Poster

Located near Marquette, Michigan, Eagle Mine is the only primary nickel mine in the United States. Eagle Mine estimates that they will raise Marquette’s economy by 20% at peak production, facilitate around $4 billion in overall revenue, and produce approximately 660 million pounds of nickel, copper, and trace metals over its eight-year life span. Eagle Mine has since sparked controversy and protest from numerous environmental groups and the Keweenaw Bay Indian Community (KBIC). The KBIC has a sacred site called Migi Zií Wa Sin, or Eagle Rock, located within the mining site, and feels the industry impedes on their rights to practice their religion, safeguard their environment, and violates the 1842 Treaty of LaPoint with which the land was acquired. The following research examines the effect of primary metal extraction on a sacred site in an attempt to resolve the following: To what degree have stakeholder groups had opportunity to influence the environment? Where do the KBIC claims of injustice originate? How might the events surrounding Eagle Mine fit within the Environmental Justice field? This research is an examination on how primary metal extraction on a sacred site affects people and place. Techniques include: Semi-structured interviews, documentary analysis, and quantitative information from Community Environmental Monitoring Program (CEMP) in regards to pollutants and their proximity to the KBIC and Marquette communities, how such trends have changes before and after the introduction of the mine.

Political Socialization in the Trump Era
Joan Toivonen, Graduate Student – Reading Specialist (BR)
Faculty Advisor: Dr. Derek Anderson – Education, Leadership, & Public Service
Poster

This study looks at the political socialization of 8th grade students leading up to and following the Presidential Election of 2016 during a classroom social studies unit on the election. Political participation among the young has always been low (Tingsten, 1937). The younger a person is, the less likely he/she is to be interested in or knowledgeable about politics (Dalton, 2009), yet the more exposure children have to politics, the more interested they become (Cohen & Kahne, 2012). Classrooms can serve as “schools of democracy” (van Ingen & van der Meer, 2016, p. 84) where students interact with differing viewpoints, practice their civic skills, and have their curiosity about politics piqued. Over the course of the study, the teachers maintained an open-door policy giving us access to all materials used. Non-instructional materials included students’ Pew Political Typology quizzes and candidate preferences that were analyzed using frequency tables. Constant comparison analysis (Strauss & Corbin, 1998) was used to analyze the qualitative data from the students’ responses to the questionnaire, as well as their class assignments. Results indicate that by 8th grade students have chosen preferred candidates that change very little, while their political typologies are subject to shifts after an election unit. As this generation becomes voting citizens it is important that we provide them opportunities to politically socialize in ways that help them become agents of change.

Mimicking Fantasy Authors with a Recurrent Neural Network
Matthew Trefilek, Senior – Computer Science & Math
Faculty Advisor: Dr. Jeff Horn – Math & Computer Science
Oral Presentation – Jamrich 1322 at 3:30 p.m.

This presentation details the processes and technology behind training a neural network to replicate the writing styles of J.R.R. Tolkien, G.R.R. Martin and Patrick Rothfuss. A recurrent neural network was set up utilizing backpropagation and a long short-term memory network. Through changing conditions and input parameters, the computer has been trained to output text similar to the styles of the writers. The final test was a combination of the three training files to create a new style. Portions of the text were collected at different training levels to observe the progression of the output text.
How Spatial and Non–Spatial Factors Influence Access to Parks in Detroit, Michigan

Austeja Uptaite, Senior – Environmental Studies & Sustainability
Faculty Advisor: Dr Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Poster

This research examines accessibility to parks in Detroit, Michigan using spatial and non–spatial factors. Spatial factors highlight geographical barriers and non–spatial factors include barriers such as age, sex, income, social class and race. For Detroit, I examined the acreage per park and number of parks with a correlation of household income and ethnic groups. The spatial data for park layer was obtained from ArcGIS.com and census tracts and census attribute data from Census.gov and ArcGIS.com. Using geographic information system I created correlation maps and analyzed the models to examine that low–income households have less access to parks and that a higher proportion of African Americans have less access to acreage of parks. Accessibility of green space such as parks is often unequal and tend to favor more affluent neighborhoods. Unequal access based on socio–economic class and race is an environmental justice issue. This research is intended to broaden the knowledge of access to parks as an environmental justice issue and to provide knowledge for the general public, activists, and local government to further increase equal access to parks in Detroit.

Determining the Effects of Ovarian Hormones on TMEM35 Protein Expression in Syrian Hamsters

Amanda Vanderplow Graduate Student – Biology
Anna Cameron, Senior – Biology/Biochemistry
Faculty Advisor: Dr. Valerie Hedges – Biology
Poster

TMEM35 is a novel peptide that is believed to modulate chemical signaling within the nervous system. High levels of TMEM35 expression are found in both the ventromedial hypothalamus and the limbic circuit of the mouse brain. These areas are known to function in both sexual behavior and reward. A study by Kennedy et al. (2016) indicated that TMEM35 has differing mRNA expression between males and females in various brain regions. Previous studies in the laboratory have determined that TMEM35 protein expression is sexually dimorphic in numerous brain areas, with females expressing higher levels than males. The immediate goal of this study was to determine whether these sex difference in TMEM35 expression in female Syrian hamsters are sensitive to ovarian hormones. Ultimately, determining the sex differences in protein expression will help us understand differences in how males and females process information in the brain. To achieve this, a Syrian hamster animal model system was utilized and their brain tissue was processed with immunohistochemistry to identify TMEM35 expressing neurons. Through statistical analysis we have shown that ovarian hormones do have modulating effects on TMEM35 expression within various hypothalamic and limbic areas of the brain. This work will further our understanding of TMEM35 protein induction to further determine if sex behavior differentially alters TMEM35 protein expression in a sexually dimorphic manner.

Sex Difference in Anatomical Expression of TMEM35 Protein in Syrian Hamster Brains

Amanda Vanderplow, Graduate Student – Biology
Faculty Advisor: Dr. Valerie Hedges – Biology
Poster

TMEM35 is a novel peptide that is believed to modulate chemical signaling within the nervous system, and high levels of TMEM35 expression are found in both the ventromedial hypothalamus and the limbic circuit of the mouse brain. These areas are known to function in both sexual behavior and reward. A study by Kennedy et al. (2016) indicated that TMEM35 has differing mRNA expression between males and females in various brain regions. The immediate goal of this study was to map the anatomical sex differences in the expression of TMEM35 protein. A Syrian hamster model system was utilized and their brain tissue was processed with immunohistochemistry staining to identify TMEM35 expressing neurons, as well as neural structural markers to define cellular localization. Both males and females were directly tested and compared. Through statistical analysis we have shown that TMEM35 expression is sexually dimorphic in several hypothalamic and limbic brain areas. Ultimately, this anatomical mapping project will direct future investigations into the functions of TMEM35, including whether TMEM35 expression can be induced via behavior or hormonal treatment, in a sexually dimorphic manner. Finally, determining the sex differences in protein expression will help us understand differences in how males and females process information in the brain and develop treatments that are sex–specific for all species.
**Interflock Gargle Call Variation in Black–capped Chickadees (Poecile atricapillus)**

James VanOrman, Graduate Student – Biology  
Faculty Advisor: Dr. Alec Lindsay – Biology  
Oral Presentation – Jamrich 1322 at 1:45 p.m.

The black–capped chickadee (Poecile atricapillus) is a small year–round resident songbird of temperate habitats of North America. During the fall and winter, chickadees stay in flocks that contain an average of 5–10 individuals. Flock membership includes breeding pairs, dispersing juveniles, and occasionally non–breeding individuals. Flock members roost and forage together, and will defend the flock territory from other flocks. One of the most frequently used vocalizations in agonistic interactions between chickadees is the gargle call. A gargle is composed of several syllables, and many possible syllables can be used in a single gargle. Every chickadee in an area could potentially have several different gargles, but studies have shown that flock members will share some gargles. This would allow chickadees to determine flock membership based on the gargles they use. The presented study describes the gargle variation of chickadee flocks in a 53 ha woodlot in Marquette, Michigan.

**Assessment Of TRBK Receptor Expression and Function at the Neuromuscular Junction in Mice Missing Muscle–synthesized BDNF**

Luke VanOsdol, Graduate Student – Biology  
Amanda Vanderplow, Graduate Student – Biology  
Mikel Cawley, Graduated – Biology  
Amanda Judkins, Junior – Biology  
Joseph Novak, Senior – Biology  
Faculty Advisor: Dr. Erich Ottem – Biology

Poster

Brain–derived neurotrophic factor (BDNF) is a widespread protein synthesized by neurons and other cell types, including muscle. BDNF is crucial for maintaining the strength and integrity of synapses, dendrites, and other cellular structures. While its cellular roles and functions in neurons are generally understood, its activity in other tissue types is not well characterized. Our laboratory has focused on the role of BDNF in the maintenance of the neuromuscular junction (NMJ). Research assessing motor neuron pathology has revealed evidence suggesting that disruption of the cellular process, retrograde axonal transport, may underlie the progressive myopathy and neuropathy observed in transgenic mice missing a muscle–synthesized source of BDNF. The receptor that binds BDNF is critical in retrograde transport initiation, and we have found trends of reduced expression of the receptor in the NMJs of our transgenic mice. Retrograde transport relies on the interaction of numerous adaptor proteins, including dynactin and JIP3, which help bind the vesicular cargo to motor proteins. Disruption of retrograde axonal transport can lead to the accumulation of dysfunctional proteins in the NMJ, which has been shown to be correlated with the neuropathologies and myopathologies associated with neuromuscular diseases such as amyotrophic lateral sclerosis (ALS). This study addresses the function of the BDNF receptor in the NMJ and its role in the initiation and disruption of retrograde axonal transport in motor neurons to provide insight into the disease process of ALS and other neuromuscular diseases.

**Considering Salman Rushdie as a Post–Colonial Filmmaker**

Stephen Wardell, Senior – English & Philosophy  
Faculty Advisor: Dr. Jaspal Singh – English

Poster

Audiences are conditioned to expect a certain product when they view a film. These are institutionalized expectations created by a First World film industry. The novelist Salman Rushdie does not acquiesce to these expectations, instead creating his own version of the cinema, by co–opting established film grammars and styles, and by adopting the perspective of cameras. His version of the cinema fits within a model of post–colonial cinema, because Rushdie plays with the important idea of oppressors misrepresenting an oppressed group through stereotypes and absenting. This process of misrepresentation changes what audiences understand to be true. Rushdie also plays with this idea of misrepresentation and truth by demonstrating the inherently limited perspective of his unique camera that is a perforated sheet in Midnight's Children, and by adopting the perspective of a news camera in The Satanic Verses. Ultimately, when Rushdie plays with these cameras, he adopts the
conventions of dominant media forms to critique these same media forms for the way they can change representations of truth. Rushdie also draws connections between the film industry and religion; his way of critiquing film is analogous to the way a colonized people use the religion of the colonizer to critique the colonizer. In this presentation, I will show that in the novels Midnight's Children and The Satanic Verses Salman Rushdie adopts the role of a post–colonial filmmaker.

Kissing the Platonics
Anthony Webb, Senior – Secondary Math Education
Faculty Advisor: Dr. Daniel Rowe – Math and Computer Science
Poster

This project studies "sphere–kissing" arrangements (where spheres are arranged around the outside of a central sphere) in the context of the five Platonic solids. In this poster, I will show how one can find the circumradii of the five Platonic solids (tetrahedron, hexahedron, octahedron, icosahedron, and dodecahedron) and the relation to the sphere–kissing arrangements.

Examining the Effects of Handling on the Behavior and Long–Term Growth Rates of Brook Trout
Caleb Welk, Junior – Biology/Zoology
Faculty Advisor: Dr. Jill Leonard – Biology
Oral Presentation – Jamrich 1322 at 2:45 p.m.

This study evaluated whether routine handling affected the growth rates and behavioral responses of brook trout (Salvelinus fontinalis). We hypothesized that fish subjected to repeated handling would experience stress and would thus display lower growth rates compared to fish that were not handled. We also hypothesized that fish subjected to repeated handling would show decreased fear response when exposed to a familiar, but potentially alarming, stimulus (a net). Over the course of 8 weeks, we handled our experimental group twice a week by netting all fish into a bucket and then back into the tank. At the beginning and end of the testing period, we measured the mass and standard length of each fish. At the end of the experiment, each fish was behaviorally tested with exposure to a net stimulus where we monitored their escape response. We concluded that there was no difference between the experimental and control growth rates, nor was there a difference between the fear responses of the experimental and control groups. This suggests that repeated laboratory handling should be safe for brook trout, as it does not alter their growth rates or behavioral patterns.

Effect of Glomus intraradices on the Growth of Lettuce in Zinc Contaminated Soils
Zachary Whitacre, Junior – Microbiology
Faculty Advisor: Dr. Donna Becker – Biology
Poster

Plants and their symbiotic fungi have a complex relationship. Plants give the fungi carbon and in return the fungi help plants take up water and nutrients from the soil, and can help plants adapt to live in polluted environments. Common pollutants in the environment are heavy metals that are the result of hydraulic fracking and many other human activities. The pollutant used in this study was ZnCl2 which is commonly used in hydraulic fracking. The objective of this study was to see if a vesicular arbuscular mycorrhizae (VAM) fungus, Glomus intraradices, can alleviate zinc stress on the common crop plant, lettuce (Lactuca sativa). Soil was amended with ZnCl2 at a concentration of 0.5 g ZnCl2/kg soil. Amended and unamended soils were inoculated with G. intraradices by mixing fungal spores into the soil. Lettuce was grown in the various soils in 450 cm3 pots in the greenhouse for 30 days. The height of the plants were measured weekly. When plants reached maturity they were harvested, leaf width and length was recorded, and plant growth in each group was determined by measuring biomass of roots and shoots separately. Physiological health was determined by measuring the photosynthetic rate of isolated chloroplasts using the Hill Reaction method. Percent VAM root length infection/ total root length will be determined by staining roots with trypan blue. Leaf and root samples will be analyzed for their respective zinc levels. This research will give insight into any benefits that plants receive from their associated fungi in heavy metal polluted soils.
American pikas (*Ochotona princeps*) are small mammals that are widely distributed across North America's Intermountain West. Previous investigations revealed five geographically distinct mitochondrial lineages within *O. princeps*. These lineages represent genetically distinct pika populations that have been evolving independently in association with different mountain systems of the Intermountain West. In contrast, diversity of endoparasitic helminths are not structured geographically in the same way. Instead, there are two primary parasite assemblages, one distributed across southwestern pika populations and one found across the northeastern part of the host range. These contrasting patterns suggest that the shared history of pikas and their parasites had different consequences for the evolutionary trajectories of these organisms. Here we investigate whether or not patterns of ectoparasite diversity suggest a history that is more similar to that of the host or that of the endoparasites. We characterized the flea diversity within American pikas based on a sample of 823 flea specimens collected from 37 localities in the Intermountain West. We identified 13 flea species, 2 of which are common and known to be specific to pikas. The population genetic structure of the most common flea species, *Ctenophyllus armatus*, was examined to test for phylogeographic concordance between host and parasite diversity. We generated DNA sequences from the mitochondrial COII gene for 72 fleas representing 22 different localities, and show general congruence between the phylogeographic structure of the fleas and that of the endoparasites. This pattern is consistent with post–glacial population movement from Southern Rocky Mountains and Utah to the Cascade Range and Rocky Mountains. Strong phylogeographic congruence between host and parasites is not supported by our analysis.

**An Analysis of Fresh Water Aid Delivery During the Flint Water Crisis**

Michael Williams, Senior – Environmental Studies & Sustainability
Faculty Advisor: Dr. Sarah Mittlefehldt – Earth, Environmental, & Geographical Sciences
Oral Presentation – Jamrich 1311 at 1:00 p.m.

This research aimed to describe the aid distribution process following the declarations of emergency in Flint, MI during the Flint Water Crisis. Through documentary analysis and interviews with key individuals in Flint, MI, a model emerged showing a pre–existing charity infrastructure built during decades of “decline” that both competed and coordinated with national Non–Governmental Organizations (NGOs) and governmental aid sources. My findings suggest that this constellation of organizations were essential to the aid delivery in this economically, politically and racially marginalized city. Because Flint’s charity infrastructure was active before the city required aid delivery and was intimately familiar with Flint’s preexisting problems that stemmed from economic decline, it was most poised to deliver aid efficiently and quickly.

**Female Agency and Auctoritee in Medieval British Literature**

Emily Winnell, Junior – English
Faculty Advisor: Dr. David Wood – English
Oral Presentation – Jamrich 1311 at 9:30 a.m.

My essay, written for EN 312 (Medieval British Literature), examines representations female agency and "auctorite" in medieval British literature. It focuses primarily on Sir Gawain and the Green Knight, but also includes *The Wife of Bath’s Prologue* and *Tale* and *Beowulf*.

**Neural Correlates of Aversive Anticipation: A Meta–Analysis of Neuroimaging Studies**

Erin Wylie, Senior – Psychology – Behavior Analysis
Faculty Advisor: Dr. Joshua Carlson – Psychology
Poster

Anticipation of aversive events is an adaptive preparatory response. This process is has been reliably shown to involve the anterior insula. Other structures appear to be involved, but are less consistently activated. In order to address this incomplete understanding of the neural correlates involved in aversive anticipation, this meta–analysis was conducted. We hypothesized...
that aversive anticipation involves a distributed response including the anterior insula, amygdala, & dorsal anterior cingulate, and that aversive anticipation elicits broad sensory responses. Neurosynth, an online platform that allows users to automatically synthesize the results of many different neuroimaging studies, was used to carry out this meta–analysis. Results of the Neurosynth analysis implicate the bilateral anterior insula, amygdala, bed nucleus of the stria terminalis (BNST), striatum, as well as the dorsal anterior cingulate cortex (dACC) and other prefrontal cortex (PFC) regions. The bilateral visual and somatosensory sensory regions were implicated as well. Thus, as expected, the anterior insula is activated during aversive anticipation. However, this activation is only part of a broader anticipatory response. Overall, our Neurosynth meta–analysis provides evidence for a core network of affective regions in addition to a broader network of sensory regions involved in a preparatory response during aversive anticipation.

**Fluorescent in–situ Hybridization to Visualize BDNF mRNA**
Natalie Yeck, Senior – Neuroscience
Faculty Advisor: Dr. Erich Ottem – Biology
Poster

We aimed to develop a protocol for visualization of brain–derived neurotrophic factor (BDNF) mRNA in spinal motor neurons using fluorescent in situ hybridization (FISH). Recently, reliable quantifiable in situ hybridization became difficult as components of the standard isotopic in situ hybridization protocol became unavailable. In cell culture, FISH is reliably quantifiable and indicates increases and decreases in expression of target mRNAs. We adapted cell culture FISH protocols for use on neural tissue sections. We used a cDNA template cloned into a transcription vector. The vector was linearized using a restriction endonuclease and antisense BDNF cRNA probes transcribed using SP6 polymerase and digoxigenin (DIG)–labeled UTP. Because BDNF is a low–copy transcript in motor neurons, we first applied the BDNF cRNA antisense probes to mouse brain sections containing hippocampus. We reasoned that because BDNF mRNA is a high–copy transcript in pyramidal neurons, our pilot protocol would have a greater chance of success. To fluorescently label hybridized BDNF mRNA, we exposed tissue to an anti–DIG antibody conjugated to horseradish peroxidase (anti–DIG HRP) and then to Cy3–labeled biotinylated tyramide which would bind to the anti–DIG HRP complex. Confocal microscopic analysis confirmed specific BDNF mRNA labeling in all regions of the hippocampus. We applied the full protocol to spinal cord sections from the L4–L5 region. Our results demonstrated that our fluorescently–labeled BDNF cRNA probes hybridized to motor neurons in the ventral horns of the spinal cord. Future studies will apply this technique to determine whether transgenic mice missing muscle–synthesized BDNF have altered motor neuron–synthesized BDNF.

**The Vietnam Veterans Memorial and American Perception of the Vietnam War**
Sarah Zidek, Senior – Communication Studies
Faculty Advisor: Dr. James Cantrill – Communication & Performance Studies
Oral Presentation – Jamrich 1311 at 11:45 a.m.

This project focuses on public perception and memorialization of the Vietnam Veterans Memorial in Washington D.C. From its first conception by artist Maya Lin, to its production, to finally its everyday visitations, the meaning behind the memorial has evolved. The data for my project draws upon personal opinions of patrons at the wall, journal articles, historical accounts, and documentaries. The Vietnam Veterans Memorial has become one of the first national memorials to not be a tribute to the heroes but instead a solemn remembrance of the fallen. The goal of my research is to understand the communicative impact such a paradigm–shifting memorial has had on memorials, along with American perception of the Vietnam War and its veterans.

**Modelling Brook Trout (Salvelinus fontinalis) Standard Metabolic Rate vs Time of Day**
Grace Zimmermann Senior – Ecology
Taylor Preul, Senior – Ecology
Max Majinska, Sophomore – Fisheries & Wildlife
Jacob Bowman, Graduate Student – Biology
Faculty Advisor: Dr. Jill Leonard – Biology
Oral Presentation – Jamrich 1322 at 3:15 p.m.

Field estimation of metabolic rate is a useful tool in understanding the role a species plays within their ecosystem and how it
interacts with its environment based on its physiological status. However, to maximize the effectiveness of field respirometry, it is important to validate the consistency of trout metabolism at different times of day. In order to validate brook trout (*Salvelinus fontinalis*) oxygen consumption measurements in a field setting, static respirometry was used in the lab to establish a model for trout oxygen consumption. Fourteen individuals were tested for maximum metabolic rate (MMR) and field “resting” metabolic rate (FMR) at three different time–periods during the day: “morning” 6–10am, “afternoon” 11–3pm, and “night” 4–8pm. Each individual completed one trial in each time–period, allowing a comparison of oxygen consumption throughout the day. To compare oxygen consumption, the rate of change in oxygen consumption (mg·kg⁻¹·h⁻¹) during each trial was compared per individual fish at each time–periods. There was no significant difference of mean oxygen consumption between the morning and the afternoon time–periods. However, there was a significant difference in mean oxygen consumption between the night and afternoon time–periods and the night and morning time–periods. A source of error that could have caused the mean oxygen consumption in the night time–period to be significantly different from the morning and afternoon time–periods was most likely specific dynamic action.
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