



THE HONORS COLLEGE AT UW OSHKOSH

SPRING 2024
HONORS THESIS SYMPOSIA

MONDAY, MAY 6

THROUGH

THURSDAY, MAY 9

UNIVERSITY OF WISCONSIN
OSHKOSH

MONDAY, MAY 6—————

5:00 p.m.—————

BRIANNA DAVIS
BIOMEDICAL SCIENCE

AND

HANNAH KRUEGER
BIOMEDICAL SCIENCE; MINOR IN CHEMISTRY

“Effects of Cross-Species Microbiota Transfer on Liver Inflammation”

Fat-storing hibernators, such as thirteen-lined ground squirrels (TLGS), are a natural model of microbiota shifts, as they significantly increase their food intake and accrue large amounts of body fat prior to hibernation. Studies of fattening TLGS have shown increases in pro-inflammatory cytokines in the gut, white adipose tissue (WAT), liver, and skeletal muscle during fattening. To better study the relationship between the microbiota and metabolic inflammation, gut microbiota were transferred from TLGS at different time points after the emergence from hibernation (when fattening) into diversity outbred (DO) and cluster of differentiation (CD1) outbred mice. By transplanting the microbiota into mice, a non-hibernating species, we can determine whether metabolic inflammation is due to the microbiota or solely the physiology of the hibernator. The inflammatory state of the liver is particularly important because the liver directly receives signals from the gut and becomes inflamed in response to gut inflammation. The mice were gavaged twice with their assigned ground squirrel microbiota and monitored for 8 weeks after the ground squirrel microbiota transplant (GSMT). A subset of mice (N = 6 per group) were euthanized halfway through (at 4 weeks after transfer) and the remainder (N = 6 per group) were euthanized at 8 weeks. The liver was removed from mice after euthanasia. Abundance of interleukin (IL)-6, IL-10, and tumor necrosis factor (TNF)- α cytokines in each sample were found using enzyme-linked immunoglobulin assays (ELISAs). Mouse liver anti-inflammatory IL-10 decreased as time since the microbiome transplant increased in both the DO and CD1 outbred mice, but the pro-inflammatory TNF- α increased in just CD1 outbred mice. IL-6 did not show any significant variations in response to weeks of treatment, time of microbiome collection, or interaction differences in either strain of outbred mice. In humans, such dramatic shifts in microbial community structure are associated with many diseases, including inflammatory bowel disease, obesity, and autoimmune diseases.

Advisor: DR. COURTNEY KURTZ, BIOLOGY, COLS



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6:00 p.m. _____

ZACH ZIRGIBEL

BIOMEDICAL SCIENCE; MINORS IN CHEMISTRY AND PHILOSOPHY

“Correlation of Proinflammatory Tumor Necrosis Factor- α and Cell Adhesion Molecule E-Selectin in Adipose Tissue from *Ictidomys tridecemlineatus*”

Obesity is a problem at the forefront of health and is a leading risk factor for cancer and cardiovascular disease. Obesity is an inflammatory disease and inflammation in adipose (fat) tissue is associated with poorer health outcomes. Our work aims to further understand the development of this inflammation during fattening using a thirteen-lined ground squirrel (*Ictidomys tridecemlineatus*) model. This model provides unique insight given the fact that these organisms emerge from hibernation and undergo excessive caloric intake and thus rapid adiposity to prepare for their next hibernation. During fattening, the mechanism mediating metabolic dysfunction is largely unknown; however, the proinflammatory cytokine tumor necrosis factor (TNF)- α increases late in the active season. The cell adhesion molecule E-selectin is stimulated by TNF- α signaling. To determine whether TNF- α increases in omental white adipose tissue (oWAT) and if this correlates with an increase in E-selectin, we quantified E-selectin using immunoblotting and TNF- α using ELISA in white adipose tissue (WAT) collected from thirteen-lined ground squirrels at 2 days, 2 weeks, 4 weeks, 6 weeks, and 8 weeks post-hibernation to assess the relationship between proinflammatory cytokines and cell adhesion molecules in fattening. E-selectin expression and TNF- α levels did not change over the timepoints examined. The relationship between TNF- α and E-selectin showed a trending negative correlation, which could potentially be due to the earlier timepoints and the leanness of the squirrels during the study period. Further research needs to be done to understand the relationship between these molecules post-hibernation.

Advisor: DR. COURTNEY KURTZ, BIOLOGY, COLS

6:30 p.m. _____

FRANKIE KERKHOFF

ANTHROPOLOGY; MINORS IN SOCIAL JUSTICE AND SPANISH

“You Know What I Am’: A Systematic Analysis of Gendered Ethnography in Higher Education”

The connection between self-identification and the means of executing ethnographic research is a fascinating subject familiar to those who work in the field of ethnography. The unique perspective of student researchers, however, brings a fresh and dynamic element to the future of ethnographic research. Through personal experiences as an undergraduate research student for the National Science Foundation-funded interdisciplinary research project as well as the Sense of Belonging and Inclusive Excellence research project at the University of Wisconsin Oshkosh, the opportunity was presented to collect ethnographic data in multiple locations and through multiple methods with various student and faculty research teams, which had created unique situations for student researchers. This paper explores how gender identity and expression impact ethnographic fieldwork through students’ experiences conducting research at an institution of higher education. The findings from this research reflect current biases, gaps in inclusivity, hierarchies, and power dynamics experienced from student researchers’ perspectives within a higher education institution in Wisconsin.

Advisor: DR. HEIDI NICHOLLS, ANTHROPOLOGY, GLOBAL RELIGIONS, AND CULTURES, COLS

4:30 p.m. _____

RACHEL HAWLEY
CHEMISTRY (BIOCHEMISTRY)

“Assessment of Metal Remediation by Plants in Bioswales”

Bioswales, a type of bioretention system, are vegetated drainage basins with sloped sides that allow for pollutants to be filtered out of stormwater runoff, thus reducing harm to surrounding ecosystems and improving water quality. One mechanism of pollutant removal in bioswales is phytoremediation, which utilizes plants to clean up contaminated environments. Plant species, specifically native species, are therefore essential in bioswales to reduce pollutants such as the heavy metals copper and lead. This study is an extension of the prior work completed by Joshua Dewhurst, who analyzed lead, copper, and polycyclic aromatic hydrocarbons (PAHs) in bioswale soil on the University of Wisconsin Oshkosh campus. As further investigation, the effectiveness of nearly twenty plant species in five different bioswales across campus were analyzed by using EPA Method 3050B. The previous study demonstrated that lead (Pb) and copper (Cu) levels in the soils were within EPA limits. In this experiment, both native and non-native herbaceous and woody plants were assessed for their ability to uptake copper and lead into their leaves and stems. Results were assessed for any correlation between soil metal content and plant metal content as well as for differences between plant species across natives, non-natives, and invasives.

Advisor: DR. KEVIN CRAWFORD, CHEMISTRY, COLS

5:00 p.m. _____

AUDREY KOESTER
BIOMEDICAL SCIENCE; MINOR IN PSYCHOLOGY

“Exploring the Effects of Temperature Change
on Evolving Cultures of *Saccharomyces pastorianus*”

Yeasts are single-celled eukaryotic organisms classified as members of the fungi kingdom. This thesis examines how efficiently different strains of *Saccharomyces pastorianus* evolve and grow at a variety of temperatures. *S. pastorianus* is a species of yeast more commonly known as lager yeast. This strain is a hybrid combination of *Saccharomyces cerevisiae* and *Saccharomyces eubayanus*. *S. eubayanus* ferments poorly overall, with its best evolution performance being at colder temperatures between 4°C and 10°C. *S. cerevisiae* ferments very well at warmer temperatures with its best performance being between 15°C and 20°C. Cultured *S. pastorianus* was transferred every few days to a 96-well plate to be read in the plate reader. Samples were maintained at 5 different temperatures—25°C, 27°C, 30°C, 32°C, and 35°C—for 48 hours. To document evolution, values of growth were taken every 30 minutes. Since it is not explored much currently, this study aims to find data and determine whether *S. pastorianus* grows better at higher or lower temperatures and what effect the combination of cold-tolerant *S. eubayanus* and warm-tolerant *S. eubayanus* has on evolution. The lower end of the temperature spectrum tended to indicate more yeast growth, while at 35°C there was not much resulting growth. This data may provide better information over time to help find the optimal fermentation temperature for *S. pastorianus* and where it will have the most productive outcome to be used to brew lager beer more efficiently outside of the laboratory.

Advisor: DR. DAVID KRAUSE, BIOLOGY, COLS

5:30 p.m. _____

ELLA WILSON
BIOMEDICAL SCIENCE

“An Exploration of the Process through Which Yeasts Extract Iron from Pulcherrimin”

Yeasts are eukaryotes that contain a clearly defined nucleus and are single-celled microorganisms. The first yeasts originated millions of years ago and have evolved with a strong dependence on iron uptake for various cellular functions such as enzyme function, electron transport, and metabolism. Iron plays a crucial role in facilitating these processes within yeasts. Pulcherrimin, characterized by its red pigment, is a molecule that contains iron and has been identified as a key player in iron uptake. However, it is debated whether pulcherrimin acts primarily as a siderophore or as a local source of iron. A commonly studied yeast species, *Saccharomyces cerevisiae* S288C, demonstrates the ability to take pulcherrimin and iron back into their cells. This study aims to understand the mechanisms by which these yeasts extract iron from pulcherrimin and subsequently transport it back into the cell. We extracted pulcherrimin via an acid-base chemical extraction and incorporated it into a synthetic media where all the iron is sequestered by pulcherrimin. This effective synthetic media was made using agarose and 10 μ M PA. We created a mutant library using EMS mutagenesis and then replica-plated the mutants from standard YPD media to synthetic media. We screened the mutants by comparing the colonies and observing if any were absent. This research may provide additional insights into the genes responsible for the production and reutilization of pulcherrimin.

Advisor: DR. DAVID KRAUSE, BIOLOGY, COLS

6:00 p.m. _____

ANDREW HERMAN
CHEMISTRY (PROFESSIONAL)

“The Chemical Modification of Polystyrene: Conversion to Polyethylene Terephthalate Precursors”

Polystyrene is a polymer used in everyday items such as product protection (packing peanuts and Styrofoam), CD/DVD cases, food packaging, and egg cartons. One significant environmental problem with polystyrene is its negative scrap value, making it undesirable and unrealistic to recycle. The polymer polyethylene terephthalate (PET), however, is more readily recycled and is recycled roughly 14 times more than its polymer cousin.¹ As both polymers share an aromatic six-membered ring, chemical modifications could convert polystyrene into PET. In this research, the first step of this modification was the addition of an alpha-keto ester in the para position of polystyrene's benzene ring via Friedel-Crafts acylation. Upon acylation, the newly modified polymer underwent a saponification reaction alongside an oxidation reaction to convert the alpha-keto ester into a carboxylic acid functional group.² Finally, based on the work of Huang and colleagues, the polymer is submitted to a photo-depolymerization reaction in the presence of acid catalyst, oxygen gas, and 405 nm light.³ This reaction broke the polymer down and oxidized it into three different major products: formic acid, benzoic acid, and terephthalic acid. Terephthalic acid is a monomer unit of PET, which can be readily reacted with ethylene glycol to form PET. This thesis covers in detail the analysis proving successful conversion and the in-depth reaction scheme.

References:

1. Merrington, A. Recycling of Plastics. Applied Plastics Engineering Handbook. 2011, 177-192. DOI: 10.1016/B978-1-4377-3514-7.10011-X DOI: 10.1002/macp.1986.021870808
2. Argyropoulos, D. S.; Bolker, H. I. A facile synthesis of monodisperse carboxylated polystyrene and derivatives. Die Makromolekulare Chemie. 1986, 187 (8), 1887-1894.
3. Huang, Z. et. al. Chemical Recycling of Polystyrene to Valuable Chemicals via Selective Acid-Catalyzed Aerobic Oxidation under Visible Light. Journal of the American Chemical Society. 2022, 144 (14), 6532-6542. DOI: 10.1021/jacs.2c01410

Advisor: DR. BRANT KEDROWSKI, CHEMISTRY, COLS

5:00 p.m. _____

PETER BERRY

MECHANICAL ENGINEERING TECHNOLOGY AND PHYSICS; MINOR IN MATHEMATICS

“Thermal Engineering Lab: A Study of Proposed Designs and Viability”

With the increasing cost of college and increasing rates at which college graduates find themselves underemployed, it is more vital than ever for students to be adequately prepared to meet industry expectations. To better prepare students, the Department of Engineering and Engineering Technology at the University of Wisconsin Oshkosh provides students with hands-on experience to reinforce concepts from lectures and to expose them to actual systems present in many industries. This thesis outlines designs and assesses the viability of the proposed TEL (Thermal Engineering Lab); similar to the existing TERIL (Teaching and Energy Research Industrial Lab), the TEL will enhance student learning from the Thermodynamics and Heat Transfer class through labs using both custom and commercially available systems. This thesis will serve as the basis for further development of TEL, with students and faculty members working to build and refine labs for thermodynamics and heat transfer.

Advisor: DR. PAWEŁ OLSZEWSKI, MECHANICAL ENGINEERING TECHNOLOGY, COLS

5:30 p.m. _____

ANDREW WOODBURY

MECHANICAL ENGINEERING TECHNOLOGY

“Development of the Center for Applied Engineering Research”

For students graduating from universities, the importance of gaining real-world experience in conjunction with their degree is becoming more apparent. This change in emphasis during the hiring process comes in the wake of growing discontentment inside the industrial sector with the quality of employees entering the job market. To provide better learning opportunities, the University of Wisconsin Oshkosh Department of Engineering and Engineering Technology has developed a center to provide students at every level with the chance to collaborate with professionals in their respective fields as they solve authentic engineering problems. The goal of the center is to provide industries with engineering assistance for projects they may not be able to complete themselves at the present time. This gives students the opportunity to solve ambiguous problems, provides the company with potential solutions, and promotes the university and the educational opportunities it offers. The Center for Applied Engineering Research (CAER) conducted its first project, an energy analysis for Faith Technology’s Smart Residential Microgrid, with two senior students and a professor from the department. From this model of independent study, the students addressed important aspects of engineering by analyzing data, practicing project presentation, and maintaining professional communication with the contact from the company. From this initial project, the origins of the CAER, a model for further collaborative work, and a website to promote the capabilities of the students was created in hopes of providing future students the same opportunities to gain engineering experience.

Advisor: DR. PAWEŁ OLSZEWSKI, MECHANICAL ENGINEERING TECHNOLOGY, COLS

6:00 p.m. _____

PAUL PRICE

ELECTRICAL ENGINEERING TECHNOLOGY; MINOR IN LAW AND POLICY

“IoT-Facilitated mmWave Sensing Platform for Simple Gesture Recognition”

Radio frequency (RF) mmWave sensing has established the capabilities of high-frequency radar for detecting and imaging events, notably those related to human health monitoring and gesture detection. These capabilities are of interest due to the unique nature of mmWave radar’s spatial and material discernment characteristics. This research maintained the objective of exploring human localization realized with mmWave sensor signal processing implemented on a low-cost microprocessor device. Prior research introduced powerful mmWave signal processing capable of advanced human gesture and vital sign

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monitoring; however, this processing largely remained dependent on personal computers for data reception and processing. Interfacing a mmWave sensor to a compact microprocessor device with the capacity to power and process a mmWave sensor in a monitoring scenario was largely unrepresented; so too was the unique application of integrating Internet of Things (IoT) architecture to facilitate client-server computing. The research challenge involved extracting applicable live human event data from an off-the-shelf mmWave sensor, the Texas Instruments IWR6843ISK. This data was then communicated with a real-time IoT server application facilitated on the Raspberry Pi 4B. Further, as a test case, the use of a simple human gesture detection task was demonstrated to introduce performing a machine learning (ML) process on the sensor data. This research contributed successful implementation of an off-the-shelf mmWave sensor to custom sensing application involving ML-based gesture detection. Source code related to IoT server development and the ML process has been made available, along with data validation of a simple ML gesture task.

Advisor: DR. AHMED NASIF, ELECTRICAL ENGINEERING TECHNOLOGY, COLS

6:30 p.m.—————

ALLISON JAUQUET NURSING

“A Literature Review of Spinal Cord Injuries: Best Evidence-Based Practice”

This research finds and analyzes the best evidence-based practice for treating spinal cord injuries. The research breaks down the causes of spinal cord injury, discusses the pathophysiology of the injury followed by negative effects, and explores the best way to manage the injury in emergency care settings. Spinal cord injuries are increasing in prevalence and variety in the world today, and nurses play a pivotal role in the emergency treatment and management of such injuries. Understanding the best evidence-based practice in initial management can help aid in recovery, injury management, and increased safety. UpToDate, the primary database used in this research, collects the most recent studies, reviews, and experiments, and provides updated standards of care. The best evidence-based practices were found by performing a literature review, assessing medical journals, and analyzing medical treatments. Common barriers such as communication, knowledge, and variability were also analyzed. Recommendations for the proper treatment of spinal cord injuries to reduce severity, improve recovery, and aid in patient safety include educating nurses and increasing support tools at the organizational level of each department.

Advisor: MS. SARA NEBUS, COLLEGE OF NURSING

7:00 p.m.—————

ABBEY BRAKER ANTHROPOLOGY; MINOR IN GEOLOGY

“The Archaeology of Pain and Its Role in the Bog Body Phenomenon”

Pain is one of very few universally shared experiences. Throughout history, pain has been both a uniting and a dividing factor in death and mortuary practices. Bog bodies, naturally mummified human remains found in bogs, provide a unique opportunity to examine their life experiences and treatment around the time of death. Bog bodies often have a violent cause of death with additional, non-fatal wounds. The amount of violence exhibited on the bodies and their unusual depositional environment have led many archaeologists to believe that these were victims of human sacrifice. Previous analyses of bog bodies have long been centered around the physical evidence of violence; however, little consideration has been given to the experiencing of pain and its contribution to the treatment of the victims. Closer examination of bog bodies reveals evidence of pathologies and physical impairments that would have contributed to the amount of pain an individual experienced during their life. This thesis explores evidence of pathological, societally controlled, and inflicted pain and its connection to the “othering” of an individual during life and in their transformation into a bog body.

Advisor: DR. KEVIN GARSTKI, ANTHROPOLOGY, GLOBAL RELIGIONS, AND CULTURES, COLS

4:30 p.m.

LANE WOHLRAB
NURSING

“A Survey of Critical Care Nurses’ Skill Level and Attitude
Related to Their Level of Education and Experience”

Thanks to the COVID pandemic and the ever-increasing nursing shortage, more and more new grad nurses (NGNs) are going directly into critical care areas after graduation. About 20% of all NGNs leave the profession in 2 years, and the high level of patient acuity that comes with critical care heavily contributes to stress, burnout, and turnover in critical care NGNs. Externships and residency programs have become more commonplace in recent years, and data show that these programs can help ease a NGN into their role and reduce stress and burnout. This thesis compares new grad ICU nurses to more experienced ICU nurses through an anonymous survey designed to measure levels of confidence, stress/burnout, and attitude in relation to experience and education. The survey received 48 responses from 5 different facilities with various types of ICUs. Respondents ranged from fresh NGNs to nurses with 20+ years of experience and included ADN-prepared nurses as well as MSN-prepared nurses. Confidence level did not vary much, with most nurses stating they were confident in their role regardless of education or experience. A majority of respondents also stated that nursing school did not prepare them for critical care, but that self-directed learning or organizational programs adequately prepared them. Burnout, stress, and attitude did have some variation related to education level, experience, externships, residency, and facility. Surprisingly, however, nurses having externships and residency showed similar or higher levels of burnout than nurses without these experiences. Limitations of this study include sample size and the number of facilities willing to distribute the survey, too many questions/variables on the survey, and the survey being 100% voluntary with no compensation.

Advisor: DR. JASON MOTT, COLLEGE OF NURSING

5:00 p.m.

JENNA LIEDERS
NURSING

“Lack of Forensic Nursing Access in Rural Wisconsin:
A Review of Literature and Its Implications”

The Wisconsin Department of Health Services estimates that 1 in 3 women and 1 in 5 men will experience sexual violence in their lifetime. Forensic nurses are specially trained nurses who assist survivors of sexual assault as well as of domestic violence, child abuse, and other crimes. They collaborate with law enforcement and community resources while also supporting survivors in their recovery process. Forensic nursing requires sensitivity training through trauma-informed care that is utilized throughout their patient encounter. Survivors face barriers including but not limited to financial burden, transportation, and the mental toll of the assault. For individuals who live in rural communities, access to forensic nurses is an additional impediment. Survivors face the decision of traveling great distances to receive care, which creates additional barriers. Ensuring specialized forensic nursing access in rural Wisconsin communities allows survivors to access the care they deserve and rely on to assist in their healing process.

Advisor: DR. LAURA SMOLINSKI, COLLEGE OF NURSING

5:30 p.m.

JAVIT THAO
BIOMEDICAL SCIENCE

“Genomic Annotation of Odorant Receptors
in the Red-Headed Ash Borer, *Neoclytus acuminatus*”

The senses of smell and taste are important to the survival and reproduction of insects, and the diversity of insect species means that there is an equally wide diversity of chemical-detecting receptors. Chemoreceptors are broadly classified into three families—odorant receptors (ORs), gustatory receptors (GRs), and ionotropic receptors (IRs)—and understanding these receptors could yield practical applications in pest control or even in the development of synthetic biosensors to detect chemicals and odors. However, chemoreceptors remain unexamined in many groups of insects. In the longhorned beetles, a large group of economically important insects that feed in wood, chemoreceptors have been fully identified from only two species. Here, I present initial work revealing the chemoreceptors of a third species, the red-headed ash borer, *Neoclytus acuminatus*. *N. acuminatus* is of interest because it is an invasive species in Europe but native to North America. Its larvae damage weakened and dead trees, which causes further decomposition, and it can damage the quality of wood products exported throughout the world. I have examined one third of the genomic content of the OR family, and I identified 39 ORs, suggesting approximately 120 ORs total in the *N. acuminatus* genome. This is similar to the genome projects of *Tetraopes tetraphthalmus* and *Anoplophora glabripennis*, which identified 122 and 132 ORs, respectively. With this new genomic annotation, I have set the stage for future functional characterization of ORs to determine their ligands, which could be the first step in identifying new control methods for *N. acuminatus* and preventing further economic and ecological damage.

Advisor: DR. ROBERT MITCHELL, BIOLOGY, COLS

6:00 p.m.

SEBASTIAN BARTON
BIOLOGY AND CHEMISTRY (PROFESSIONAL)

“Face Mask Degradation: Monitoring Plastic Degradation
under Variable Conditions Using FT-IR Microscopy”

For decades, scientists were worried about the macro-scale debris they could observe infesting marine and terrestrial ecosystems; however, this all changed upon the discovery of microplastics.¹ Although the rate of degradation of many microplastic sources has been measured, some sources, such as disposable face masks, have yet to be well studied.² While the quantity of microplastics from these sources has been evaluated, there is little data on how these plastics degrade and form microplastics.³ In this experiment, FT-IR (Fourier-transform infrared) microscopy examined the three polypropylene layers of disposable face masks—fibrous inner layer, melt-gusted middle layer, and nonwoven outer layer—under three simulated environmental conditions within a laboratory setting: suspended in water, seawater, or humic solution. Further analysis was performed with the addition of simulated dark and light conditions. Our results indicate that polypropylene is readily measurable under all conditions, but data suggest some chemical and physical changes occur as the systems are exposed over time.

References:

1. Thompson, R. C.; Olsen, Y.; Mitchell, R. P.; Davis, A.; Rowland, S. J.; John, A. W. G.; McGonigle, D.; Russell, A. E. Lost at sea: where is all the plastic?. *Science*. 2004, 304(5672), 838.
2. Frias, J. P. G. L.; Nash, R. Microplastics: finding a consensus on the definition. *Marine Pollution Bulletin*. 2019, 138, 145-147.
3. Ma, J.; Chen, F.; Xu, H.; Jiang, H.; Liu, J.; Li, P.; Chen, C. C.; Pan, K. Face masks as a source of nanoplastics and microplastics in the environment: Quantification, characterization, and potential for bioaccumulation. *Environmental Pollution*. 2021, 288, 17748.

Advisor: DR. JENNIFER CHRISTUS, CHEMISTRY, COLS



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THE HONORS COLLEGE AT UW OSHKOSH

DR. LAURENCE D. CARLIN, DEAN

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