



# URSA

Undergraduate, Research,  
Scholarship and Arts.  
Benedictine University

## 2019 Poster Session Program

April 4, 2019 ❖ 12:30-4:30 pm ❖ Goodwin Hall atrium

Poster session abstracts are listed alphabetically by poster title.

◆ **Hajira Nayeemuddin**

“2-(2-Fluoroethyl)pyridine As an Organic-Soluble Source of Nucleophilic Fluorine”

2-(2-Fluoroethyl)pyridine has been investigated as an organic-source of nucleophilic fluorine. Pyridine's reactivity as a nucleophile and a stable aromatic system make it an interesting candidate for the generation of fluoride anions. Chemical reactions under mild conditions to create a new nucleophilic fluorinating reagent are desirable due to the important role that the incorporation of fluorine has in the pharmaceutical and agrochemical industries. These organic-soluble pyridine based substrates can successfully transfer their fluoride anion through substitution at a benzylic position to give benzyl fluoride.

*Faculty sponsor: Brooks Maki*

◆ **Lauren O'Connor**

“Air Pollution and its Effects on Skin: Investigating How Particulate Matter is Affecting the Skin of Laboratory Mice”

Particulate matter is a type of air pollutant consisting of particles such as dust and smoke that may contribute to skin problems such as premature aging, atopic dermatitis, or possibly skin cancer. The model organism *Mus musculus* has been used to study how particulate matter penetrates the epidermis and causes inflammation of tissues. However, limited studies focus on particulate matter and the specific skin diseases associated with this air pollutant. This study focuses on particulate matter and the skin using the model organism *Mus musculus*. After exposing mice to air containing particulate matter in a safe amount, the skin cells of the mice will be analyzed for damage or other problems. This research can help to protect the skin and prevent skin diseases. Individuals who are at risk for skin cancer or who are suffering from a skin disease can use this information for early treatment and prevention. Air pollution containing particulate matter may also be lowered in light of its negative effects on the skin.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Samia Douedari**

“Amazon: Is a Leadership in Energy and Environmental Design (LEED) Building Worth it?”

Amazon, the largest e-commerce marketplace and cloud computing platform in the world, is constructing a new headquarters in Washington D.C. The purpose of this research is to understand if building a Leadership in Energy

and Environmental Design (LEED) certified headquarters would benefit the company, as well as the environment. Based on reviews of previously built LEED buildings and the benefits they bring to companies, this may or may not be a viable option for Amazon. In order to assess this case, a number of studies will be examined regarding the benefits LEED buildings would have for the company and the environment, as well as the comfort of a LEED building and how it could be efficiently constructed.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Shawn Kumpuckal**

*“Amino-Oxazolines: Synthesis of Stable Organic Antioxidants”*

The synthesis and modification of multiple amino-oxazolines for exploration as antioxidants is presented. Antioxidants play a crucial role in maintaining and protecting human health. Due to the instability of naturally occurring antioxidants, it is difficult to observe and experiment with them. The natural antioxidant, methylglyoxal-derived hydroimidazolones (MG-Hs), becomes unstable once it is oxidized. The project involves synthesizing amino-oxazolines as replacements of the hydroimidazolone heterocycle and evaluating their stability and antioxidant activity. By replacing the heterocycle with oxazoline, the stability of the oxidation product is increased while the antioxidant activity is maintained.

*Faculty sponsor: Brooks Maki*

◆ **Emily Zimel**

*“Australopithecus africanus Cranial Capacity Ontogeny”*

*Australopithecus africanus* is a 2.5-million-year-old extinct hominin species. The type specimen, Taung, was about 3.73–3.93 years old at death, and had a cranial capacity (a rough estimate of brain size) of 404 ml, about the same size as the brain of a large male chimpanzee. However, it is unclear if Taung is male or female since 404 ml is small for adult specimens of *A. africanus*. It is necessary to determine how much more Taung’s brain would have grown in order to answer this question. Previous research increased Taung’s cranial capacity to 440 ml to account for the asymptotic amount of brain growth that occurs between Taung’s developmental stage and adulthood. I applied asymptotic growth curve models to data sets of chimpanzees, mountain gorillas, and modern humans in the programming language R in order to predict Taung’s adult cranial capacity. According to a chimpanzee growth model, Taung’s cranial capacity would have only increased by 1–2 ml, suggesting that Taung was a female. Since Taung is the only well-preserved juvenile *A. africanus* specimen, an understanding of its growth provides insight into the development and evolution of *A. africanus* adult craniofacial form.

*Faculty sponsor: Robert McCarthy*

◆ **Michael Skora**

*“Benedictine Bat Houses: Supporting Bats and Reducing Pesticides on Campus”*

*An Arthur J. Schmitt Future Leaders Project*

This Arthur J. Schmitt Future Leaders project aims to raise awareness of the effects animals have on our world, specifically bats. Worldwide, bats are important to any environment they live in by pollinating plants, spreading seeds, and eating insects like mosquitoes. They are also a key indicator of the wellness of wildlife areas. This project raised funds to build bat houses for Benedictine University in order to improve the biodiversity on campus.

*Faculty sponsor: Sandra Gill*

◆ **Ciera Duffy, Anna Thiel**

*“Bile Acid Effects on *Lactobacillus acidophilus* Quorum Sensing and Response”*

*Lactobacillus acidophilus* is a Gram-positive bacterium, naturally present as a microbial stabilizer of the human gastrointestinal tract. Previous work has shown that *L. acidophilus* can use bacterial quorum sensing (QS) in response to the gastrointestinal environment. Resulting functions from these QS systems allow bacteria to mediate adherence, biofilm formation, and metabolite production. We are focused on a QS system that involves production of a pheromone (SHP) and its subsequent interaction with a transcriptional regulator (Rgg). *L. acidophilus* contains

three Rgg systems from which Rgg<sub>155</sub> is the subject of this work. Rgg<sub>155</sub> has been found to have increased expression in the presence of bile acids. However, the cellular response to bile acids via Rgg<sub>155</sub> is not known. We have begun to characterize the *rgg*<sub>155</sub> operon. All genes present in the predicted Rgg<sub>155</sub> operon code for proteins of unknown function (157-159) including a potential peptide (156). We are currently analyzing Rgg<sub>155</sub> activity using transcriptional luciferase reporters. We have identified two bile acids, taurocholic acid (TCA) and deoxycholic acid (DCA), that affect the ability of *L. acidophilus* to adhere to surfaces.

*Faculty sponsor: Tiara Pérez Morales*

◆ **Syed Iqbal**

“Biomimetic Synthesis of Pyrrole-Based Natural Products”

Several families of pyrrole-based natural products have recently been isolated, and these structurally related compounds have been shown to demonstrate interesting bioactive properties. All of these compounds are derived from similar biological pathways which involve the combination of sugar metabolites and amines. An alternative route to these bioactive pyrrolidine structures has been investigated. The synthetic approach to this intermediate and its application to the synthesis of the representative natural product jiangrine will be reported. Current work is focused on expanding the scope of this route by investigating new substrates and targeting derivative structures of this key medicinal hetero-aromatic compound.

*Faculty sponsor: Brooks Maki*

◆ **Ziyad Abdelrahim, Zaain Ahmad, Milica Janosevic, Nourhan Mohamed**

“BRCA2 Gene mRNA Splicing Events in Breast Cell Lines”

BRCA2 is a tumor suppressor associated with increased breast and ovarian cancer risk. The BRCA2 primary transcript can be alternately spliced into multiple isoforms, some of which accumulate to higher levels in the cytoplasm of a cancer cell line than a non-cancer cell line. To determine whether there is a mechanism for regulating the localization of mRNA splice variants we utilized quantitative RT-PCR and applied it to analysis of a splice variant lacking exon 3 (delta 3). Methods: Nuclear and cytoplasmic fractions from a breast cancer cell line were prepared. Quantitative RT-PCR was used to determine levels of both full length BRCA2 mRNA and delta 3. Results: Using a modified quantitation method, we show that cytoplasmic accumulation of full length BRCA2 mRNA is 3.4 fold that of nuclear accumulation, while the cytoplasmic accumulation of delta 3 is 2.6 fold over that of nuclear accumulation. Conclusions: we have demonstrated that the apparent reduction of delta 3 in the cytoplasm of a non-cancerous cell line is less severe in a cancerous cell line, indicating subcellular localization of mRNA splice variants may work differently in different cell types.

*Faculty sponsor: James Fackenthal*

◆ **Ahsan Adil, Daniel Soto**

“Characterization of the *rgg*<sub>499</sub> locus in *Lactobacillus acidophilus*”

Bacterial communities present in diverse environmental conditions can respond to signals or stresses using quorum sensing (QS). QS involves production of a signal that can be recognized via cell surface or internal receptors. We are focused on a small family of transcriptional regulators called Rgg and their cognate small hydrophobic peptides (SHP), specifically, three predicted QS systems present in the human commensal *Lactobacillus acidophilus*. Rgg QS systems have been described in other Gram-positive organisms and they can promote responses such as biofilm formation and toxin production. We aim to characterize the Rgg<sub>499</sub> predicted QS system. Our preliminary work suggests *rgg*<sub>499</sub> is in a six-gene operon with another regulator (496) and a potential peptide (495). This predicted operon is located next to a carbohydrate utilization locus. We hypothesize that Rgg<sub>499</sub> may have effects on this operon given that sugars have acted as signals for other Rgg QS systems. We are currently testing the effects of various carbohydrates and small molecules on *L. acidophilus* and changes in *rgg* transcriptional expression using luciferase reporters in a heterologous host.

*Faculty sponsor: Tiara Pérez Morales*

◆ **Urva Mehveen**

“Cranial Capacity Estimates from External and Internal Cranial Vault Linear Measurements”

Several recent studies have reported estimates for cranial capacity from external linear measurements of the cranial vault that increase with age in ontogenetic series of radiographs or dry skulls. This does not reflect biological reality as brain growth in modern humans should be largely completed by five years of age. We explored this issue by (1) collecting 12 landmarks from the cranial vault and basicranium of lateral and anteroposterior radiographs from the Colorado Child Research Council (Denver) Growth Study, (2) calculating linear distances between landmarks, and (3) utilizing previously-published equations to estimate cranial capacity. External measurements overestimated cranial capacity at later ages because growth in the supraorbital and nuchal regions continues into adulthood, whereas growth of the brain and internal cranial cavity ceases prior to 10-12 years of age. Thus, cranial capacity estimates from internal variables are more accurate than those from external cranial variables. Neither external nor internal variables provide accurate estimates of cranial capacity at younger ages, an expected result given that we were applying adult equations to non-adult crania.

*Faculty sponsor: Robert McCarthy*

◆ **Olivia DeBenedictis**

“Design of Organic and Inorganic Catalysts for Safe and Efficient Nitrate Reduction in Water Using Titanium Dioxide”

The presence of nitrates in groundwater has worsened over the years and still no solution to the issue exists. Starting as polluted runoff from animal agriculture, fertilizers, and pesticides, nitrates end up in drinking water and salt and fresh water systems. Nitrates pose a major threat to people and aquatic ecosystems alike. The effect of consuming nitrates over time is thought to be a cause of cancer and other health issues in people. In bodies of water, the presence of nitrates is known to decrease oxygen supplies, creating massive dead zones and algal blooms. These areas unsuited for sea life are growing larger as nitrates continue to pollute water sources. Many studies have been done on the ability to reduce nitrates using different types of metals and catalysts; however, it is unknown which ones can be implemented safely and efficiently. In this study, ligand, enzyme, and monometallic catalysts would be used in reactions with titanium dioxide to reduce nitrates in contaminated water samples without over reducing to ammonium, which could poison waters if the implementation is not controlled.

*Faculty sponsors: Anne Marie Smith, Kari Stone*

◆ **Olivia DeBenedictis, Megan Fast, Stephanie Slagle**

“Determination of Gentamicin in Milk Using Gold Nanoparticles”

Antibiotics are necessary to preserve milk sold in stores, however, they can be harmful to consumers in large quantities over time. Because of this, many brands advertise their products as antibiotic free. In this study, different types of milk were tested to determine the gentamicin concentration. This experiment tested fat free, Vitamin D, reduced fat, and goat’s milk purchased from a local grocery store, and reduced fat milk from the Benedictine University cafeteria. In order to determine the concentration of gentamicin in each milk sample gold nanoparticles (AuNP’s) were used. Once the concentration of gentamicin is determined it will better educate consumers on the antibiotics that they are consuming when they purchase milk at their local grocery stores.

*Faculty sponsor: Kari Stone*

◆ **Robert Dudzinski**

“Determining the Best Alternatives to Primary Microplastics”

Microplastic pollution has been a priority issue for environmentalists for years, but has only recently made its way into the popular media. Regulations started to eliminate primary microplastics, but they are still produced for exfoliation in many cosmetic products. Alternative microparticles, such as beeswax, walnut shells, peach pits, and other natural products, are being tested for their biodegradability in aquatic environments. Since microplastics have been found to negatively affect zooplankton, and thus the entire food chain, testing natural microparticles for biodegradability and their effects on zooplankton will help identify viable alternatives to microplastics. Ocean conditions will be recreated in a laboratory setting, with zooplankton in concentrated areas of microplastics and

their possible alternatives. The responses of the zooplankton to each of these microparticles will be observed. The best alternative will have minimal effects on zooplankton's life cycle. This information can be shared with businesses so that they can make a quality economic decision on what is their best option for an exfoliating microparticle.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Prerana Mitta**

"Developing Undergraduate Student Leaders: Oral History and Impact Assessment of Arthur J. Schmitt Future Leaders, 2009-19"

*An Arthur J. Schmitt Future Leaders Project*

Our ten-year longitudinal assessment is a mixed methods project, using survey and oral history methods. This project assesses leader development among our total population of 92 Arthur J. Schmitt Future Leaders, 2009 to present. Descriptive data will be obtained in qualitative oral histories from current and former Future Leaders. Comparative data will be reported using the 2018 Leadership Indicator Scale, from the Center for Creative Leadership, developed with and for students. Aggregated sub-group responses from Future Leader program students, alumni and faculty are compared with each other and with national norms, on four dimensions of student leadership: leading self, leading academically, leading with others, and changing our world. Anonymized oral history transcripts will be analyzed to develop themes, categories, and relationships on respondents' leader development and program impact, to improve the Arthur J. Schmitt Future Leader program at Benedictine University.

*Faculty sponsor: Sandra Gill*

◆ **Alexandra Arrich, Mahvesh Hasan, Nasreen Kamal, Nida Sultana**

"Digitization of the Jurica-Suchy Nature Museum Herbarium"

The Jurica-Suchy Nature Museum (JSNM) Herbarium Digitization Project aims to compile data from the museum's herbarium, a collection of preserved plant specimens dating to the late 1800s. This research project began in 2017 and we are continuing to work on the initial stages of the digitization process. The project entails accessioning, cataloging, barcoding, verification of data, and creating a searchable database. Since its creation, our research team has grown from two students to four students. We have thus adjusted our workflow to four stations: data verification, barcoding, accessioning, and data input. This has enabled the research team to increase efficiency of our workflow. This year we completed 500 specimen entries, compared to the 150 specimen entries that were completed last year. Our ultimate goal is making the collection and its associated material available to the public. Our next steps include applying to join the Consortium of Midwest Herbaria portal, which is a subset of the SEINet North American plant network, and uploading our collection information to the portal.

*Faculty sponsor: Karly Tumminello*

◆ **Stephanie Slagle**

"Discovering the Source of Arsenic in Dog and Cat Foods"

The health of pets has been a recent concern due to the discoveries of the true contents of their food. Many studies have assessed whether dog and cat foods meet appropriate standards and revealed the presence of toxic trace metals. With high quantities in select pet foods and potential linkage to health risks, arsenic has been shown to be a major concern. In order to protect the health of these animals, further investigation to find the source of this toxic element is needed. By analyzing pet food ingredients, the source of the high arsenic concentration can be tracked and further study can address its elimination. This could have positive impacts on the health of pets and humans.

*Faculty sponsors: Anne Marie Smith, Kari Stone*

◆ **Jinkle Modi**

"An Educational Outreach Program for Biofortified Rice Products in Ahmedabad, India: A Study About Changes in Consumer Preference"

One hundred women each from Gyaspur and Satellite, Ahmedabad, aged 25 to 35 and mother of at least one child, will be given a pre-survey evaluating their knowledge regarding micronutrient malnourishment, biofortified rice and

their willingness to accept it. An outreach program will be carried out in those two very different areas that will aim to spread awareness among the residents regarding biofortified rice with the help of local grocery shop owners. The outreach program will include regular campaigning on behalf of the biofortified rice varieties, distributing pamphlets, and also monthly meetings for answering questions. Distribution of Golden Rice samples will also be carried out so that people can self-evaluate if they would prefer it in the future or not. After six months, a post-survey will be handed to the same 200 women asking the same questions. These surveys will enable us to analyze the role of education outreach programs in convincing people to adopt a technology created for their benefit. Moreover, it will allow us to assess the willingness of consumers to adopt this technology based on their education as well as income background.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Aisha Diab**

“Effect of Polymers TEC and Eudragit L 30-D55 on Release Rate of Coated Naproxen”

Over the counter pharmaceuticals, such as naproxen, are coated with polymers to increase the release rate of the drug and reduce the number of times naproxen tablets are consumed per day. Synthetic polymers are used in plastic material because of the strength of the bonds and the inability to decompose right away. Although polymers extend the release rate of drugs, the body finds it difficult to decompose and high levels of polymer in the body have toxic effects on the body. In this proposed research, a mixture of polymers (TEC and Eudragit L 30-D55) will be synthesized and tested on the release rate of naproxen. The polymer mixture will coat the drug using a spray nozzle to evenly coat it. The drug will be placed in a neutral pH buffer solution for 24 hours and drug concentration will be measured by computing the percent mass loss from the mass before it is placed in the buffer solution to the mass after 24 hours in solution. This research could change the amount of toxins entering our body systems since common brands of naproxen, such as Aleve, are used every day.

*Faculty sponsors: Anne Marie Smith, Kari Stone*

◆ **Luke Scherer**

“Effects of Alarmist Rhetoric in Climate Science Communications”

The purpose of this research proposal is to ascertain if the ferocity of rhetoric affects the willingness to believe or act according to a message on climate science. Twelve students of different political, economic, religious, and cultural backgrounds will be separated into two groups, each of which will be presented with one of two messages on climate science. One group will be given a message with fierce rhetoric, while the other will receive a message with neutral vocabulary. By surveying the students afterward, it will be determined whether or not the alarming rhetoric was more or less effective at persuading the students. This information may be useful for publishers and media organizations that report on climate science, allowing them to reach a wider audience.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Amaris Hernandez**

“The Effects of Climate Change on Mental Health And How To Address It”

A correlation between climate change and mental health has been suggested by numerous studies that show our mentality is affected by certain climate conditions. Natural disasters affect our mentality as much as climate change. The negative effect that change in general has on the human psyche gets out of control when people are undereducated on how to control or contain their emotions. In areas with a higher risk of natural disasters due to climate change, psychologists should be introduced in educational and work environments to ensure psychological control. In areas at a lower risk for natural disasters, this approach can also be used to spread awareness. Education on mental control and tranquility is vital to ensure children and young adults are maturing in a healthy way. As a result of mental/emotional awareness, when a critical situation arises there will be skills that were discussed in the past that will aid control among communities.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Maryam Mohamed, Noura Omari**

“Effects of Rgg Agonist Molecules on the Probiotic *Lactobacillus acidophilus*”

Bacterial quorum sensing (QS) is a mechanism in which gene expression is controlled within a population of bacteria. Microbial communities can secrete and respond to a diverse array of pheromones. Our research is focused on a QS pathway that uses a transcriptional regulator, Rgg, and a small hydrophobic peptide (SHP) as the pheromone. These Rgg QS systems appear in many Gram-positive bacteria including species within *Listeria*, *Streptococcus*, and *Lactobacillus*. Our main interest is in the lactic acid bacteria *Lactobacillus acidophilus*. Three predicted Rgg proteins are present in *L. acidophilus*. However, there are no known pheromones associated with them. Our focus is on characterization of Rgg<sub>1765</sub>, a stand-alone regulator. Previous work isolated several small compounds that act as agonists of Rgg QS pathways. Of interest, these compounds can serve as surrogate pheromones to study cellular responses associated with Rgg QS systems. We hypothesize that these compounds have an effect on the QS pathways present in *L. acidophilus*. We have two promising candidates, C-0251 and M-0446. Transcriptional reporter assays and phenotypic assays will be used to determine compound effects.

*Faculty sponsor: Tiara Pérez Morales*

◆ **Ismail Ahmad, Zarish Hafeez, Mohammad Hamdan, Kaitlyn Lipps, Jack Lyons, Bilal Shehaber, Vedant Soni**

“Efficiency Comparison of Benedictine University's Horizontal and Vertical Axis Wind Turbines”

Recently, there has been a growing public interest concerning wind turbines and their role in a sustainable future. Benedictine University currently has two donated wind turbines on campus: one vertical shaft turbine which is installed on top of the parking garage and another nonfunctional horizontal shaft turbine located in storage. This project documents the restoration of the horizontal shaft turbine and the development of a robust data logging system for the collection of wind speeds through the use of an anemometer, Arduino, and Raspberry Pi 3. The data collected on wind speed will be combined with power output data from each turbine allowing comparisons of efficiencies for these starkly contrasting designs. In the end the project will develop the wind turbines into useful campus resources that can be used for research projects and outreach activities.

*Faculty sponsor: William Schubert, Andrew Wig*

◆ **Matthew Grubb**

“Environmental and Cost Benefits of Implementing Technology into Corporations”

This project explains how implementing modern technology (such as robotic cells and other inventions made to reduce environmental impact) can be cost-effective and beneficial to the environment. Various types of available technologies will be described, in addition to how these technologies have already made an impact.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Jennifer Brown-Griffin**

“Environmental Racism and Its Effects in Black and Latino Communities: Curriculum Proposal for Environmental Literacy in District 86”

Decades worth of research has proven the existence of environmental racism in America, an institutionalized malady that especially affects poor and underprivileged minorities in America. In order to combat some of the perceived implications of environmental racism on poor black and Latino communities, I propose an environmental curriculum program for District 86 that will increase students' awareness of the changing world they will inherit. This curriculum will include: the definition of environmental and political terms that are used in modern environmentalism. which will give students the ability to understand the politics and language around the topic; environmental history both in America and abroad, which will provide students with the historical background to understand modern social attitudes towards environmentalism on the national and international levels; and environmental racism/environmental justice so that students understand the real-world consequences of those who are forced to live in unsustainable environments and to comprehend its effects on underprivileged populations.

*Faculty sponsor: Jean-Marie Kauth*

- ◆ **Theofilos Lolis, Jeremy Rosko**

“Facts and Demographics on Veterans in the Chicagoland Area”

*An Arthur J. Schmitt Future Leaders Project*

My colleague and I will be interviewing veterans from VFWs in the surrounding area and asking them questions regarding age, birthplace, race, education, conflicts fought in, opinions on warfare, how they have been affected by conflicts, marital status, number of children, level of loneliness, and how they felt society treated them after coming back from conflicts. Some of these questions are opinion-based and will be scaled from 1-10.

*Faculty sponsor: Sandra Gill*

- ◆ **Reenie Baidya, RYanne Ehrman, Fayda Hasan**

“Fluorimetric Analysis of a Promising Medicinal Compound 7-Methyl-7-Hydroxycoumarin in Various Solvents”

Hymecromone (7-methyl-7-hydroxycoumarin, a synthetic coumarin, 4MU) is an aromatic chemical compound in the benzopyrone chemical class. Studying fluorescent properties and fluorimetric quantification of 4MU has become pertinent due to its possession of a range of diverse pharmacological properties. Both natural and synthetic coumarins are extensively used as medication and analytical reagents. Hymecromone has been noted to be an excellent fluorophore with high quantum yields. An FP 6500 JASCO Fluorescence Spectrophotometer was used with 1 cm quartz cell to measure limit of detection, quantum yields, and room temperature emission intensities of varying concentrations of 4MU in aqueous solutions. Solvent comprised of 80% water and 20% methanol was determined to be ideal. Hymecromone was studied in 80% aqueous phosphate buffer and 20% methanol at various concentrations, and the detection limit was reached at 7.05 $\mu$ M.

*Faculty sponsor: Niina Ronkainen*

- ◆ **Macy Andlinger, Alexandra Karwowska, Mary Keenan, Rebecca Weber**

“A Hematological Assessment of Augmented Blanding’s Turtle Populations”

Blanding’s turtles (*Emydoidea blandingii*) are an IUCN-listed wetland-dependent species that have experienced population declines due to habitat loss and fragmentation, road mortality, and increased depredation rates. To mitigate these declines in the greater Chicago area, captive-rearing programs have been implemented to augment wild populations of Blanding’s; however, little is known about their effectiveness. We assessed the hematological health of captive-reared and released juvenile Blanding’s via leukocyte profiles, which can provide a measure of chronic stress. We investigated leukocyte profiles of recently-released juvenile Blanding’s pre- and post-release from captivity, throughout the 2016-2017 active seasons (May-October), and compared these values to leukocyte profiles from formerly-released Blanding’s. Preliminarily, we found that heterophil/lymphocyte (H/L) ratios did not differ pre- and post-release from captivity or between recently- and formerly-released Blanding’s, however; H/L ratios for recently-released Blanding’s were lowest in October. This study is the first to compile a leukocyte profile for Blanding’s, and results can be used to inform augmentation programs.

*Faculty sponsor: Leigh Anne Harden*

- ◆ **Haripriya Koritala, Zeeshan Zubair**

“Hominin Vocal Tract Dimensions Estimated Using a Mixed-Longitudinal Human Radiographic Sample”

In modern humans, a descended larynx is the physiological basis for many aspects of speech because it creates a “two-tube” supralaryngeal vocal tract (SVT) in which the horizontal length (from lips to posterior wall of pharynx) approximately equals the vertical length (from vocal folds to soft palate). In this arrangement, the tongue can restrict the SVT midway along its length, enabling the production of a wide range of acoustically-distinct speech sounds. We used the program tpsDig32 to collect 19 2-D landmarks from the mandible (lower jaw) on lateral radiographs of the head and neck in a mixed-longitudinal sample of 12 males and 13 females from the Denver Growth Study. We generated regression equations for pairs of variables from the mandible and SVT and used the 3 equations with the highest correlation coefficients to predict SVT dimensions in a small sample of fossil humans from France. Regression estimates consistent with a 1:1 SVT configuration were estimated in pre-modern *H. sapiens* (Cro Magnon, Abri Pataud) but not in large Neanderthals (La Chapelle-aux-Saints), supporting previous research that

a non-1:1 SVT restricted the types of speech sounds made by Neanderthals.

*Faculty sponsor: Robert McCarthy*

◆ **Ansareen Hassan**

“Illinois Coal Ash Ponds and the Pollution of Drinking Water”

This project is a grant proposal for studying how groundwater contamination caused by coal ash affects Illinois waterways, especially sources of drinking water. To test the effect of coal ash ponds on surrounding rivers and water sources, I propose to use the methods set forth in *Water Quality Monitoring and Management* to detect the presence of heavy metals in the ten coal ash sites that are near drinking water sources. Spectrophotometry and fluorimetry will be used to detect elements, especially metals, in river water. I will compare the presence of the contaminants against EPA standards to determine whether they are above safe levels. As a control, I would need to test a water source located far away from the ash ponds for the same metals. I believe if water surrounding coal ash dump sites were tested now, we would find increased levels of toxins, but not yet quite above safety standards. It is why this testing must be done now and used to support immediate preventative measures.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Morgan Weber**

“The Impact of the Modern Women's Movement: How Recent Social Movements Have Led to More Political Inclusion”

On November 8th, 2016, Donald Trump and his supporters thought they had succeeded in materializing their movement to sustain white supremacy, limit the free speech of the press, and degrade women. About three years later, I contend that they instead started a movement in the opposite direction – one that makes being a liberal feminist great again. This shift to leftist views has specifically led women to display their disdain for his election through various social movements like the Women’s March, #MeToo, and #Time’sUp. These social movements have led to more diverse representation in politics through more women becoming politically active, voting, and running for office. To add credibility to my claim that recent social movements have led to more political inclusion, I completed extensive research with citations from five different newspapers, three credible websites, two field-work studies, and one book. My findings justify the larger implication of the importance of the representation of women in politics today.

*Faculty sponsor: Gregory Ott*

◆ **Natalia Soja**

“Implementing Early Childhood Sustainability Education”

The environmental crisis is one of the toughest current issues facing humanity and yet few schools spend a lot of time explaining this problem to children. This project proposes an environmental curriculum for elementary school-aged children. It will also analyze the effectiveness of sustainability education, as well as criticisms of such approaches, to ultimately advocate for all elementary schools to introduce sustainability curricula. The focus will be on how sustainability education affects children’s understanding of the environment, but also notes the importance of training educators. Children need to create an emotional bond with nature in order to care about environmental issues. The curriculum will achieve this by having the children spend time outside and doing manual work in addition to discussing environmental issues. They will be taught how to make sustainable choices in their daily life, including how to recycle properly, how to save water and electricity, and how to limit food waste.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Mohammad Hamdan**

“Improvement of Reinforced Concrete Structures by Inclusion of Chloride-Resistant Additives”

Potholes are a result of structural failures on a road’s surface which eventually lead to gaping holes. Researchers have found that using chloride resistant admixtures in concrete helps improve concrete strength and durability. Muralidharan *et al.* studies the damage in concrete by methods of measuring corrosivity of steel bars and measuring

the pH level of the concrete mortar. They tested chemicals such as sodium hydroxide, sodium citrate, and calcium oxide and found all three decreased corrosiveness in steel bars. Recycled concrete aggregates and municipal solid waste bottom ash have also been found by Ismail *et al.* and Carsana *et al.*, respectively, to improve reinforced concrete structures. Using these chemicals and recycled materials, this proposal seeks to identify the ideal concrete additive. Decreasing corrosiveness in steel bars will enhance the concrete's compressive strength over time.

*Faculty sponsors: Anne Marie Smith, Kari Stone*

◆ **Aisha Baggia**

“Interactive Educational Experiences Using a Sand-tank Groundwater Model”

The purpose of this research is to demonstrate the importance of the regulation and preservation of groundwater. The impact of contamination and waste tarnishes the purity of the groundwater and can be detrimental to those locations that rely on groundwater as their primary source of drinking water. Groundwater is used for 25-40% of the world's drinking water. The Jurica-Suchy Nature Museum received a new groundwater model through a grant-funded program by the UW-Extension's Center for Watershed Science and the Wisconsin Geological and Natural History Survey. The sand-tank groundwater model demonstrates a cross-section of the earth and is used as a visual representation of how groundwater moves through aquifers. The model supplements geology lessons to give students a better understanding of how quickly groundwater can be contaminated. This research project focuses on compiling Discovery Box materials to assist educators in using the groundwater model and to enhance the learning experience for 6th-12th grade students.

*Faculty sponsor: Karly Tumminello*

◆ **Gabrielle Illut**

“Is Johnson & Johnson a Model Company for Helping the Environment?”

This research is based on the following question: is Johnson & Johnson a model company for helping the environment? The audience will be SustainAbility, a B Corporation company. Johnson & Johnson has many leading efforts in environmental and social responsibility. They socially invest, contributing to those who cannot help themselves. The company is also a good model for making sustainability reports. However, there is controversy surrounding their baby powder, a product that has been marketed very effectively but that has been shown to contain toxic carcinogens such as asbestos and talc. Johnson & Johnson's product and motives for hiding the truth may undermine their environmental work.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Marleen El-Zabet, Iqra Majid**

“Kids with Special Needs”

*An Arthur J. Schmitt Future Leaders Project*

This project is intended to create a peaceful environment for children with special needs. My partner and I plan will discuss an egg hunt event we organized in the Villa Park area in March 2019.

*Faculty sponsor: Sandra Gill*

◆ **Jonathan Avendano, Aisha Diab, Maryam Sohail**

“Limiting Reagent Effect on Dichroic Behavior of Gold Nanoparticles”

Dichroism is a property of materials in which the perpendicular and horizontal views exhibit different absorption coefficients. In this experiment, the amount of reducing reagent, sodium citrate ( $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$ ), was changed to observe the dichroic behavior of the gold nanoparticles. It was concluded that dichroism is observed when an insufficient amount of reducing reagent is synthesized with the gold nanoparticles. When a surplus amount of reducing reagent is synthesized with the gold nanoparticles, dichroism is not observed.

*Faculty sponsor: Kari Stone*

◆ **Mariyam Alam**

“The Long-Term Effects of Wildfire Smoke on Respiratory Health”

This proposal is to conduct a prospective-cohort study to determine the long-term effects of wildfire smoke on respiratory health. It’s been determined through many previous studies that particulate matter in wildfire smoke has negative short-term impacts and, based on studies of the long-term effects of smoking on the respiratory system, there is sufficient evidence to assume that there is some type of long-term impact caused by exposure to the smoke from wildfires. However, there are no studies currently that prove this to be true. Testing a group of school-age students (approximately 8 to 10 years old) exposed to wildfires in the California area and observing potentially correlative respiratory issues can help establish whether there are or are not long-term negative effects of exposure to wildfire smoke, and if so, determining what they are.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Nashwah Memon**

“Long-Term Neurological Effects of Ingesting Contaminated Water in Children”

A global environmental issue that continues to affect millions is the water crisis. Water sources around the world are threatened with contamination by a variety of chemicals, potentially severely affecting the neurological development of children. Chemicals such as lead have polluted the drinking water and increased the overall blood lead levels in children. Many effects of lead poisoning in adolescents have resulted in impaired growth and development of the central nervous system, affecting learning, speaking, memory, and emotional skills. Underprivileged populations are more vulnerable to unsafe drinking water. It is a human right to have access to clean water. More action must be taken to end the spiraling water crisis.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Samreen Mushtaheed**

“Medical Ethics: The Impact of Personal Philosophy and Education on the Use of Mitochondrial Transfer and the Prospect of Use”

The medical procedure known as mitochondrial transfer has created an ethical debate over its use. In the United Kingdom, the medical procedure is regulated through strict supervision, whereas in the United States the procedure has not yet been approved. Although there are many perspectives to mitochondrial transfer, this study aimed to quantitatively and qualitatively analyze the impact of personal philosophy and educational level on the use of mitochondrial transfer and the prospect of use. The same pre-and post-questionnaire was utilized to assess the impact of watching the two videos that supported and disagreed with the ethics of mitochondrial transfer. The participants were composed of Benedictine’s students which included science and nonscience majors. Preliminary data suggests that most students are not sure if they support or disagree with mitochondrial transfer even after watching the videos. This research aims to increase the awareness of students to mitochondrial transfer and create a baseline for other researchers to dive deeper into this new area of study.

*Faculty sponsor: Allison Wilson*

◆ **Theresa Couri, Ugne Dinsmonaite, Mohammed Haq, Suhayl Khan**

“Novel Endoperoxides Increase Apoptosis in Cancer, but not Normal Cells and May Involve Differences in Transferrin Receptor (TfR) Expression”

Artemisinin and its analogs are useful as anti-cancer drugs, but their properties are not fully elucidated. We synthesized ART analogs and showed that at low doses, HSM and DMR induced apoptosis in cancer cells, but not in normal cells and the actions involved reactive oxygen species. We hypothesize that high levels of transferrin receptor in cancer cells increases [Fe<sup>2+</sup>]<sub>i</sub>. This interacts with ART analogs to produce ROS and induce apoptosis. We examined the mechanism of action of DMR/HSM in breast, lung and colon cancer cells compared to normal cells. We also designed/synthesized a 3rd analog, PMW. Cells were treated with DMR, HSM or PMW Deferoxamine, stained with FITC-Annexin V, propidium iodide or CellRox Green, and imaged/quantified by flow cytometry and/or microscopy. Cell lysates were subjected to SDS-PAGE and immunoblotting with polyclonal TfR antibody or anti-

GAPDH. Iron content was measured by colorimetric assay. DMR and HSM induced apoptosis in cancer cells only. In lung cells HSM was more effective than DMR, in breast cells DMR was more effective. PMW did not induce apoptosis in the cancer cells. TfR expression and iron content was high in cancer cells.

*Faculty sponsors: David Rubush, Jayashree Sarathy*

◆ **Robert Szczypta**

“Nucleophilic Fluorination with Small Organic Molecules”

Nucleophilic fluorination is the generation of fluoride ions through chemical reactions. The creation of a new nucleophilic fluorination reagent is valuable due to fluorine being an essential element in the pharmaceutical and agrochemical industry. Carbon fluoride bonds contain many beneficial properties such as increased bond polarity and strength due to the high electronegativity of fluorine in comparison to carbon hydrogen bonds. However, existing fluorinating reagents must be handled with care due to their toxicity and high reactivity. Our goal is to create nucleophilic fluorine under mild conditions. This research uses stable aromatic systems as substrates where a nucleophilic fluorine can be generated.

*Faculty sponsor: Brooks Maki*

◆ **Justyn Wicks**

“Pesticides and Their Link to Brain Tumors in Children (CBT)”

Pesticides have been used around the world for decades and they have many positive effects. At the same time they have many undesired effects and recent studies have shown that pesticides could be causing brain tumors in children. My goal is to show a connection between these two by reviewing research done in the past and providing an argument as to why more research should be conducted. I will examine studies from multiple countries around the world and from cancer associations. The data that I have found involves a few different scenarios, typically being either from direct exposure of pesticides to the children or exposure to the parents. Studies also focused on two types of pesticide exposure: agricultural and home-use pesticides. As this work shows, there is evidence to connect pesticides and brain tumors in children but more research needs to be done.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Mohammad Hamdan, Claire Vospette**

“Preparation of Gold Nanoparticles Using Black Darjeeling Tea”

Green chemistry experiments and environmentally sustainable practices are increasingly becoming significant ways to avoid the adverse effects of pollution and waste. A simple way of incorporating green chemistry experiments in nanotechnology is the extraction of tea leaves for the synthesis of gold nanoparticles. Tea replaces the use of sodium citrate and the experiment can be conducted in any lab setting. Two concentrations of black darjeeling tea, decaffeinated green tea and classic green tea are brewed. Once brewed, tetrachloroauric acid was added to each tea. UV/Vis was conducted to determine the absorbance and wavelength of the nanoparticles. The results showed that all varieties of teas were able to facilitate synthesis of gold nanoparticles.

*Faculty sponsor: Kari Stone*

◆ **Megan Fast**

“Production and Characterization of Poly(lactic acid) with *Cynara caradunculus* Oil, Soybean Oil, Cardanol Oil, and Acetyl Tributyl Citrate as Plasticizers”

Petroleum-based plastics are causing pollution all around the world, and an alternative is poly(lactic acid) (PLA). Over the years, PLA has shown it can be plasticized with many different plasticizers, but for the purpose of this experiment, bioplasticizers are the focus. This is the case because bioplasticizers are better for the environment and are easily biodegradable. The bioplasticizers that will be studied are *Cynara caradunculus* oil, soybean oil, cardanol oil, and acetyl tributyl citrate. The thermal stability, tensile strength, oxygen transition rates, the degree of crystallinity, and molar weight will be tested for the plastic produced from PLA with these different plasticizers.

*Faculty sponsors: Anne Marie Smith, Kari Stone*

◆ **Dalya Kanani**

“The Promising Environmental Benefits of Empowering Women”

Population growth today is surpassing Earth’s ability to sustain life long-term. To cut down on consumption and carbon dioxide emissions, population growth must be controlled. Providing women with equal opportunities poses positive benefits to the environment. When women have access to contraceptives and family planning, they are statistically proven to have less children. Furthermore, access to quality education for women is essential to improving their chances for job security. Having job prospects allows women to be involved in society and have less children. These opportunities enable women to make their own decisions about how many children they want to have and when. In order for society to cut down on its consumption of resources, population growth must be controlled. Women must have the basic right of obtaining the essential resources in order to live an equal quality of life in society.

*Faculty sponsor: Jean-Marie Kauth*

◆ **Theresa Couria, Ugne Dinsmonaite, Mohammed Haq, Suhayl Khan**

“Reactive Nitrogen Species (RNS) Play a Role in Bile acid (BA)-Induced Barrier Dysfunction and Proinflammatory Cytokines (PiC) Release in Human Colon Carcinoma T84 Cells”

Dysfunction of mucosal immune response and tight junctions (TJ) play an important role in the pathogenesis of inflammatory bowel diseases (IBD) and diarrhea. We have previously reported a role for ROS in bile acid action, particularly chenodeoxycholic acid (CDCA). The effect of CDCA on TJ was attenuated by CDCA’s derivative, lithocholic acid and ROS inhibitors. In patients with IBD, PiC upregulate inducible nitric oxide synthase (iNOS). Thus, we hypothesize a role for RNS in mucosal damage and studied the involvement of oxidative/nitrosative stress in BA-induced TJ dysfunction and cytokine release in colon carcinoma, T84 cells. We examined the role of RNS/ROS in BA action by studying the effect of BAs±L-NAME± NAC on: (a) apoptosis; (b) paracellular permeability; and (c) IL-8 release. Confluent T84 cells were treated apically with BAs for 0.5-18 H. [NO<sub>2</sub>/NO<sub>3</sub>] was measured by the Griess assay. We demonstrate a novel role for RNS in CDCA-induced TJ dysfunction in T84 cells. Inhibiting RNS in the presence of LCA reverses CDCA action on leak function and reduces PiC release. Understanding the role of ROS/RNS in BA action can lead to novel therapeutic strategies for IBD.

*Faculty sponsor: Jayashree Sarathy*

◆ **Matti Oshin**

“Reusable Pads for Underprivileged Women”

*An Arthur J. Schmitt Future Leaders Project*

This project aims to make reusable cloth pads for women who might not necessarily have the economic resources to purchase pads every month. I chose cloth pads because I was inspired by a video where homeless women had to go to extreme lengths in order to keep themselves clean during their period. I decided that this would make a huge impact for women and would be perfect for my scholarship. In order to get material for the pads, I did a clothing drive in December to receive donations for the outer fabric. Then, on March 2nd, there was an educational introduction about the female homeless population and how this project benefits them. The pads had cotton fleece in the insides for absorbency and were hand sewn together. A button was applied to the front for easy storage. After the pads were completed, they were distributed to the YWCA for women to take for free. The plan is to have an intimate relationship with the YWCA where the stories of the women can be heard.

*Faculty sponsor: Sandra Gill*

◆ **Ahmad Hamed**

“Spatial Distribution of Strong Gravitational Lenses on the Celestial Sphere”

Strong gravitational lensing is the deflection of light by gravity, due to the chance alignment of celestial objects. This phenomenon was first predicted by Albert Einstein’s General Theory of Relativity, which proposes that matter distorts spacetime. This distortion is what causes the effect we know as gravity. Massive objects can create a

gravitational field strong enough to visibly bend the light of another object. For the lensing to be visible the source, lens, and observer must be aligned correctly. When the deflection of light by a massive object is easily visible it is known as strong lensing. For this poster we will be compiling the known cases of strong gravitational lensing to look for patterns in spatial density in the celestial sphere.

*Faculty sponsor: Matthew Wiesner*

◆ **Zohia Arif**

“The Spectroscopy of White Dwarfs using Goodman Spectrograph on SOAR”

A white dwarf is an astrophysical object made of electron degenerate matter that forms during the end stages of a lower mass star. A white dwarf is very dense; it has a mass similar to the Sun but a volume similar to that of Earth. We used the Goodman Spectrograph on the Southern Observatory for Astrophysical Research (SOAR) telescope to produce images at wavelengths from optical to near infrared. The initial purpose was for calibration for the Dark Energy Survey (DES). DES is an international effort to map the sky and reveal the nature of the dark energy that is accelerating the expansion of our Universe. The secondary purpose of our observations was to train for follow-up observations of gravitational wave events. There are many types of white dwarf, but our focus was on DA white dwarfs, those that exhibit only hydrogen absorption lines in their spectra. I have taken the spectroscopy of these white dwarfs and reduced and calibrated the images. I plan to further investigate the temperature and surface gravity of this sample of white dwarfs.

*Faculty sponsor: Matthew Wiesner*

◆ **Theresa Couria, Ugne Dinsmonaite, Faith Donner, Mohammed Haq**

“Structural Variations and Functional Ramifications of Bile Acids (BA) on Tight Junctions (TJ) in Human Colon T84 Cells”

BA-induced diarrhea affects  $\frac{1}{3}$  of patients with chronic intestinal inflammation, but the mechanisms remain to be elucidated. A yin/yang in BA action with CDCA disrupting TJs and LCA attenuating it. We hypothesize that structural differences account for varied actions, namely the presence of the 7-OH in CDCA. We used a tagged CDCA, to show that apical CDCA-FA travels paracellularly to the basolateral surface, altering TJ permeability. We predict that LCA-FA will not alter TJ or access BLS. We studied the structural basis for BA action on TJ function, by synthesizing a fluorescein amine-tagged LCA and a 7-methoxy CDCA. T84 cells were treated apically with DMSO, CDCA-FA, and LCA-FA. Cell viability was measured by propidium iodide stain, fluorescence microscopy and Image J analysis. TJ function was assessed by pore function measured as TER and leak function measured as apparent permeability of CDCA-FA vs LCA-FA across the monolayer. CDCA moves paracellularly to the BLS whereas LCA limits CDCA movement to protect barrier integrity. We postulate that the 7-OH group in CDCA is critical in disrupting barrier function and triggering inflammation.

*Faculty sponsor: Jayashree Sarathy*

◆ **Katelyn Howe, Anna Thiel**

“Synthesis of 1H-Pyrazole-1-acetamide-N-(2,6-dimethylphenyl), a Lidocaine Anesthetic Derivative”

Lidocaine is a local anesthetic used for treatment of acute and chronic pain. In this experiment, a lidocaine derivative, 1H-Pyrazole-1-acetamide, N-(2,6-dimethylphenyl), (MW 229.28) was synthesized in hopes of understanding the reaction process and allowing for further examination to identify anesthetic qualities. The derivative was synthesized through a series of 3 reactions based primarily on existing literature as well as exploration in creating new reaction conditions. The first reaction synthesized 2-chloro-N-(2,6-dimethylphenyl)acetamide. The second reaction, commonly known as the Finkelstein reaction, converted the chloride to an iodide. The third reaction attached a pyrazole group. From these experiments, a new lidocaine derivative was synthesized. NMR spectra confirmed that 1H-Pyrazole-1-acetamide, N-(2,6-dimethylphenyl) was successfully synthesized.

*Faculty sponsor: David Rubush*

◆ **Habib Hassan, Martinas Stanys**

“Synthesis of 5-methyl-2H-benzo[b][1,4]oxazin-3(4H)-one, a Lidocaine Derivative”

Lidocaine is an anti-inflammatory anesthetic with various applications in surgery and daily uses. The lidocaine mechanism involves blocking various channels such as voltage-gated sodium and potassium channels. Thus, the purpose of this experiment was to synthesize a more efficient inhibitor of cellular depolarization mechanisms. The desired derivative of lidocaine that would be synthesized was 2-(diethylamino)-N-(2-hydroxy-6-methylphenyl)acetamide, but during the synthesis, the desired product cyclized creating 5-methyl-2H-benzo[b][1,4]oxazin-3(4H)-one (A). The first step was to create 2-chloro-N-(2-hydroxy-6-methylphenyl)acetamide (B) by combining 2-amino-3-methylphenol and 2-chloroacetyl chloride using DCM and Et<sub>3</sub>N. A <sup>1</sup>H-NMR of the product was conducted to make sure the correct product was synthesized. The final step of the experiment produced the cyclized lidocaine derivative by combining compound B and diethyl amine using DIPEA and THF as the solvent. The solution was purified, dried, and weighed out giving a percent yield of 53.4%. A <sup>1</sup>H-NMR of the final product was conducted and compared to a predicted <sup>1</sup>H-NMR of compound A. Both of the NMR's were found to be nearly identical.

*Faculty sponsor: David Rubush*

◆ **Patrick Salazar, Madelyn Sullivan**

“Synthesis of Gold Nanoparticles from Plant Extracts”

Using plant extracts as a reducing agent when forming metal nanoparticles replaces the waste of chemical capping agents in the environment. Various plant extracts were combined with multiple concentrations of the gold chloride solution to form gold nanoparticles. The plants researched were black tea, green tea, herbal tea, cabbage, cauliflower, broccoli, apple, orange, and banana. Each extract was created by boiling the plant in nanopure water and filtering the solution twice. The gold chloride solutions were formed by diluting gold chloride with nanopure water. A 1:1 ratio was used to combine the plant extracts and gold chloride solutions, which was analyzed for the absorption values at 550 nm using ultraviolet-visible spectroscopy. No specific extract or AuCl<sub>3</sub> concentration consistently reported a high absorption, in turn leaving area for further research.

*Faculty sponsor: Kari Stone*

◆ **Omar Jafry**

“Synthesis of an Intramolecular Cycloaddition Substrate for Access to Uncommon Bridged Heterocycles”

*Lycopodium japonocumin* is an ordinary club moss found throughout China used as a traditional medicine to treat contusions, strains, and myasthenia. Three new alkaloids (Lycojaponocumins A-C) have recently been isolated. These natural products have biological activity paired with a unique bridged heterocyclic core structure. The purpose of this study is to synthesize similar structures to the bridged heterocyclic core of Lycojaponocumin A in order to investigate and access the bioactivity of these compounds. A Wittig reaction along with multiple oxidations and other synthetic manipulations will be implemented in order to access the bicyclic core. Progress toward an intramolecular substrate will be presented along with potential conditions for future synthesis of the target compound.

*Faculty sponsor: Brooks Maki*

◆ **Emaad Ahmed, LJ Bhullar**

“Synthesis of Lidocaine Derivative 2-(3,4-dihydroisoquinolin-2(1H)-yl)-N-(2,6-dimethylphenyl)acetamide”

Lidocaine is the one of the most widely prescribed pain relievers in the world of healthcare today. The improvement of medicinal drugs is a priority in the pharmaceutical world. This experiment was aimed to improve the efficacy of lidocaine through synthesis of a new derivative: 2-(3,4-dihydroisoquinolin-2(1H)-yl)-N-(2,6-dimethylphenyl). The derivative was synthesized in 2 steps: reaction of 2,6-dimethylaniline with 2-chloroacetyl chloride yielded 2-chloro-N-(2,6-dimethylphenyl)acetamide. This product was combined with 1,2,3,4-Tetrahydroisoquinoline to create 2-(3,4-dihydroisoquinolin-2(1H)-yl)-N-(2,6-dimethylphenyl) in 73.8% yield. This experiment was successful in synthesizing the desired product and was confirmed through Hydrogen NMR spectroscopy.

*Faculty sponsor: David Rubush*

◆ **Zaain Ahmad, Noah Davis**

“Synthesis of Lidocaine Derivative: 2-((2,6-dimethylphenyl)amino)-N,N-diethyl-N-methyl-2-oxoethan-1-aminium”

Lidocaine is a drug frequently found within hospitals and utilized as a local anesthetic. It instills a numbing effect on the user utilized to relieve pain in the event of medical procedures, insect bites, burns, etc. 2-((2,6-dimethylphenyl) amino)-N, N-diethyl-N-methyl-2-oxoethan-1-aminium, which is a lidocaine derivative, was synthesized following three reactions. 2,6-dimethylaniline and 2-chloroacetyl chloride were used to synthesize 3.56 g of 2-chloro-N-(2,6-dimethylphenyl) acetamide at a 74.0% yield. In the second step of the synthesis, toluene and dimethylamine were used to help synthesize lidocaine with a very high yield. The final step involved methyl iodide, acetone, and the synthesized lidocaine collectively added to a heated glass pressure tube for 24 hours. After this period, the solution was left to cool for four days in order to synthesize 1.92g of 2-((2,6-dimethylphenyl) amino)-N,N-diethyl-N-methyl-2-oxoethan-1-aminium with a 59.9% yield, which was confirmed by NMR spectroscopy.

*Faculty sponsor: David Rubush*

◆ **Maureen Black, Karen Long**

“Synthesis of N-(2,6-dimethylphenyl)-2-morpholinoacetamide”

In this experiment, a lidocaine derivative, N-(2,6-dimethylphenyl)-2-morpholinoacetamide, was synthesized. Lidocaine is an anesthetic that is used on humans and other species. Different derivatives of lidocaine are formed to alter how long the drug last, side effects of the drug, or to find other uses. The lidocaine derivative was successfully derived in two steps. First, 2,6-dimethylaniline and 2-chloroacetyl chloride were combined to form 2-chloro-N-(2,6-dimethylphenyl)acetamide. Second, using 2-chloro-N-acetamide and morpholine, N-(2,6-dimethylphenyl)-2-morpholinoacetamide was produced in 64% yield. An H-NMR and TLC were used to confirm the structure of our product.

*Faculty sponsor: David Rubush*

◆ **Ruth Morales, Wamuyu Munyiri**

“Synthesis of N-(2,6-dimethylphenyl)-1-pyrrolidineacetamide”

Synthesis of a lidocaine derivative was undertaken with the long-term goal of producing long-lasting local anesthesia. N-(2,6-Dimethylphenyl)-1-pyrrolidineacetamide's structural difference to generic Lidocaine is in the presence of pyrrolidine, a cyclical secondary amine<sup>1</sup>. Lidocaine derivatives have been tested extensively on animal models with promising clinical applications<sup>2</sup>. Rate-limiting factors in drug discovery projects show a need for new reactions that enable non-traditional disconnections, more C-H bond activation and late-stage functionalization, as well as stereo selectively substituted aliphatic heterocyclic ring synthesis, C-X or C-C bond formation<sup>3</sup>. N-(2,6-Dimethylphenyl)-1-pyrrolidineacetamide was synthesized using 2-chloro-N-(2,6-dimethylphenyl) acetamide, as the starting chemical. 2-chloro-N-(2,6-dimethylphenyl) acetamide was refluxed with pyrrolidine in toluene and later recrystallized using hexane. The product was isolated in 14% yield and the structure of the predicted product was confirmed using H-NMR spectroscopy.

*Faculty sponsor: David Rubush*

◆ **Madelyn Sullivan**

“Synthesis of a Superabsorbent Polymer from Acetic Anhydride”

A biodegradable superabsorbent polymer (SAP) can replace the plastic in disposable diapers to create a biodegradable disposable diaper. Different concentrations of acetic anhydride with the soy-protein isolate and glycerol will be combined to form the biodegradable SAP. The carboxylic group, COO-, from the acetic anhydride binds to the positive hydrogen atoms in the water molecule. In order for the tested plastic to be a SAP, the substance must absorb 10 to 1,000 times its own weight in water.

*Faculty sponsors: Anne Marie Smith, Kari Stone*

- ◆ **Ali Alyan, Mohammed Alyan**  
“A Systematic Review of Ectopic Teeth in the Maxillary Sinus”

An ectopic tooth is a tooth that erupts outside the tooth row. In rare cases, ectopic teeth appear in regions such as the nasal cavity, chin, maxillary sinus, mandible, palate, and orbit. In this research, we are cataloging dental and orthodontic cases of ectopic teeth that have erupted into the maxillary sinus. We found 345 published cases of teeth in the maxillary sinus, most of them associated with dentigerous cysts, odontogenic keratocysts, and other tumors. We present preliminary data on frequencies of ectopic teeth in the maxillary sinus split by patient's age, sex, tooth type, and side (left or right) in 217 cases. Ongoing research includes plans for cataloging additional variables such as the position of the tooth in the maxillary sinus, pathological association, and etiology. When completed, this study will increase the number of systematically-reported and -analyzed teeth in the maxillary sinus 7-fold.

*Faculty sponsor: Robert McCarthy*

- ◆ **Madeline Kim, Alexandra Kizluk**  
“Two-Step Synthesis of a Lidocaine Anesthetic Derivative: N-(2,6-dichlorophenyl)-2-(diethylamino)acetamide”

Local anesthetics such as lidocaine create temporary suppression of pain by blocking action potentials in neurons. The goal of this experiment was to successfully synthesize N-(2,6-dichloro-phenyl)-2-(diethylamino)-acetamide, a lidocaine derivative. The basic structure of lidocaine was kept the same to ensure reversible blockade of nociceptors, but instead of methyl groups, the derivative contained a chlorine at both the 2 and 6 positions on the benzene ring. N-(2,6-dichloro-phenyl)-2-(diethylamino)-acetamide was synthesized by first reacting 2,6-dichloro-aniline with 2-chloroacetyl chloride to produce 2-chloro-N-(2,6-dimethylphenyl)-acetamide. This compound was then dissolved in acetonitrile and diethylamine. The product was extracted using a separatory funnel and recrystallized. TLC plates and <sup>1</sup>H-NMR results confirmed that the desired product of N-(2,6-dichlorophenyl)-2-(diethylamino)-acetamide which was produced in 32.9% yield.

*Faculty sponsor: David Rubush*

- ◆ **Elizabeth Kvitek, Emily Zimel**  
“Two-Step Synthesis of a Lidocaine Anesthetic Derivative: N-(2,6-diisopropylphenyl)-2-(pyrrolidin-1-yl)acetamide”

Various lidocaine derivatives have been synthesized in order to establish more effective local anesthetics. The goal of this derivative was to create a longer lasting anesthetic by increasing hinderance around the amide and slowing the body's breakdown of lidocaine. Having a molecule which mimics the benefits of lidocaine while offering longer lasting anesthetic would benefit patients during surgery and recovery for pain management. The Lidocaine derivative N-(2,6-diisopropylphenyl)-2-(pyrrolidin-1-yl)acetamide with synthesized in two steps starting from 2,6-diisopropylaniline, 2-chloroacetyl chloride, and pyrrolidine. A yield of 84% was obtained and confirmed by running an NMR. While this lidocaine derivative has yet to be tested on cells, the chemical can be made at high yields. If the molecule acts similarly to Lidocaine, further testing would be needed to understand the effects of N-(2,6-diisopropylphenyl)-2-(pyrrolidin-1-yl)acetamide as an anesthetic for different types of pain in patients.

*Faculty sponsor: David Rubush*

- ◆ **Macy Andlinger, Rebecca Weber**  
“Utilizing Capture-Mark-Recapture Methods to Study Lake St. Benedict's Freshwater Turtle Population”

Spatial capture-mark-recapture (CMR) studies are used to assess the abundance and long-term viability of wildlife populations and to explore patterns of individual heterogeneity within populations. In spring 2018, a long-term, spatially-explicit, robust CMR was initiated to survey the freshwater turtle population in Benedictine University's Lake St. Benedict and retention ponds. Turtles were sampled using baited hoop-net and basking traps and dip net surveys. Captured turtles were identified by filing a set of three marginal carapace scutes. We also collected morphometric, trap location, and environmental data. Over 24 trapping nights, 74 unique turtles including 61 painted turtles (*Chrysemys picta*), 4 red-eared sliders (*Trachemys scripta*), and 9 common snapping turtles (*Chelydra serpentina*) were captured, measured, and marked. Of 99 total captures, most turtles were caught once, but some were caught up to 4 times. A preliminary closed CMR model estimated a painted turtle abundance of 94 individuals,

95% CI [56, 170]. This study is the first to survey the freshwater turtle community at BenU and has generated educational outreach in collaboration with the Jurica-Suchy Nature Museum.

*Faculty sponsor: Leigh Anne Harden*

◆ **Ismail Ahmad, Habib Hassan**

“Utilizing Recombinant Myoglobin Mutants as “Small Molecule” Mimics of Hydroxylamine Oxidoreductase and Lactoperoxidase”

Hydroxylamine Oxidoreductase (HAO) and Lactoperoxidase (LPO) are both large proteins with practical biological and industrial applications which also contain an active site that is a heme b derivative. In this study we attempted to create a small molecule mimic of the heme active site of HAO and LPO by mutating peripheral amino acids surrounding the myoglobin heme. Myoglobin is a small protein that has been well studied, has well defined electronic characteristics, and has been shown to make cross links similar to those of interest in HAO and LPO on its heme b. After identifying which sites on the polypeptide chain of myoglobin show the greatest potential for forming cross links of interest with the heme b via PyMOL analysis, primers for site-directed mutagenesis of the pET-19b vector were ordered commercially. Mutated plasmids were verified using a restriction enzyme digest, PCR, and gel electrophoresis. Protein production was done by growing transformed *E. coli* in Terrific Broth. Proteins were purified using Ni-NTA spin columns and verified by U/V-vis spectrophotometer. Proteins collected will be verified further in future research by reacting with H<sub>2</sub>O<sub>2</sub> and mass spectrometry.

*Faculty sponsors: Mark Poch, Kari Stone*

◆ **Patrick Salazar**

“The Variation of Light Emitted from Plants Due to the Usage of Different Enzymes”

As more of the world’s energy is consumed for lighting purposes, many are trying to look for alternate sources. One of those alternate sources being looked into is bioluminescence: the production and the emission of light by a living organism. Certain organisms can bioluminate because they have enzymes that are able to break down certain substrates through the consumption of ATP to facilitate the production of light. However, the light produced isn’t bright enough to be used for practical use. Instead, we can use plants for light as we can engineer them to bioluminate. We can take the enzymes and substrates that facilitate bioluminescence out of organisms, like fireflies, and bind them to nano-particles in water. We can take that solution and pour it onto plants, allowing them to uptake the protein-bound nano-particles. The ATP produced by plants allows the enzyme to break down the substrate, causing them to glow. The most common light produced is yellow light because firefly luciferase is the most commonly-used enzyme. Our research aims to determine if enzymes from other organisms could produce different colors of light.

*Faculty sponsors: Anne Marie Smith, Kari Stone*

◆ **Fatimah Alani, Emma Khalid, Hiba Moinuddin**

“When Equality Feels Like Oppression: Examining the Relationship Between White Identity and Political Violence”

There is some literature about predictors of political violence, but little has studied this in the American context. Economic inequality and government repression are important predictors of political violence, and the current research aims to understand this in the context of the US electorate. Using a Large nationally representative sample we examine the relationship between the importance of ethnic identity and support for political violence. Among a self-identified white sample (n=1834), white identity significantly predicts political violence. This effect is mediated by perceptions of decreased income inequality and increasing ethnic diversity as well as general prejudice. Importantly these effects are largely independent of political conservatism. We conclude that the picture of white political violence in the US is more nuanced than previously thought and focus on how future research can help to clarify these patterns.

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