Undergraduate Research and Creative Activity Symposium

April 15, 2021
A Letter from the Dean

Welcome to the twelfth annual College of Arts & Sciences Undergraduate Research and Creative Activity Symposium at Ashland University! This opportunity for students to present their scholarly and creative work has become a signature event in our college. Following the format of a professional conference, students will present original research and read original creative writing. CAS undergraduate students continue to make original intellectual and creative contributions to their disciplines early in their careers.

Undergraduate research and creative activity mentored by a faculty member, or in collaboration with a faculty member, enhances the educational experiences of our students. Engaged students present research at professional conferences; author and/or co-author publications in professional journals; compete and perform at state, regional and national levels; and exhibit work in a variety of venues.

Students who participate in undergraduate research and creative activity demonstrate increased persistence in the pursuit of an undergraduate degree, are more apt to pursue a graduate education, and report greater preparation for carrying out research, acquiring information and speaking effectively.

Faculty and students in the College of Arts & Sciences share a joy of learning that frequently translates into life-long professional relationships. We are delighted to share with you highlights of the outstanding work being conducted by our students in departments across the fine and performing arts, humanities, natural science and social science disciplines. Enjoy the day!

All the best,

Dawn R. Weber, Dean
College of Arts & Sciences
The College of Arts & Sciences
at Ashland

The College of Arts & Sciences is a vibrant academic community at the heart of the university undergraduate experience. Grounded in liberal arts, students prepare for careers in science, business, the arts, education, communication, government and service organizations as well as for professional programs and graduate school.

Ashland University Mission Statement

Ashland University, guided by our Christian heritage, is a comprehensive, private university that provides a transformative learning experience, shaping graduates who work, serve and lead with integrity in their local, national, and global communities.

Undergraduate Research and Creative Activity Symposium Committee

Chair, Dr. Christopher Swanson, Professor, Mathematics
Ms. Megan Connor, Director, University Writing Center
Dr. Allyson Drinkard, Assistant Professor, Sociology
Dr. Scott Garlock, Professor, Music
Dr. Nicholas Johnson, Assistant Professor, Chemistry
Dr. Peter Mallik, Assistant Professor, Psychology
Dr. Wendy Schaller, Associate Professor, Art
Dr. Kelly Sundberg, Assistant Professor, English
Ms. Sara Garska, Administrative Assistant (Program Design and Layout)
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Equiano’s Battle in Stockholm: Effects of Internalized Racism
Tyayia Zarelle’ June Young

Student’s Majors: Creative Writing, English, & Psychology
Faculty Sponsor: Dr. Sharleen Mondal, English

_The Interesting Narrative of the Life of Olaudah Equiano_ (1789) has inspired some compelling arguments for current scholars regarding race during the eighteenth century. Equiano’s autobiography talks about his identity in regard to whiteness. Equiano describes his enslavement from Africa, to Great Britain, to America. Equiano also uses his narrative to persuade readers to support the abolition of slavery. Literary scholar Ronald Paul argues that Equiano’s psychological dualism is a representation of the denial of Black self and the adoption of a White other. Although I agree with Paul, I think it is important to narrow down what Equiano’s racial alienation led to, which is internalized racism. For this reason, I will argue that looking at Equiano’s enslavement from the position of Stockholm Syndrome and its many elements will show how Stockholm Syndrome aided in his internalized racism. Investigating deeper into the text with a psychoanalytic lens allows for a vast understanding of how Stockholm Syndrome, the act of becoming emotionally attached to one’s kidnapper or abuser, aided in Equiano’s experience, and the prosperity of slavery as a whole. Over the course of his narrative he becomes emotionally dependent on his various “masters.” He even goes as far as trying to protect his enslavers in his narrative. For instance, he never gives himself credit when speaking about his education, and instead gives all the credit to them. Exploring the story from the perspective of Stockholm Syndrome also raises the question of how free Equiano truly was.
Writing and Publishing Personal Creative Nonfiction: How to Breathe Through It

Erika Gallion

Erika Gallion is a 2014 graduate of Ashland University. Erika graduated Magna Cum Laude with double degrees in English and Creative Writing as a part of the AU Honors Program. After graduating from AU, Erika went on to complete a master’s degree at Kent State University where she studied Higher Education Administration. Her career has been centered on international efforts within Higher Education - she has worked at the University of North Florida as a Study Abroad Advisor and International Student Advisor, UCLA as a graduate student advisor, and now works at USC in International Admissions. Erika’s creative writing has appeared in Entropy, Angel City Review, The Racket, Women’s Review of Books, and more. She has a monthly Substack newsletter and a website (www.erikagallion.com). Currently, she lives in Los Angeles, California with her fiance and cats. She is working on completing her memoir and finding an agent to sell the book.

Writing has been a daily practice for me since I learned to write and read. As an adolescent, writing took place in the solitary spaces of my mind and journal; I was extremely hesitant to share my work with anyone. During my four years at Ashland University, I learned how to share my work and how to accept criticism. I began feeling comfortable sharing my work in workshop settings, but worried about what would become of my writing and the progress I’d made once I graduated from AU. I completed a master’s degree in Education and my career took the path of administration within Higher Education. Throughout my career, though, writing has stayed constant for me, and in 2018, I began sending my writing out for publication. As a mainly creative nonfiction writer, sharing my work can bring forth difficult memories or emotions, such as shame, grief, and the perplexing experience of wondering if the story I’m telling is actually mine to tell. Despite these difficulties, I’ve found contentment in the publishing process, and know that examining the human condition, which writing is ultimately about, is something I have a deep interest and talent in. I will read the first creative piece of mine to be published (via Entropy in 2018) and discuss the difficulties and joys of publishing such personal work.
Synthesis of Phosphazene Drug Delivery Systems & the Investigation of Imidazole-Based Compounds as Anti-Cancer Agents

Evan Thomae

Student’s Major: Biochemistry
Faculty Sponsor: Dr. Nicholas Johnson, Chemistry

The use of imidazolium salts and their derivatives as potential anti-cancer molecules is gaining attention within the medical field; however, imidazolium salts, and many other pharmaceuticals, suffer from the loss of water solubility (hydrophilicity) as the anti-cancer activity increases. The effects of the decreased solubility can be circumvented by attaching the drug molecule to a carrier molecule with high hydrophilicity. Utilizing a phosphazene, we were able to synthesize a tunable drug delivery system. Phosphazenes possess many qualities that make them a favorable candidate for drug delivery systems. The ease of substitution that phosphazenes possess makes them a favorable delivery candidate for our research utilizing imidazoles as a potential anti-cancer agent. Highly water-soluble groups, such as tetraethyleneglycol monomethylether (TEGME), can be added to the phosphazene while still leaving points of attachment open for imidazolium salts. Imidazolium salts are being studied for their potential anti-cancer activity that comes from their structure, containing primarily insoluble portions that increase the anti-cancer activity of the molecule. We have synthesized a benz-imidazole based compound in order to explore its potential anti-cancer activity. The imidazole that was synthesized contained an alcohol moiety for future attachment to the aforementioned phosphazene drug delivery system. Results from this study were characterized via $^1$H and $^{13}$C NMR spectroscopy.
The (Not So) Good, Bad, and Ugly: Adolescent Alcohol Exposure  
Dr. David Werner

Dr. David Werner graduated in 2001 with a double major in biology and chemistry. While at Ashland, he was a member of the Honors Program and completed his thesis under the guidance of Dr. Brian Mohney. David was also a collegiate athlete in swimming throughout his time at Ashland, and was involved in Greek life. Following graduation, he continued onto his graduate studies at the University of Pittsburgh School of Medicine specializing in neuropharmacology, followed by a postdoctoral fellowship at the University of North Carolina School of Medicine. He is currently a tenured associate professor and Director of Graduate Studies for the Department of Psychology and Behavioral Neuroscience at Binghamton University, State University of New York, where his lab focuses on intrinsic and extrinsic developmental factors related to substance use disorder, primarily alcohol.

Despite its widespread societal use, much remains unknown regarding alcohol use and consequences therein, particularly during adolescence when the brain is still undergoing major developmental changes. This presentation will give an overview of the current state of understanding adolescent alcohol use vulnerability, its relationship to alcohol use disorder later in life, and novel translationally relevant preclinical interventional conduits.
Oral Session II
10:30-11:30 a.m.
Investigating the Role of γN-Crystallins in Zebrafish Eye Lens Development

Adil Hussen

Student’s Major: Biology
Faculty Sponsor: Dr. Mason Posner, Biology

Zebrafish are important model organisms for the analysis of eye lens development and vision diseases like cataracts. Similar to other vertebrates, the zebrafish lens is composed of crystallin proteins (α, β, and γ) that are largely responsible for maintaining its transparency. While many studies have examined the functions of α-crystallins, little is known about what γ-crystallins do in the lens, especially a subtype called the γN-crystallins. Therefore, our goal was to use CRISPR gene editing to examine the role of γN1- and γN2-crystallin. We injected zebrafish zygotes with a mix of four guide RNAs to direct Cas9 protein to damage each γN-crystallin gene. Microscopic analysis of the embryos at 4 days after injection showed that 83.3% of lenses were abnormal. We found two types of defects in the lenses. The most common was an abnormal central pitting. Some lenses also showed disorganization in the radial arrangement of fiber cells. Furthermore, the lens diameters of the γN-crystallin CRISPR damaged embryos were significantly smaller than those of untreated embryos (P<.001, Tukey post-test). These results suggest that both γN-crystallins are required for normal lens development. We are now generating a population of zebrafish with a nonfunctional γN2-crystallin gene to facilitate further experiments on the role of this protein. We have successfully generated a mutation using multiple guide RNAs that deleted ~3000 base pairs of the gene and confirmed this mutation with PCR genotyping. We provide the first evidence that γN-crystallins are required for lens development and are generating tools that can be used to examine their roles in the development of the vertebrate lens.
Triumphus et Ruina autem Leviathan: A Critique of Christianity’s Embrace of the State as Savior
Nathan Sims

Student’s Majors: Religion, Philosophy, & Political Science
Faculty Sponsor: Dr. Craig Hovey, Religion

The Christian faith has a rich history of relationships to societies and governments. Both the church and the state have taken many different stances on the relationship between the church and the state throughout history. However, the rise of early modern political philosophers such as Hobbes, Locke, and Machiavelli ushered in a new age of church-state relationships. Mark Lilla calls this the Great Separation, which relegates the church to a position which is under the jurisdiction of the state and makes the state the sovereign of the church. This shift is problematic for the church because it has resulted in the church idolizing the state, replacing God as savior with the state as savior. The most blatant example of this is the allegiance of the German Christian Church to Adolf Hitler. I was driven by the desire to know why the church accepts the state as savior and how, if there is any way, to keep the church from idolatry of the state. The use of Romans 13 by the German Christian Church is what spurred both the critique of the church’s theology and the state’s theology regarding their relationship. I discovered a way to recognize the theological significance of the state, by reading and analyzing theologians like Karl Barth, Augustine, and William Cavanaugh, while at the same time recognizing the church’s relationship to the state as an entity that provides goods to the church but also threatens the political integrity of the church’s existence. This led me to extend Augustine’s teachings on disordered desires to the realm of the state and revealed that the state’s telos in the end time events is to eventually disappear and give way to the Kingdom of God.
The design and synthesis of polymers for use in biomaterial applications (e.g., drug-delivery and antimicrobial agents) is an important area of current research. Most polymers used in biomaterial applications have a linear structure compared to star-shaped polymers, which is the focus of our research group. The synthesis and study of star-shaped polymers is significant because of the potential for star polymers to have different properties than their linear counterparts. In this presentation, efforts to synthesize new six-armed calixarene-core polylactide/polyethylene glycol (PLA-PEG) star block copolymers will be described and compared to our research group's earlier synthesis of four- and eight-armed calixarene-core PLA-PEG copolymers. The six-armed calixarene-core PLA-PEG star block copolymers have been synthesized in several steps. First, six-armed PLA star polymers were prepared using an appropriate calix-6-arene initiator in a Sn(II)-catalyzed ring-opening polymerization of lactide. Subsequent incorporation of alkyne functional groups at the end groups of the star PLA chains provided a handle for attaching PEG blocks using a copper-catalyzed click reaction. No-deuterium (No-D) NMR spectroscopy has been used to successfully follow and optimize this challenging polymer coupling. Efforts are currently underway to scale up the synthesis of calixarene-core star polymers in order to further research their use in biomaterial applications.
Headphones: A Familiar Story
Tyayia Zarelle’ June Young

Student’s Majors: Creative Writing, English, & Psychology
Faculty Sponsor: Dr. Deborah Fleming, English

“Headphones” is an essay about the effects catcalling has on young women and the extremes these women will go through to divert this unwanted attention. Once women begin to experience catcalling, using headphones for musical entertainment is no longer their sole reality. Instead they are forced to carry headphones around as a security blanket to protect them from catcallers. Headphones discourage some men from catcalling because they usually do so at a distance, and headphones make it easier for women to pretend they did not hear. I discuss how to address catcalling and the traumas it can cause better than we have in the past. Movements such as “Me too” have caught the attention of millions, making the conversation easier to bring up and allowing young women to come into contact with others who share similar stories. I also discuss how catcalling is so normalized that it is seen as a “rite of passage” for teen girls. These young women are often told they are overreacting to these advancements and are questioned by peers and family rather than supported. Other times they are coerced into simple things such as giving out their phone number. These men will harass women until they feel as if they have to give into the men’s wishes in order to get out of the situation safely. The essay also discusses the effects catcalling can have on women of different backgrounds. Women of color, particularly Black women, often face more severe catcalling and at younger ages.
Poster/Exhibition Session I
11:45-12:45 p.m.
Developing a New Method for the Analysis of Volatile Chemicals
Kayla Lightcap

Student’s Major: Chemistry
Faculty Sponsor: Dr. Jeffrey Weidenhamer, Chemistry

*Alliaria petiolata*, or garlic mustard, releases small amounts of volatile, biologically active chemicals from its roots, including benzyl isothiocyanate (BITC). Isothiocyanates provide a defense against herbivores and pathogens, as well as other plants. Isothiocyanates are biologically active at very low (micromolar) concentrations, and this combined with BITC’s volatility has made it difficult to develop sensitive analytical methods that can be used in the field. Our research goal is to trap and analyze BITC through a new sampling method where a syringe needle is placed inside a gas chromatography-mass spectrometry (GC-MS) vial containing silicone tubing. Silicone is effective in trapping nonvolatile chemicals, so our hope was that it would trap volatile chemicals as well. BITC will diffuse through the needle into the vial but remain in the silicone. The silicone is then extracted with solvent and the BITC trapped is analyzed by GC-MS. The most effective method for our purposes was Selective Ion Monitoring (SIM), in which particular ions produced by BITC are measured, giving higher sensitivity. Preliminary results showed inconsistencies, but also showed that BITC can be trapped and retained on the silicone. Success in retaining enough BITC in our sampling vials is a large step towards reproducible analysis of volatile chemicals in soil. Further studies are planned to characterize the length of time required for BITC to absorb in the silicone, the rate at which it is lost from the vials if undisturbed, and how needle diameter and placement affects BITC recovery.
Visual and Auditory Memory Differences
Julia Valeiro Paterlini

Student’s Major: Psychology
Faculty Sponsor: Dr. Christopher Chartier, Psychology

Auditory and visual memory are important aspects to be studied because they are the reason why living beings are able to retain and retrieve important information, emotions, and events from the past. Cohen, Horowitz, & Wolfe, (2009) found that visual memory is far superior in memory recollection than auditory memory. This may be because visual memory has better cognitive accessibility. The purpose of this study was to find out if, when an image and a sound are paired together, they could aid each other in memory recollection. Participants were exposed to 50 matching images and sounds (e.g. image of a dog and a sound of a dog barking) and 50 mismatching images and sounds (e.g. image of a bird and the sound of a car’s horn). To allow memory decay, participants took a demographic survey, and then they received a questionnaire with very detailed descriptions of images and sounds such as “You were exposed to an image of a small red car.” Participants then had chosen 1 of the 3 answers, 1. Yes, I remember; 2. No, I didn’t; and 3. I don’t remember. A within-subject ANOVA revealed a significant difference between the matching and mismatching conditions, \( N=45, F (1,44) = 2.30, p= 0.003 \). Participants performed worse on the mismatching items \( (M = 0.61, \ SD = 0.49) \) than on the matching items \( (M = 0.69; SD = 0.47) \). The results suggest that people remember better when an image and a sound are complementary to each other.
The Impact of E-Cigarette Exposure on the Metabolism of Male and Female C57/BL6 Mice
Gabriella Hartz

Student’s Majors: Biology & Psychology
Faculty Sponsor: Dr. Dolly Crawford, Biology/Toxicology

Inhalation of e-cigarette vapor may shift metabolism from a carbohydrate-based system to a lipid-based system, but this has not been empirically tested. I tested the hypothesis that inhalation of e-cigarette vapor will cause a shift to a lipid-based metabolism in male and female C57/BL6 mice using indirect calorimetry. Six mice (three males and three females) aged between 177-296 days were exposed to either room air (controls) or 15-seconds of e-cigarette vapor (experimental) in a 1 L chamber over a period of fifteen minutes. The volume of CO₂ produced and O₂ consumed was measured using a GA-200 gas analyzer (iWork Systems, Inc.). The respiratory exchange ratio (RER) is the ratio of CO₂ to O₂; an RER > 0.70 denotes carbohydrate metabolism and RER < 0.70 is indicative of lipid metabolism. The statistical analyses assessed the impact of the independent variables on the dependent variables (RER, O₂, CO₂) using the Wilcoxon and Kruskal-Wallis tests in R v.3.4.3. Tests of normality were validated for RER (W=.441, p<.001), CO₂ (W=0.853, p<.001), and O₂ (W=.907, p=.002). Animals exposed to e-cigarette vapors (N=40) had lower median RER (W=86.85, p=0.006 and higher) CO₂ production (W=53.28, p=0.003) compared to the controls (N=24). These results suggest that inhalation of e-cigarette vapor produces a shift toward lipid metabolism, which may have significant health consequences. Additional research is needed in order to fully extrapolate the interrelationship between e-cigarette exposure and metabolism.
Synthesis of Phosphazene Based Drug Delivery System & the Investigation of Incorporating Targeting Groups
Patricia Alley & Zoey Lockwood

Students’ Majors: Biology (PA) & Biochemistry (ZL)
Faculty Sponsor: Dr. Nicholas Johnson, Chemistry

Approximately 1.7 million American people are diagnosed with cancer each year. Due to the large number of diagnoses, the need for effective cancer treatment is essential. Most current pharmaceuticals are lipophilic (fat soluble) molecules which have inherent issues of delivery throughout the body. Therefore, these pharmaceuticals must become more hydrophilic (water soluble) to be fully utilized. Cyclichlorophosphazenes can be utilized to increase the aqueous solubility of the current pharmaceuticals. Substitution can occur at six different sites within the cyclichlorophosphazenes because the phosphorus atoms are highly substitutable. Anaerobic techniques were utilized to increase the aqueous solubility of the drug delivery system, tetraethylene glycol mono-methyl ether (TEGME), onto the phosphazene trimer ring. Once three equivalents of TEGME are substituted, there are three more sites available for different modifications and substitutions. The primary focus of our research is to add the targeting agent, triphenylphosphonium cations, to the previously synthesized phosphazene system along with an anti-cancer agent. This targeting agent has demonstrated effectiveness in attacking the mitochondria of cancerous cells and may lead to increased efficiency while also decreasing toxicity. The results of this study were primarily characterized using proton, carbon, and phosphorus NMR.
An Investigation of Fish Biodiversity in the Ashland University Canfield & Dayspring Preserves with Respect to Species Tolerance & Upstream Habitats as Indicators of Water Quality

Kassandra Blackburn

Student’s Majors: Biology & Toxicology
Faculty Sponsor: Mr. Merill Tawse, Biology

Aquatic habitats are known to be good indicators of environmental pollution as they accumulate contaminants from the adjacent areas. This project investigated the fish biodiversity within two Ashland University preserves and compared their streams based on species tolerance and upstream habitats as measures of water quality. The Canfield Preserve has a small to mid-sized stream that has passed through agricultural land near State Route 250 in Ashland County. The Dayspring Preserve has a small stream that drains from and through wooded properties in Coshocton County. Field sampling was conducted during the summer of 2020 using seines, D-nets, minnow traps, and visual counts to catalog species and populations. The primary species at Canfield was the Creek Chub, *Semotilus atromaculatus*, a highly tolerant fish to polluted waters. The primary species at Dayspring was the Western Blacknose Dace, *Rhinichthys obtusus*, a less tolerant species that prefers high gradient streams with water free of silt. Both sites also supported varied populations of mottled sculpin, green sunfish, and several darter species. Some moderately sensitive species were found at Canfield; however, particularly sensitive species were absent or scarce. As the upstream waters of this site run through farmland, run-off of agricultural chemicals and silt are likely pollutants. The water upstream from Dayspring, in comparison, is primarily surrounded by woodland that is less likely to be a source of chemicals or eroded soil. Additional biological assessments may be done to further the understanding of the differences in species diversity at these and other university preserves.
Microplastics are small plastic particles, measured at less than 5 millimeters, that can infiltrate bodies of water, harming aquatic life and contributing to pollution of the water source. While previous research has measured microplastics in other MidWest rivers, we are interested in Lang Creek and its tributaries that flow through the Canfield Preserve and downtown Ashland, OH, as well as residential areas S/ SE of Ashland University’s campus. The hypothesis being tested is that microplastic concentrations decline with distance downstream of the source, as they are diluted or buried in the stream sediment.

In fall 2020, samples were collected from the river at seven locations along three streams in the Lang Creek Basin, each flowing through parts of the basin that are more urban, suburban, or agricultural. There are three pairs of locations, representing upstream and downstream, as well as samples from below the Ashland Wastewater Treatment Plant. Four-liter whole-water samples were collected along with turbidity and other water quality measurements at each site. The lab analysis included gravimetric separation of the microplastics from sediments in the suspension. The abundance of microplastics ranged from 11.3-37.0 particles/liter. The upstream sites had slightly higher microplastic concentrations than their correlating downstream sites. These samples assure that there is a baseline for comparison with future measurements and monitoring of change over time. The information collected from this research can be used to inform ongoing community projects towards improving and sustaining their resources.
Soil Degradation Dynamics of Thiophenes Released by Marigolds
Maykahla Gain & Zoe Shellenbarger

Students’ Majors: Toxicology & Environmental Science-Biology
Faculty Sponsor: Dr. Jeffrey Weidenhamer, Chemistry

Thiophenes are naturally occurring compounds exuded from marigold roots which are toxic to other plants and help defend against pathogens and herbivores. Alpha-terthiophene (Alpha-T) and 5-(3-buten-1-ynyl)-2,2′-bithienyl (BBT) are two of these compounds. Though highly beneficial, the degradation of these compounds in soil has not been thoroughly studied, providing the objective of the experiment. BBT was isolated from marigold root extract and spiked onto sterile and non-sterile soil at three different concentrations: 1, 5, 10 microgram BBT per gram soil, rates known to be comparable to actual thiophene levels under marigolds. The soil was extracted at ten time points and analyzed using high performance liquid chromatography (HPLC) with fluorescence detection. Preliminary studies suggested BBT will break down similarly to Alpha-T. We found the time it took for the spiked alpha-T concentration to degrade to half its original amount was 4.65 weeks for sterile soil and 3.02 weeks for non-sterile soil. This aligns with the hypothesis that microbial interactions will speed compound degradation. By contrast, we found that sterile soil contained half of the original concentration of BBT at 3.6 weeks, but that the half-life was longer, 5.5 weeks, in non-sterile soil. This unusual result counters initial predictions that BBT will degrade at a faster rate in non-sterile soil due to microbial interactions. The extracted BBT standard was found to be impure, which may have impacted the results. Further experiments with more highly purified BBT will be required to confirm these results.
Poster/Exhibition Session II
12:45-1:45 p.m.
Capturing & Quantifying Volatile Organic Compounds from Garlic Mustard
Maykahla Gain & Zoe Shellenbarger

Students’ Majors: Toxicology & Environmental Science-Biology
Faculty Sponsor: Dr. Jeffrey Weidenhamer, Chemistry

Many plants produce volatile chemicals involved in both defense and communication, known as allelochemicals. *Alliaria petiolata*, or garlic mustard, is an invasive species in North America and is a plant that produces potent allelochemicals. Garlic mustard releases allyl-isothiocyanate (AITC), a compound that is also found in horseradish, giving it its pungent smell. AITC has proven to be difficult to quantify in field experiments due to its high volatility. The objective of this study is to create a new method that can capture and quantify AITC and can be used in the field. It is known that AITC absorbs onto silicone tubing, a material that absorbs nonpolar compounds, but desorbs after short periods of time. With this new method, syringe needles are inserted into sealed vials containing silicone tubing. AITC vapors diffuse through the needle and are trapped on the silicone inside the vial. To quantify the captured AITC, the tubing was extracted and analyzed using Gas Chromatography (GC) with flame ionization detection. We found that the capturing method retained roughly 70% of the originally spiked concentrations, 0.15 milligram/liter and 1.5 milligram/liter, over a two-week period at the two concentrations studied. The study also showed that AITC was retained for a longer period when a thinner needle was used. The capturing method was successful in the laboratory and will be examined in a field study.
Getting Them on Their Own: Methods of Bacteriophage Isolation for Broadening Host Range
Megan Lollo & Joshua Davis

Students’ Majors: Biology (ML, JD) & Toxicology (ML)
Faculty Sponsor: Dr. Paul Hyman, Biology

Bacteriophages are viruses that infect bacteria. They are found in different environments, including soil, which was the bacteriophage source utilized for this research on bacteriophage host range. Host range is a characteristic of viruses that describes which cells the virus is capable of infecting. Knowing which bacteria are infected by which bacteriophages facilitates a greater understanding of the microbial ecology of soil. Additionally, the isolation and host range characterization of bacteriophages can be useful in the practice of phage therapy, using bacteriophages to treat bacterial infections. We wanted to assess whether adding a specific host to the isolation sample would produce bacteriophages with a broader host range than isolation relying on bacteria already in the same soil sample to initially grow the bacteriophages. Bacteriophages were isolated from several soil samples found in a variety of locations. Some samples were inoculated with Bacillus cereus 6A3 bacteria, while others were left uninoculated. Bacteriophages were isolated from these samples, and, through procedures of passaging and amplification, stocks of phage were obtained. From these stocks, host range was determined. There did not seem to be a distinct difference in the host range pattern between the samples with and without bacteria. Throughout both of these, there was a mixture of broader and narrower host ranges.
Phosphazenes & Metal-Organic Frameworks
Benjamin Jones

Student’s Major: Geology
Faculty Sponsor: Dr. Nicholas Johnson, Chemistry

Metal-organic frameworks (MOFs) have been increasingly gaining interest due to their highly variable and tunable structures. MOFs are compounds consisting of organic ligands chelated to metal ions which result in a porous cage-like framework. These open structured compounds have numerous applications and show great potential in carbon capture, energy storage, and drug delivery. The typical organic component of a metal-organic framework contains aromatic rings. The focus of this study is to synthesize metal-organic frameworks that are phosphazene based. Phosphazenes, which are compounds consisting of alternating phosphorus and nitrogen atoms, are extremely versatile and easily substitutable. By modifying cyclophosphazenes with carboxylic acids, a ligand was created to chelate to various precious and base metals through organometallic synthesis. Several experiments were conducted with a series of different transition metals; however, gold, silver, and copper displayed the most promising results. Adsorption trials were conducted utilizing common organic dyes and their adsorption capabilities were tracked via UV-spectroscopy.
Using Solid-Phase Sediment Extraction (SPSE) with Hydrophobic Pesticide Contaminants in Sand

Destiny Whitmer

Student’s Majors: Biology & Toxicology
Faculty Sponsors: Dr. Jeffrey Weidenhamer, Chemistry & Dr. Andrew Trimble, Biology/Toxicology

Solid Phase Sediment Extraction (SPSE) is an innovative passive sampling technique that is quick, inexpensive, and adaptable compared to other methods of trace pesticide analyses. Passive sampling is an environmental monitoring technique involving the use of a collecting medium to accumulate chemical pollutants in the environment over time. The aim of this study was to use silicone-based tubing to passively sample pesticides in sand. The pesticides used include insecticidal compounds in current use today, along with legacy pesticides that are no longer used, but still remain at detectable levels in the environment. The extraction efficiency of the probes was evaluated at low concentrations using 10 ppb DDE, DDD, methoxychlor, lindane, and chlorpyrifos, 50 ppb bifenthrin, and 300 ppb imidacloprid. Extraction efficiency was also evaluated at high concentrations using 30 ppb DDE, DDD, methoxychlor, lindane, and chlorpyrifos, 100 ppb bifenthrin, and 500 ppb imidacloprid. Using a gas chromatograph that is equipped with an electron capture detector (GC-ECD) sensitive to halogenated compounds, pesticide residues were detected following hexane extraction of the compounds. More pesticide was extracted from the probes as pesticide concentrations increased and as the time the probes were exposed to sand increased. The findings reveal how effective it is to measure pesticide residues in solid environmental media using this passive sampling method. This methodology potentially can be utilized in future studies for a variety of applications, in areas such as food, environmental, biological, pharmaceutical, and forensics fields. Further projects will include analyzing real sediment samples from the Black Fork Wetlands.
Water Quality Testing of Lang Creek Basin in Ashland, Ohio
Allison Whitt

Student’s Major: Biology
Faculty Sponsor: Dr. Patricia Saunders, Biology

Water is essential to life, so it is crucial to study concerns with local bodies of water as they have significant impacts on the surrounding environment and human health. Lang Creek in Ashland, Ohio was chosen due to its proximity to campus and public interest in its quality. Lang Creek water improves at more natural sites and collects pollutants as the water travels through less natural land. The objective of this project was to gather information on 24 sites in the Lang Creek watershed using water samples, a turbidity stick, and water quality sensors to measure dissolved nutrient levels, turbidity, salinity, dissolved oxygen levels, conductivity, and temperature. Samples were taken at 24 sites along Lang Creek approximately every two months from March to November of 2020. Pairs of sites were compared upstream and downstream of wooded sections. The study results include differences in elevated levels (upstream vs. downstream) of total dissolved solids, phosphates, and nitrates for different areas of Lang Creek Basin. This information provides a baseline for comparison with future monitoring data, indicates locations that could benefit from further assessments and interventions, and increases awareness of the different impacts that human activities have on Lang Creek. Further, these results can be used to manage local streams for safe private and public recreational use.
Inventory of Ambystomid Salamanders at Minnich Pond
Brenda Boes

Student’s Major: Environmental Toxicology
Faculty Sponsor: Mr. Merrill Tawse, Biology

This study observes the population of two species of salamanders (*Ambystoma tigrinum* and *Ambystoma texanum*) in Mansfield, Ohio. Population samples of the two species of salamanders were collected to find out which species were in the area as well as their relative abundance to each other in the vernal pool (seasonal wetlands) located near Minnich Manufacturing. The collecting of the salamanders was completed by setting minnow tunnel traps inside the vernal pool. The traps were then checked each morning and the species, gender, and number of each species of salamander was recorded. Twenty-four traps were used in various areas of the vernal pool. Within a month of collecting data, it was found that the *Ambystoma texanum* were mostly caught around the areas that had trees surrounding the vernal pool and the *Ambystoma tigrinum* were mostly caught around the area where there were no trees. The research was started in late February 2020 and went into early April 2020. As temperatures increased in the springtime, it was found that the *Ambystoma texanum* population increased until it hit mid-March. As the experiment went on, the *Ambystoma texanum* population decreased as the *Ambystoma tigrinum* population increased. There were more males than females in the sample of salamanders. For the *Ambystoma texanum* the sample count reached twelve males without any females present. If a female *Ambystoma texanum* was present, the male count reached as high as twenty-four individuals. For the *Ambystoma tigrinum*, the number of males tripled upon introduction of a female.
Overall Health and the Contributing Variables of Stress, Companionship, and Life Satisfaction

Agatha Loucks

Student's Majors: Criminal Justice & Psychology
Faculty Sponsor: Dr. Allyson Drinkard, Sociology

Stress, companionship, and life satisfaction are factors that have an impact on health. The current study examined how stress, companionship, and life satisfaction impact overall health. A secondary analysis was conducted using General Social Survey data (2018) consisting of 696 complete cases. The Stress Process framework, developed by Pearlin in 1981, was used to frame this study. The three null hypotheses stated that stress, companionship, and life satisfaction had no relationship to overall health. Univariate analysis, bivariate analysis, mean comparisons, and multiple regression were conducted. Results showed that each of the three null hypotheses were rejected because stress, companionship, and life satisfaction had statistically significant associations with overall health.
Oral Session III
2:00-3:00 p.m.
Superior Origins: How Empires Craft Their Identities to Assert Dominance
Joshua Jasmin

Student’s Majors: Political Science, History, & Spanish
Faculty Sponsor: Dr. Gregory McBrayer, Political Science

When considering the world’s greatest empires, one usually thinks of the Roman empire and the Aztec empire in different spheres. Separated by a vast ocean and almost a millennium of time, their cultures and stories may seem at first glance to be completely foreign to one another, lacking even the remote possibility of having come into direct contact. Nevertheless, a closer examination reveals striking similarities between the two and suggests a larger pattern common to all empires. Drawing upon recorded mythology and archeological evidence, this study asserts that military dominance alone does not define an empire and that the Roman and Aztec empires demonstrate three areas of dominance necessary for an empire to exist: origins, religion, and technology. These two empires crafted nearly identical historical origin stories to establish the legitimacy of their dominance over other states. Both stories begin with the birth of a people from a fiery disaster, tell how the gods gave them a quest to find a new home, and end with the building of a city at a divinely ordained location. Once the city is built, it prospers in accordance with the promises of the gods, justifying the shadow it casts over its neighbors.
Optimizing Initial Settlement Placements in *The Settlers of Catan*
Josiah Moore

Student’s Major: Computer Science
Faculty Sponsor: Dr. Christopher Swanson, Mathematics

*The Settlers of Catan* is a popular board game that has a heavy emphasis on resource management and maximizing the odds of obtaining more resources. Every game uses a randomized board that consists of numbered tiles. Players can place settlements on intersections of these tiles. On each turn, two dice are rolled and if a player is settled next to a tile that has the sum that was rolled, they gain resources that will help them win the game. This means that the starting tiles a player chooses to settle on dictates the odds of obtaining resources throughout the game, so it ends up being the single most important decision made in the game. In order to increase the chances of winning the game, I have designed and written a program where the user is able to either manually enter a specific game board or have one randomly generated for them. The program will then calculate and display the most optimal settlement locations on that game board. The program does this by using five unique strategies that are each designed to fit different playstyles. For example, one strategy best supports playstyles based around trading, and another one supports players who would rather prioritize expanding their settlements as much as possible. Each strategy has its own way of evaluating what the most optimal settlement locations are regarding that specific playstyle. This allows the user to choose the strategy that best matches their own personal playstyle.
Intellectual Disabilities and Reformation Theology: What Do Luther and Calvin Have to Say?
Alec Dunlap

Student’s Majors: Religion & Philosophy
Faculty Sponsor: Dr. David Aune, Religion

This presentation explores how the theology of Reformation leaders Martin Luther and John Calvin help us to think about and minister to people with intellectual disabilities. It follows three major loci within the Reformers’ theological systems: the image of God in humanity, the providence of God, and the sacraments of the Church. This framework is used to show that the Reformation theology of Luther and Calvin is helpful today for ministering to those people with intellectual disabilities. The frameworks that Calvin and Luther provide allow us to see how people with disabilities should be viewed within the Church, how God is involved in their disabilities, and how they should be included in the life of the Church through the means of grace.
Leaching Potential of High-Cadmium Jewelry
Rachel Price

Student’s Major: Chemistry
Faculty Sponsor: Dr. Jeffrey Weidenhamer, Chemistry

Cadmium is a highly toxic metal, but has been found in high concentrations in some inexpensive jewelry. When ultimately disposed of as trash, this jewelry can end up either in landfills, where cadmium can leach out over time and contaminate the surrounding environment, or if waste is incinerated, cadmium contaminates the fly ash (burned landfill soil) which is then put on farmland, where it can be taken up by crop plants and then consumed. In this study, 34 jewelry samples were tested using an EPA procedure which evaluates potential hazards from solid waste. Samples were analyzed by atomic absorption, which gave cadmium concentrations in parts per million (ppm). The EPA limit for cadmium in TCLP fluid is 1 ppm. Only two samples were below this limit. There were nine samples between 1-100 ppm, fourteen between 100-500 ppm, seven between 500-1,000 ppm, and four between 1,000-4,000 ppm. These results show that even though jewelry makes up a small percentage of household waste, a large amount of cadmium can still be leached from these items. At present, the US does not regulate the cadmium content of inexpensive jewelry that is not intended for children. Cadmium is used in these items because it is inexpensive, and there are no regulations against using it. These results indicate that this approach needs to be reevaluated.
Oral Session IV
3:15-4:15 p.m.
Visual Attention Differences among Video-Game Players

Andrew Bailey, Miranda Bielawski, Natalie Clinger, Tyler Mothersbaugh, & Lacy Rasmus

Students’ Majors: Biology (TM), Psychology (AB, MB, NC, LR), & Spanish (TM)

Faculty Sponsors: Dr. Peter Mallik & Dr. Mitchell Metzger, Psychology

It has been demonstrated that individuals who are video game players outperform non-video game players in visual cognition (Bediou et al., 2018); however, this effect is not always observed leading to inconsistencies in the literature (Mack et al., 2016). Based on their self-reported video-game experience, seventy-four participants were divided into three groups and then completed several visual attention tasks. A mixed ANOVA comparing the gaming group and the number of distractors on the screen was conducted for the visual search task for response time (RT) and accuracy. For RT, there was a significant between-subjects effect for gamer group $F_{(2, 69)} = 6.376, p=0.003\eta^2_p = 0.156$. Non-gamer and moderate gamer’s RT was significantly slower than heavy gamers (over 10 hours a week). There was a main effect for distractor count with RT being slower when there were more distractors $F_{(3, 207)} = 37.790, p<0.001\eta^2_p = 0.35$. For the Posner cueing task (Probe and target on the same side for congruent and different sides for incongruent), an ANOVA showed that the heavy gamer group had faster RT (indicating a smaller cueing effect) than the other groups $F_{(2, 72)} = 3.306, p=0.042\eta^2_p = 0.08$. The data indicate that there is a relationship between visual cognition and “heavy” videogame playing as opposed to non-gaming or moderate gaming. This has demonstrated that not all aspects of visual cognition are differentially related to video-game involvement.
The Impact of $\alpha$-Crystallin Loss during Lens Aging
Taylor Kaye

Student’s Major: Biology
Faculty Sponsor: Dr. Mason Posner, Biology

Cataracts are the leading cause of blindness worldwide and typically form when aging protein aggregates and blocks light passage through the lens. Previous studies show that proteins called $\alpha$-crystallins inhibit protein aggregation and slow cataract formation. However, the specific role of each $\alpha$-crystallin is not known, and the presence of two $\alpha$B-crystallin genes in the zebrafish provides a unique opportunity to dissect the functions of this protein. Our lab has engineered zebrafish that lack each $\alpha$B-crystallin gene. In this study, we examined lenses from these fish as they age to determine the impact of losing each $\alpha$B-crystallin on lens clarity and size. Fish from each strain were anesthetized and euthanized at 6, 12, 18 and 24 months of age and their lenses removed. Microscopy was then used to assess lens clarity and measure diameter. The diameter of normal and knockout zebrafish lenses relative to body length were compared. The $\alpha$Ba-crystallin knockout fish had significantly larger lenses (ANOVA, p-value < 7x10$^{-7}$). However, $\alpha$Bb-crystallin knockout lens diameters were not statistically different from normal fish. We observed two types of lens abnormalities that might impair vision. The first was a general opacity throughout the lens and the second was a localized irregularity near the surface of the lens. We are currently quantifying the prevalence of both abnormality types to see if they are more common with increasing age or knockout of an $\alpha$B-crystallin. These findings will help to detail the possibly divergent roles of different $\alpha$B-crystallins in preventing lens cataracts during lens aging.
“Memories for the Moment” is a personal essay about my grandmother’s gradually decaying memory and the struggle of seeing her regularly forget various aspects of her life. This essay emphasizes the privilege of memory, especially in the form of nostalgia, through a single morning at my grandmother’s house as I recall the days I spent there when I was younger. Each memory—painted happy and bright—is paired with the less-than-spectacular reality of the present and the mournful realization that things have changed. Though I am able to compare what used to be with the present; my grandmother no longer shares that opportunity. In conversation, she forgets what she has said previously, she tells the same story multiple times a day, and she’s slowly beginning to not recognize those close to her. I’ve also included stories of my dog from that morning. As she was always having adventures or finding something new to explore, she provides a mirror to my youth. This essay gives voice to my fears through my account of the days spent at my grandmother’s house, her lack of awareness of how severe her forgetfulness has become, and my dog’s constant eagerness to make new memories. This personal narrative uses literary techniques such as metaphors, imagery, and symbolism to subtly speak on how much of a privilege memory truly is.
Bracketology: A Mathematical Approach to Elimination Brackets  
Brittany Close

Student’s Majors: Mathematics & Business Administration  
Faculty Sponsor: Dr. Gordon Swain, Mathematics

Every March, millions of people fill out tournament brackets as part of college basketball’s March Madness. Brackets are filled out in many ways, ranging from individual knowledge of the teams’ past performances to who has the better mascot, but have you ever wondered if there is a mathematical approach to filling out the bracket? This presentation will start with a brief explanation of two mathematical methods of “Bracketology,” the process of predicting the outcome of each game in an elimination tournament. In order to gain a better understanding of these methods, we will show how they can be applied to college life by predicting the winner of the Ashland University Intramural Basketball tournament. The methods and results will then be applied to the business world through the ranking of restaurants. Every year culinary experts work together to create a list of the World’s 50 Best Restaurants. The lists from 2009-2018 were used as the primary data where 10 restaurants, that appear on the lists for all 10 years, were selected for analysis. Head-to-head matchups were created, where a better ranking was considered a “win.” Finally, we will discuss a way of adding a handicap to game scores in order to produce a more mathematically competitive ranking through the use of 2018-2019 Big Ten Basketball data.