



URSA

Undergraduate, Research,

Scholarship and Arts.

Benedictine University

2023 Poster Session Program

April 13, 2023 ❖ 12:30-2:30 pm ❖ Goodwin Hall Atrium

♦ **Saalih Abdul-Salam, Jibran Haque**

“Who Is Eating Whom? Trophic Dominance In a Phylogenetic Context”

The human species consumes large quantities of various forms of life. Likewise, many living species use our species for sustenance, causing human mortality. What is the current state of this ancient trophic conflict? We ask this question in a phylogenetic context by grouping non-human taxa into clades, specifically sister clades of organisms whose common ancestors diverged from the clade that would give rise to humans. For example, 320 million years ago, the common ancestor to the Sauropsida (dinosaurs, reptiles, and birds) diverged from the common ancestor to the mammals, which eventually would give rise to humans. We focused on finding quantitative data to demonstrate which species consumes the other and by how much, and vice versa. By converting numerical death rates to biomass, we present these data using a phylogenetic tree. Our findings are fourfold: (1) Humans are the dominant consumer. (2) Human predation is distributed heterogeneously across sister taxa. (3) Most human mortality comes from sister clades (viruses, bacteria, fungi) that diverged long ago from the line leading to humans. (4) Some sister clades (e.g., Sauropsida) show a dramatic change of standing across time, going from dominant predators (dinosaurs) to dominant food source (chicken).

Faculty sponsors: Preston Aldrich, James Fackenthal, Jeremy Nadolski

♦ **Mohammed Abrar, Syed Farhan**

“Development of a Local Anesthetic by Combining Lidocaine and Benzocaine”

A local anesthetic is a medication that produces a reversible loss of sensation in specific areas of the body, without causing loss of consciousness. A popular example of this in modern medicine is lidocaine, which is a widely used anesthetic that has antiarrhythmic and anti-inflammatory properties. It is effective in managing pain, ventricular arrhythmias, and inflammatory conditions such as rheumatoid arthritis. Its versatility and effectiveness make it a valuable tool in modern medicine. Benzocaine has similar applications to lidocaine, but also contains an ester functional group which allows benzocaine to be broken down by the body's natural enzymes faster. Therefore, by incorporating benzocaine into lidocaine, a product could be made that contains favorable properties from both. This derivative was chemically constructed using the Ethyl 4-aminobenzoate and further reacting that with 1,2,3,4-tetrahydroisoquinoline to create the final derivative product, ethyl 4-(2-(3,4-dihydroisoquinoline-2(1H)-yl)acetamido)benzoate. This derivative of lidocaine contains an ester functional group that enables professionals to expedite the speed at which their patients can return to their natural state. Furthermore, an additional aromatic ring that would increase the molecule's membrane permeability to target sodium channels, therefore increasing the drug's overall effectiveness.

Faculty sponsor: David Rubush

♦ **Mariam Ahmad**

“Skin Deep: The Relationship Between Colorism and Racism”

Colorism damages darker-skinned women’s chances of marriage (Hunter 2002), earning a higher salary (Fears 2003; Devaraj et al. 2018), residing in better living environments (Hughes & Heretel 1990), and being accepted by peers (AlGhamdi 2010). Colorism is prominent in regions such as South Asia and may be a product of European colonization. Regardless of its origins, colorism encourages the belief that European features, including lighter skin, are more desirable than darker features. This belief has encouraged women to use products such as skin lighteners to achieve a more acceptable status in society. Colorism coincides with anti-Black attitudes as both generally perpetuate the belief that darker skin is undesirable and/or lacks the attractiveness of lighter skin. There is an abundance of research that studies anti-Black attitudes in the United States but there is a lack of research in South Asia, where colorism is prominent. This study seeks to understand the relationship between colorism-based beliefs and anti-Black attitudes within South Asian populations. Colorism-based beliefs serve as the independent variable with anti-Black attitudes as the dependent variable. Results show a positive correlation between the colorism-supporting and anti-Black attitudes, $r = .545$, $n = 230$, $p = .000$. Higher colorism-supporting attitudes were correlated with higher Anti-Black-supporting attitudes. Participants that reported stronger belief in colorism-supporting attitudes were more likely to also show stronger belief in Anti-Black-supporting attitudes.

Faculty sponsor: James Davis

♦ **Mariam Ahmad, Sarah Choudhury, Diana Valencia**

“Women in the Workplace: How Stereotypes Surrounding Gender, Race, Professional Title, and Attire Can Affect Perceived Competence”

Evidence suggests that attire and personal characteristics such as gender and race can alter how others perceive competence and authority in the workplace. For example, more conservatively dressed women (blouse buttoned up/longer skirt) are judged as more competent than less conservatively dressed women (unbuttoned blouse/shorter skirt). This is particularly true for women who are perceived to have a higher status (Howlett et al., 2015). Two studies were conducted to investigate the effect of attire on perceptions of competence and authority in the workplace. In study 1, results were replicated indicating that more conservatively dressed women would be seen as more competent than those less conservatively dressed. Our second study plans to replicate and extend these findings. Using a 2 (attire: more conservatively dressed vs. less conservatively dressed) x 3 (race of women: White, Black, Latinx) experimental design, we tested the prediction that the race of the participant might also alter the perceptions of competence as a function of attire. To keep the body size constant, the skin tone of the woman was manipulated so that she might appear to be White, Black, or Latinx. Participants viewed the photo and evaluated the woman based on dimensions of competence and warmth using a 5-point scale with higher numbers indicating more competence or warmth. Based on previous research on stereotypes and competence, we expect that when the woman was conservatively dressed, she would be seen as more competent, but less warm; this might be particularly true when the woman was perceived as White. Overall, these findings may shed light on how stereotypes and skin tone might influence judgments of competence in the workplace.

Faculty sponsor: James Davis

♦ **Subhaan Ahmad, Saul Casas**

“Synthesis of a Lidocaine Structural Analog: 2-(benzylamino)-N-phenylacetamide”

Lidocaine, which is often used as a local anesthetic, is synthesized in a two step process: a reaction between 2,6-dimethylaniline and 2-chloroacetyl chloride, which creates a 2-chloro-N-(2,6-dimethylphenyl)-acetamide intermediate. This intermediate reacts with diethylamine to create Lidocaine. The purpose of this experiment was to synthesize a lidocaine structural analog, 2-(benzylamino)-N-phenylacetamide, using a similar process, instead using aniline to create a 2-chloro-N-phenylacetamide intermediate that reacts with benzylamine to form the final product. The final product was isolated and purified using a series of techniques including extraction with a separatory funnel, vacuum filtration and recrystallization.

Faculty sponsor: David Rubush

♦ **Nayyer Ahmed, Alvic Araneta**

“Synthesis of a Lidocaine Derivative via Chloroacetyl Chloride and N-(2,6)-diisopropylphenyl)-2-morpholinoacetamide”

Lidocaine is used in modern medicine and has commercial use as a local and topical anesthetic. The synthesis of a lidocaine derivative N-(2,6)-diisopropylphenyl)-2-morpholinoacetamide was completed. Reagents, chloroacetyl chloride and 2,6- Diisopropylaniline, were used to synthesize an intermediate 2-chloro-N-(3,5-diisopropylphenyl) acetamide through stirring and filtering. To create the final product, morpholine and toluene were added to the intermediate and refluxed for 3 hours. The impure product was then moved to a separatory funnel where it was washed with water, HCl, and then mixed with NaOH to create a basic solution. The product precipitated and it was collected through filtration and washed with cold water. As the product synthesized is similar to lidocaine in overall structure and functional groups, it is likely that it has similar properties to lidocaine.

Faculty sponsor: David Rubush

♦ **Nada Ali**

“Simulation of Kilonovae Using PhoSim: LSST Kilonova Data Challenge”

Kilonovae are astronomical phenomena that occur when two neutron stars or a neutron star and a black hole collide, producing an intense explosion. The collision results in the emission of visible light and gamma rays, as well as fundamental elements such as gold, platinum, and uranium. LSST (Legacy Survey of Space and Time) is a ten-year astronomical survey conducted by the Vera C. Rubin Observatory in Chile. Using PhoSim, a software utilized to simulate astronomical events, the primary goal of the project is to add simulated kilonovae to astronomical images and to assess how well those objects can be found by processing pipelines. My work was on further testing addition of kilonovae to astronomical images using PhoSim.

Faculty sponsor: Matthew Wiesner

♦ **Rida Ali**

“Tuvalu and Rising Sea Levels: Examining Solutions to Cultural Loss”

Climate change has caused an increasing environmental irregularities, resulting in disastrous effects on weather and temperature patterns. One such effect is the rapid rise in sea levels, a pattern scientists are wary of due to the likely endangerment of coastal zones, people, and cultures. Loss of land has endangered culturally important historical sites, alongside “intangible” culture or traditions heavily rooted in native lands. Loss of culture has negative implications as it can create a disconnect between communities and disengagement from knowledge of oneself. For instance, the Inupiat community of Alaska has experienced a high rate of youth suicide due to cultural disengagement stemming from colonization. A case study on the island nation of Tuvalu will examine whether countries vulnerable to rising sea levels may be at similar risk and propose solutions for cultural loss. Tuvalu must take short-and long-term measures to address this issue: completing risk assessments to ensure the safety of historic sites, determining means of migration when the land loss occurs, and creating effective policies and measures to protect the culture and inhabitants post-migration.

Faculty sponsor: Jean-Marie Kauth

♦ **Aleena Amra**

“The Effect of Wildfire Smoke on the Health of Firefighters”

Forest fires have become a significant issue over the years, causing immense harm to both the environment and human health. The smoke from forest fires is a source of dangerous pollutants, such as fine particulate matter (PM_{2.5}) and toxic gases. PM_{2.5} particles can travel into the respiratory tract where they negatively affect the respiratory and cardiovascular systems, though little is known about the the long-term effects or their severity. An epidemiological study will be used to classify the health effects on fire-fighters associated with exposure to smoke from wildfires. Hospital visits from firefighters will be recorded along with the outcomes during and after major forest fires. Patients’ pre-existing conditions and outcomes of the visit will also be recorded and used to track the impact of smoke on human health over time. Based on the results of prior investigations, it is hypothesized that the severity of the health impact on firefighters will be correlated with the length of time they have worked.

Faculty sponsor: Jean-Marie Kauth

♦ **Mohammed Ansari, Hiba Siddiqui, Jordan Werner**

“Doxorubicin Alters Exon 3 Skipping during BRCA2 mRNA Processing”

BRCA2 is a tumor suppressor gene that encodes proteins involved in DNA repair. The BRCA2 gene sequence consists of 27 exons, with exon 3 playing a key role in DNA repair. Inherited pathogenic mutations causing frequent exon 3 skipping during BRCA2 mRNA processing are associated with a 38%-84% risk for breast cancer and a 16.5%-27% risk for ovarian cancer. Drugs used in cancer therapy are known to have genome-wide effects on splicing patterns, including DNA damaging agents like doxorubicin (Adriamycin). To determine whether doxorubicin affects the frequency of exon 3-skipping during BRCA2 mRNA processing in cancer cells, doxorubicin was applied to a breast cancer cell line (MCF7), RNA was extracted, and isoform-specific reverse transcriptase polymerase chain reactions (RT-PCR) were performed to amplify cDNA fragments flanking exon 3. Fragments were resolved and visualized with agarose gel electrophoresis. End point RT-PCR reveals doxorubicin increases the frequency of BRCA2 mRNA exon 3-skipping and may reduce the level of functional BRCA2 activity in affected cells. This may indicate exon skipping is increased transcriptome-wide in the presence of doxorubicin, potentially contributing both to its therapeutic effects and toxic side effects.

Faculty sponsor: James Fackenthal

♦ **Mariyam Arshad, Zein Hammami**

“Bioinformatic Analysis of Eesa_37, a Predicted RecE-like Exonuclease Family Gene Present in the Genome of *Arthrobacter globiformis* Phage Eesa”

The Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science (SEA-PHAGES) program promotes undergraduate research through phage discovery and genome annotation. Students at Benedictine University can engage in SEA-PHAGES research through the first-year biology laboratories. Our research focuses on Eesa, an *Arthrobacter globiformis* phage isolated by fellow researcher, Mariyam Arshad, in Fall 2021 at Naperville, IL. Our work focuses on the genome annotation of phage Eesa and specifically, bioinformatic studies on one gene, Eesa_37. Eesa is a temperate phage with a viral structure belonging to the Siphoviridae family that includes an isometric capsid and flexible tail. Genome sequencing assigns Eesa to the *Arthrobacter* phage cluster AS and subcluster AS1. Phages most similar to Eesa in this cluster include Orcanus and Brynnie. In this work, we hypothesized Eesa_37 was a gene with a predicted RecE-like exonuclease domain. A variety of gene and protein bioinformatic tools were used to study Eesa_37. Protein analysis showed Eesa_37 is a 342 amino acid protein with no predicted transmembrane domains. BLAST aligns Eesa_37 with 94-99 % identity to Orcanus_38 and Brynnie_37. Its genome location places Eesa_37 downstream of an excise gene and upstream of a RecT-like ssDNA binding protein. HHPRED analysis aligns amino acids 22 – 329 from Eesa_37 with an exonuclease domain studied in *Escherichia* sp. and *Laribacter* sp. phages with 99% probability. Based on genomic location and protein analysis we predict the gene product of Eesa_37 is involved in DNA integrity by participating in DNA repair or accuracy.

Faculty sponsor: Tiara Pérez Morales

♦ **Arbaaz Basha**

“Molecular Inspection and Identification of Parasitic *Wolbachia* derived from *Torymus cecidomyae*”

Studies have shown that the most populous class of animals in the world, insects, are being infected by a distinct bacterium called *Wolbachia*. This bacterium inhibits male reproductive cells in insects, and as such, it modifies genetic male insect specimens to female specimens, which can then pass on the bacterium genetically. Since it is not clear which specific insects are most prone to *Wolbachia*, and which environments are especially susceptible to this bacterium, it is integral to test insect specimens to gain this information. This was done so by extracting and sequencing genes from a wasp collected at the Benedictine University campus to analyze if it is genetically modified with the presence of *Wolbachia*. This also extends to the identification of its species. The genetic tests yielded results that prove that the insect carried *Wolbachia*, and that the insect is identified as the moth *Helicoverpa zea*. Since the specimen was not a moth, practical and preparatory errors have been made during sample processing. This research is evident that insects on campus are infected with *Wolbachia*, and that our lab protocol is able to confirm which insect species carry them.

Faculty sponsor: Phil Novack-Gottshall

♦ **Kaitlyn Brunken, Nina DiNardo**

“Chemical Analysis of Plant-Based Ingredients and Extracts in Common Skincare Products”

In our poster, we will explore properties of chemical components that are main ingredients to common skincare products. Research will be analyzed on compounds including ginseng, Rosmarinus acid, b-carotene, hyaluronic acid, and Ginkgo biloba extract to determine the specifics of their properties that allows their functions to be effective. We will highlight the importance of the products applied to the skin and point out chemical toxins that should be avoided and substituted with the natural ingredients listed above. Understanding the labels on your products to fully be aware of the effects is crucial when wanting the best long-term outcome for skin. We will specifically touch on the importance of natural serums and creams. Overall, we will conclude that plant-based ingredients and extracts can not only help reach personal skincare goals, but also treat skin disorders.

Faculty sponsor: Brooks Maki

♦ **Cayden Cagle**

“Recommendations for National Parks on Conservation in a Time of Climate Change and Increased Use”

National Parks are a system of preserved land created by the government to save land from industrialization. The original purpose of these parks was to preserve land in the rapidly growing country so that way the landscapes and land diversity within the United States would be conserved. The national park system is a legal body that represents the national parks, but some of the legislation created for national parks is vague and leaves the door open for national parks to become damaged—first by tourists and then by climate change. The Bureau of Land Management is doing work in this field to slowly remedy this, but the land is still being damaged. While national parks were created to conserve the environment, crime rates and ecocide is a common occurrence and climate change is destroying the environment within these parks. Temperatures rising, precipitation decreasing, and bio-diversity declining are all common within national parks. Solutions to this are both congressional and internal. Creating legislation within congress that punishes ecocide could protect the national parks from tourism. Also, paying rangers and partner companies could incentivize a higher standard of maintenance. A higher standard of maintenance is one of the key elements to revitalizing the national park system to a true method of conservationism.

Faculty sponsor: Jean-Marie Kauth

♦ **Giovanni Carbonara**

“Could the Combination of Computer Intelligence Systems Find Solutions to Oil Spills More Efficiently?”

Many oil rigs operate in oceans, providing necessary petroleum to the infrastructures of countries. Spills of petroleum into bodies of oceans, however, remain a prevalent issue. Oil spills are known to be harmful to marine life. Methods of detecting and handling oil spills are not heavily researched. There are systems available such as Case-Based Reasoning (CBR), Genetic Algorithm (GA), and Artificial Neural Networks (ANN) that utilize computer databases to help people find the best approach to treating an oil spill. Combining these computerized systems to generate the best solution to an oil spill is hypothesized to be better than just one individual computer intelligence system by providing a faster response with a higher success rate. If the hypothesis is found to be true, then solutions to an oil spill scenario could be generated more quickly, saving marine communities from the toxicity of petroleum. This research is essential to develop more efficient methods of stopping oil spills before major environmental damage becomes irreversible.

Faculty sponsor: Jean-Marie Kauth

♦ **Rachel Cepolski, Isabel Rossi**

“Synthesis of a Lidocaine Analog using 2,6-diisopropylaniline and 1,2,3,4-tetrahydroisoquinoline”

Lidocaine is a local anesthetic that relieves pain by binding and blocking voltage-gated sodium channels in the heart, nerves, and skeletal muscles. This binding inhibits generation of action potentials. Action potentials, initiated by specific ionic concentrations, control sensory transmission to the brain. This effect is known as analgesia, and local anesthetics, such as lidocaine, typically achieve complete analgesia more effectively than systemic analgesics; thus, they are very effective for clinical use. Studies show that lidocaine derivatives can experience varying potencies and lengths of duration. Lidocaine derivatives with a higher lipid solubility show the longest duration of action. This

research intended to synthesize a more lipophilic derivative to enhance lidocaine's biological activity. Lidocaine derivatives can be synthesized from an aniline, an amine, and chloroacetyl chloride. 1,2,3,4-tetrahydroisoquinoline was the amine of choice in this research due to its bulky lipophilic carbon group. 2,6-diisopropylaniline was reacted with 2-chloroacetyl chloride to obtain the first synthetic product, and was then reacted the 1,2,3,4-tetrahydroisoquinoline to reach the final product. The biological activity of the lidocaine derivative product will later be assessed.

Faculty sponsor: David Rubush

♦ **Rachel Cepolski, Aymun Khan**

"Macroinvertebrate Ecology Sampling and Surveying Project"

Macroinvertebrate biodiversity surveys are used to help determine the health of an aquatic ecosystem. We studied the spatiotemporal variation in macroinvertebrate diversity using active and passive sampling of Lake St. Benedict throughout the spring, summer, and fall of 2022. For active sampling, we used 500µm sieves and modified methods developed by Illinois RiverWatch. For passive sampling, we used leaf packs developed from the Leaf Pack Network. Macroinvertebrates were identified down to family, and biodiversity was assessed using Shannon's Diversity Index as well as predator-prey ratios. Our results reveal spatiotemporal variation in macroinvertebrate diversity in Lake St. Benedict that we can use to inform the aquatic ecosystem health of our campus lake. Additionally, our research has increased accessibility to studying macroinvertebrates by integrating our methods into educational outreach events such as Morton Arboretum's Nature Play for All and Jurica Suchy Nature Museum's "Life in the Pond" community events. Our hands-on activities at these events allowed community members of all ages and abilities to get involved in learning about macroinvertebrates and, ultimately, their importance in our local freshwater ecosystems.

Faculty sponsor: Leigh Anne Harden

♦ **Emma Cottrell, Zain Gill**

"Synthesis and Characterization of a Lidocaine Derivative: A Promising Anesthetic"

Lidocaine is a local anesthetic widely used as a numbing agent for pain and has been around for decades. However, its use is often limited by its short duration and its potential side effects. In an effort to address these limitations, a lidocaine derivative has been synthesized and characterized. The compound was prepared via a two-step synthesis. The synthesis utilized commercially available reagents such as, chloroacetyl chloride, 2,6 dimethylaniline, 2-ethylamino ethanol, and toluene. The final product yield was 0.088 grams and was subsequently characterized by thin line chromatography. This process helped us characterize the purity and chemical similarities between the derivative and the original lidocaine. The results may indicate that the new derivative exhibits improved anesthetic properties compared to lidocaine, however it has yet to be tested biologically. Overall, this lidocaine derivative could be a promising new anesthetic agent with a potential for improved efficacy and fewer adverse effects.

Faculty sponsor: David Rubush

♦ **Jeff Creager**

"Progress Toward the Synthesis of Lobechine, a Bioactive Pyrrole"

2-formylpyrrole compounds have a variety of reported medicinal uses. A sub-family of these structures including lobechine, morrole A, and pyrroleanthine butyl ether exhibit antiinflammatory and antifungal properties. Reported here, a biologically-inspired method to access 2-formylpyrrole structures using an Achmatowicz reaction and condensation sequence is expanded to gain access to these biologically active and structurally interesting small molecules. This robust synthetic process has been used to access a variety of 2-formylpyrrole structures related to naturally isolated and bioactive compounds.

Faculty sponsor: Brooks Maki

♦ **John Creviston, Vasilios Katsambas, Cole McManus**

"Proof of Concept for Recycled Expanded Polystyrene Boards"

The increasing consumption of single-use plastics, including styrofoam (aka expanded polystyrene or EPS), continues to have adverse effects on the environment and even human health. If EPS is not disposed of properly, it can

damage terrestrial and aquatic ecosystems. This project attempts to recycle waste EPS from a precast concrete manufacturer to create new industrial grade EPS boards. Initial testing attempted to maximize bead-to-bead contact by softening the outer shell of EPS beads and creating internal tensile strength. The research group has also evaluated bonding agents (Portland Cement, Plaster of Paris, and EVA glue) to create internal tensile strength. Different formulations of bonding agents were used to create prototype boards for physical testing. The prototypes have been undergoing testing for density, compressive strength, and flexural strength to compare to industry standards, while also ensuring the financial feasibility of these alternatives. In this manner, we hope to formulate acceptable alternatives to the use of new polystyrene resin for EPS boards. Hopefully, a breakthrough in the recycling of waste polystyrene can counter the harmful effects of improperly disposed EPS.

Faculty sponsor: William Schubert

♦ **Ramzey Douedari**

“The Rising Popularity of High-Frequency Trading in the Stock Market”

A trading strategy known as High-Frequency Trading (HFT) is becoming the norm for how securities are traded in the equity markets over the last decade. HFT is a form of algorithmic trading, which is the process of executing orders using automated electronic systems. It requires powerful computers to execute a massive number of orders at rapid speeds. Within microseconds, hedge funds, institutions, or investment banks outpace the average retail investors with ease. HFT has encouraged various strategies within the equity markets, ranging from arbitrage to momentum strategies. The focus of this paper is to provide a meaningful analysis of HFT in the stock market. There are several benefits to HFT, such as the increase in liquidity and overall efficiency for equity markets. That is not to say HFT does not remain to be a very controversial topic. HFT is largely criticized by retail traders and investors because of how difficult it becomes to compete with large hedge funds and firms. The rise in HFT makes opportunities within the stock market difficult to grasp for “average Joe traders.” HFT accounts for nearly 50 percent of stock trading volume in the U.S., yet it remains to have significant problems in equity markets like stock manipulation.

Faculty sponsor: Stefan Stefanoski

♦ **Hiba Durrani, Zohaib Farooq, Ayesha Moosani, Iman Naseeruddin, Yusra Naseeruddin**

“Probiotics Play a Key Role in Alleviating Bile Acid (BA)-Induced Cytokine Release and Tight Junction (TJ) Dysfunction in Human Colonic Epithelial T84 Cells ”

High colonic BAs play a role in pathogenesis of diarrheal diseases in ~1% of the population and probiotics are often used to help alleviate symptoms. We have reported that the primary BA, chenodeoxycholic acid (CDCA; 500μM), disrupts barrier integrity in T84 cells, while its derivative, lithocholic acid (LCA; 50μM), did not; CDCA action involved reactive oxygen species, the proinflammatory cytokine IL-8, and apoptosis. Further, probiotics±LCA ameliorated CDCA-induced apoptosis and oxidative stress. In the present study, we hypothesize that probiotics could ameliorate CDCA-induced cytokine release, barrier disruption and increases in paracellular permeability in T84 cells. Probiotic strains in Up & Up extra strength supplement were grown in T84 cell culture media±BA under anaerobic conditions at 37°C, sterile filtered to obtain conditioned media (CM), and used in subsequent experiments. ELISA (IL-8 release), TER (Ω.cm²) (resistance to measure pore function of TJ), FITC-10 kDa dextran flux (F10D; μg) (to measure leak function of TJ) assays were performed ±BA±CM. Probiotics±LCA mitigates CDCA-induced inflammation, by decreasing IL-8 release, and TJ dysfunction by decreasing leak, but not pore function, in T84 cells. Understanding the mechanism by which probiotics restore barrier integrity will help identify novel therapeutic strategies to target symptoms in patients with BA-associated diarrhea.

Faculty sponsors: Jayashree Sarathy, Mark Poch

♦ **Ali Ebraheemi, Jeffrey Korbitz, Mayeli Vivaldo-Nikitovic**

*“Synthesis of Small Molecules for Bacterial Quorum Sensing in *Lactobacillus acidophilus*”*

The synthesis of small molecules for bacterial quorum sensing in *Lactobacillus acidophilus* is a crucial aspect of understanding bacterial communication and behavior. Previous work by microbiologist Dr. Tiara Pérez Morales has shown that only five molecules out of 10,000 were capable of affecting bacterial quorum sensing. In this study, we aimed to synthesize analogs of M-0466, the most promising molecule identified by her work, in order to improve its

activity and effectiveness. To achieve this, a series of small molecules were synthesized using organic chemistry techniques. The synthesized compounds were then tested for their ability to affect bacterial quorum sensing in *Lactobacillus acidophilus* using a range of analytical methods including liquid chromatography, mass spectrometry, and bioassays. Our results showed that several analogs of M-0466 had significantly increased activity in bacterial quorum sensing, with some showing up to a fold increase in activity compared to the original molecule. These findings have important implications for the development of novel treatments for bacterial infections, as well as for understanding the mechanisms of bacterial communication and behavior. In conclusion, our study has successfully synthesized several small molecules with increased activity in bacterial quorum sensing in *Lactobacillus acidophilus*, which provides a promising starting point for further research in this field.

Faculty sponsors: David Rubush, Tiara Pérez Morales

♦ **Ambreen Elahi**

“Characterization of Planarian Photolyase/Cryptochrome-like Protein”

The presented work aims to determine whether a Planarian (*Schmidtea mediterranea*) protein has a cryptochrome or photolyase function by subcloning the corresponding gene into a pET-19B expression plasmid. The His-tagged protein is overexpressed in BL-21 E. coli cells and purified in one step using a His-tag on a Ni-NTA column. Photolyases and cryptochromes are blue-light-driven flavoproteins that share a common origin and amino acid sequence but differ in their catalytic function. Photolyases repair UV-induced damaged DNA, while cryptochromes regulate the circadian rhythm in light entrainment mechanisms. Through research on planarians, scientists have gained valuable knowledge about the molecular and cellular mechanisms that drive regeneration, including gene expression. This work presents the outcomes of subcloning, protein expression, and purification processes, which led to the binding of the purified protein to the antibody test, with an estimated molecular weight of approximately 62 kDa.

Faculty sponsors: Madhavan Narayanan, Mark Poch

♦ **Zohaib Farooq, Hedayah Krakra, Ayesha Moosani**

“Collaborative Characterization of Bacterial Colonies Isolated from Soil Samples at Benedictine University”

The Tiny Earth program is a global initiative that promotes antibiotic discovery research in undergraduate microbiology laboratories. The main goals of the program are to identify and characterize new antibiotics that can be utilized in healthcare. In this work, two soil samples from the grassland at Benedictine University were selected for study. We hypothesized that the yearly soil turnover and fresh landscaping would promote higher bacterial activity. Three bacterial samples were obtained for further study and were labeled as TE1, TE3, and TE7. All samples were characterized using Gram stains, Phase contrast, and 16s rRNA sequencing. Antibiotic production was tested using known bacterial Gram-positive and Gram-negative strains *Staphylococcus cohnii* and *Acinetobacter baylyi*, respectively. Preliminary results show that TE1 is a Gram-positive bacterium while TE3 and TE7 are Gram-negative bacteria. TE1 and TE7 produced antimicrobials in the presence of *S. cohnii*. All colonies produced antimicrobials when exposed to *A. baylyi*. Phenotypic studies and 16s rRNA sequencing data will help identify the genus and potential species of the Tiny Earth isolates. In the future, we will explore published data to determine if there are known antibiotics produced by these soil microorganisms.

Faculty sponsors: Tiara Pérez Morales, Mark T. Poch

♦ **Adam Ghani**

*“Pond to Plate: Characterization of *Arthrobacter globiformis* Phage Ader”*

SEA-PHAGES (Science Education-Phage Hunters Advancing Genomics and Evolutionary Science) is a nationwide collaborative research-based program offered at Benedictine University to students in the Principles of Biology laboratories. The main goal of SEA-PHAGES is to characterize the activity and genomes of bacteriophages, viruses that infect specifically bacteria. Our work focused on isolation of a phage at a pond's edge in Oak Brook, IL, that could infect the soil microorganism *Arthrobacter globiformis*. We hypothesized the damp soil and contact with water would increase bacterial and phage diversity in our samples. Two phages were recovered and one, Phage Ader, is described in this project. Phage Ader was purified, amplified, and visualized using transmission electron

microscopy. Structurally, Phage Ader belongs to the *Siphoviridae* family which includes short or long capsids (genome storage) and flexible tails (binding and genome delivery). Infection data suggests Ader can fully lyse cells and its activity is specific to the genus *Arthrobacter*. Our next steps are to continue characterization by studying Ader's infection capabilities using a variety of temperatures and different *Arthrobacter* species. In the future, we would like to explore phages that infect bacterial pathogens as they are becoming a potential alternative treatment for antibiotic resistant infections.

Faculty sponsor: Tiara Pérez Morales

♦ **Zain Gill, Maria Rodriguez-Briseno**

"Design, Construction, and Testing of a Stand-Alone Solar-PV System at Benedictine University"

The use of solar-photovoltaic (solar-PV) systems has become increasingly popular as an alternative source of clean and renewable energy worldwide. However, Midwestern states are lagging behind others in the U.S., most notably California, Texas, North Carolina, and Florida. This is due to popular misconceptions, such as weather conditions, but also because a lack of outreach and creating awareness through renewable energy educational programs across the universities in the Midwest. The engineering program in Benedictine's Department of Physical Sciences has created avenues to promote solar energy, by introducing coursework on renewable energy and by involving students in active research. This project includes the design and construction of a standalone solar-PV system on our campus. The system components include solar panels, an inverter, charge controller, and a battery to store the generated energy. Several properties of interest were tested under varying solar irradiance, including short-circuit current, open-circuit voltage, I-V curves, and charge/discharge characteristics of the battery, to name a few. This solar-PV system will be used as a showcase for recruitment activities, research projects, and demonstration for courses taught at Benedictine.

Faculty sponsor: Stefan Stefanoski

♦ **Madolyn Greenwood**

"Climate Change Effects on the Spread of Vector-Borne Diseases"

Vector-borne diseases have been shown to thrive in warmer, wetter climates that are increasingly affected by climate change. This is causing the alarming and fast-moving spread of vector-borne diseases like dengue fever, African swine flu, and malaria. We propose a study using a Maxent model to further research distribution of virus outbreaks while using WorldClim bioclimatic data to better help predict future climatic change and disease spread based on the data the Maxent model collected as well as current circumstances. The Maxent model is a maximum entropy modeling database that collects information and uses empirical data to predict or model what may happen in regards to distribution of species, disease, etc. WorldClim bioclimatic data uses variables to represent trends of temperature, environmental factors, and other measures. When using this technology, it is easier to analyze the potential effects of disease that is correlated with climate change. This will help not only prevention, but understanding what to do if the diseases spread more widely. Moreover, with this study we can predict that the warmer climates will be projected to have more outbreaks of disease in the future.

Faculty sponsor: Jean-Marie Kauth

♦ **Jennifer Griffin**

"Politics of Racism: The Relationship between Education and Racism"

There are many forms of education; likewise there are many ways in which one's political ideology and worldview are developed, but the most influential element of that development is one's education. Recent educational research highlights the nature vs nurture arguments in the development of a student; my research hopes to analyze if there is a relationship between one's various forms of education (both traditional and non-traditional) to one's political ideology and behavior, and whether or not the introduction of specifically anti-racist and inclusivity-based education affects those developments.

Faculty sponsors: Phil Hardy, Allen Legutki

♦ **Zein Hammami, Ihsaam Izzathnayem**

“The Derivative of a Structural Analog of Lidocaine with the Addition of Iodine Used in the Aniline”

Lidocaine is a muscle relaxant drug used to temporarily numb a region of the human body. Lidocaine’s principal function is to inhibit nerve impulses, which lessens the sense of pain or suffering during operation, or a skin wound. Lidocaine is frequently favored over other anesthetics due to its quick onset of action and extended duration. It is essential to make this medication using a variety of ways which synthesis enables. With 4-iodobenzenaminium as aniline and 3-chloropropanyl chloride, the product 3-chloro-N-(4-iodophenyl)propanamide is made and reacted with di-isopropyl amine to create a synthesis of lidocaine. No synthesis conducted with these specific reagents has been documented.

Faculty sponsor: David Rubush

♦ **Maaz Haque**

“Evaluating the Capabilities of Mycosporine-like Amino Acids to Protect against Ultraviolet Radiation in Phytoplankton Near Antarctica”

Ultraviolet radiation is a form of electromagnetic radiation that has immense potential to damage organisms, including causing skin cancer in humans and diminishing the survivability of aquatic organisms. There are defense mechanisms that have proved beneficial in blocking ultraviolet radiation and mitigating its effects. One of these defense mechanisms observed in creatures residing in Arctic ecosystems are protective antioxidants, chemicals within cells that prevent damage from ultraviolet radiation. A 55-day study in Antarctica will be utilized to analyze the presence of mycosporine-like amino acids, a major type of chemical antioxidant, and their effectiveness in mitigating ultraviolet radiation. Seawater samples will be collected for nutrients, and high-performance liquid chromatography and CHEMTAX will be utilized to analyze the phytoplankton in the seawater samples for mycosporine-like amino acids. The phytoplankton can be tested for resistance against UV-B radiation with their respective mycosporine-like amino acids. Based on current information regarding mycosporine-like amino acids, it is hypothesized that mycosporine-glycine will be the most prevalent and effective of the mycosporine-like amino acids present in the set of samples. The most effective of these chemical antioxidants may be able to be used for sunscreens and similar protective barriers against UV radiation for humans and other organisms.

Faculty sponsor: Jean-Marie Kauth

♦ **Abdallahman Hasan, Areeb Siddovatam**

“Synthesis and Characterization of a Lidocaine Derivative for Potential Use as a Local Anesthetic”

This synthesis report details the successful production of a lidocaine derivative, N-[2,6-Bis(1-methylethyl)phenyl]-1-piperidineacetamide, using chloroacetyl chloride, 2,6-Diisopropyl aniline, acetamide, and piperidine. The synthesis process involved multiple steps, including the formation of an intermediate compound and subsequent purification through recrystallization. Overall, this report highlights the successful synthesis of a lidocaine derivative using a novel approach, and its potential for use as a local anesthetic. The findings presented in this report contribute to the development of new therapeutic agents in the field of pharmacology and specifically in dental applications.

Faculty sponsor: David Rubush

♦ **Samreen Hussain, Yumnah Khan**

“Prevalence of Haemogregarina Parasites in Freshwater Painted Turtles Inhabiting Lake St. Benedict”

Haemogregarine protozoans are found in freshwater turtles as intraerythrocytic parasites transmitted by leeches. We investigated the prevalence of intraerythrocytic parasites in painted turtles (*Chrysemys picta*) inhabiting a lake on the Benedictine University campus, Lisle, Illinois. In June and July 2022, blood samples were collected from 22 painted turtles captured in Lake St. Benedict: 9 females, 8 males, 5 juveniles. A drop of blood was used to make triplicate blood smears per individual. Blood slides were air-dried, fixed with methanol, Giemsa stained, and viewed under an oil immersion microscope in a zigzag pattern for 50 field views per slide, or ~4050 erythrocytes. We calculated mean parasitemia per turtle by dividing the total number of parasites by 4050 erythrocytes and averaging across triplicate slides. We then calculated mean parasitemia by sex. Mean parasitemia (proportion of infected erythrocytes) in females (0.11 ± 0.22) was higher than in males (0.02 ± 0.02) and juveniles (0.04 ± 0.38), which could

be due to the female-biased sexual dimorphism in this turtle species. We plan to continue exploring patterns of leech parasitism, and comparing parasitemia in our turtles to those in other studies as a measure of individual and population-level health.

Faculty sponsor: Leigh Anne Harden

♦ **Zahra Irfan**

“An Update to the Synthesis of a Family of Lawsoniaside Molecules”

The henna plant, *Lawsonia inermis*, is commonly used as an organic dye to tint the skin and hair a reddish-brown color. Henna contains many constituents, where its main dyeing compound is a naphthoquinone called lawsone (2-hydroxy-1,4-naphthoquinone). Another component of henna dye is lawsoniaside, which is a naphthoquinone that closely resembles lawsone except for the addition of two glucose residues. This research aims to synthesize lawsoniaside and a family of related glycosidic derivatives which have different sugar residues. The original proposed synthesis began with lawsone and attempted to add two equivalents of sugar to yield the glycosylated lawsone product. However, given the lack of success with the aforementioned route, a new synthetic process has been proposed to construct lawsoniaside and related molecules. Biological and electronic testing of this family of compounds are planned to explore physical properties.

Faculty sponsor: Casey Larsen

♦ **Yousuf Kamal, Manal Syeda**

*“Initial Characterization of the Analog JM27 and Its Activity on the Rgg Quorum Sensing Systems Present in *Streptococcus pyogenes*”*

Microorganisms including bacteria can communicate with each other using a mechanism known as quorum sensing (QS). QS promotes responses to environmental cues through modulation of specific genes and/or operons. Our work focuses on transcriptional regulators named Rgg and their interacting partner molecules named SHPs (short hydrophobic peptides). Our laboratory studies the Rgg/SHP QS systems present in the Gram-positive pathogen *Streptococcus pyogenes*. There are four Rgg/SHP QS pathways known as RopB/SIP, ComR/XIP, and Rgg2-3/SHP2-3. These lead to social responses in *S. pyogenes* such as toxin production, DNA transformation, and biofilm formation respectively. We are focused in studying the effects of small molecules on these QS pathways. In this work, we are characterizing a molecule, named JM27, and its potential QS modulatory activity in *S. pyogenes*. Based on prior small molecule data, we hypothesize JM27 may have specificity to only one of the Rgg/SHP QS pathways. This work explores QS activity through transcriptional luciferase assays aimed at promoters regulated by the Rgg proteins. We will also determine if JM27 may have any effects in bacterial growth through indirect quantitative methods. Our work aims to compare the activity of JM27 to other synthesized molecules with similar structures.

Faculty sponsor: Tiara Pérez Morales

♦ **Aymun Khan, Zaara Manzoor, Nick Musick**

“The Relationship Between Sediments and Aquatic Habitat in Lake St. Benedict”

Lake St. Benedict has been studied for several years, in an effort to understand the causes and potential prevention of on-going eutrophication and fish kills. This year's study evaluates the impact of 2022 sediment treatment and the potential to improve habitat conditions in the future. In 2022, at the recommendation of the College of Science, the deepest part of the lake was treated with a lanthanum enriched clay product to prevent the flux of phosphorus from the lake sediment into the overlying water column. A mass balance of potential phosphorus sources, supported by regular water quality analysis, indicated that the largest contributor of phosphorus to the water column was the deep-water sediments. Since the 2022 treatment event, water quality and macroinvertebrate analysis has indicated little effect of the initial sediment treatment on macroinvertebrates or water quality. Sediments are also being evaluated to examine the effect conventional algicides on the lake sediment. In addition, bench scale treatment studies are being conducted to evaluate the potential effectiveness of on-going sediment treatment and the advisability of routine application of conventional algicides.

Faculty sponsors: William Schubert, Leigh Anne Harden

♦ **Jennah Khan**

“The Effects of Unsustainable Farming and Forest Fires in the Amazon on Indigenous Populations”

Unsustainable farming practices and forest fires in and around the Amazon Rainforest pose a serious threat to indigenous populations within the region. Slash-and-burn practices have been employed more frequently by local farmers within the past few decades, increasing the toxicological risk to native inhabitants. This study will observe how the fires have resulted in an increase in carbon, ozone, and fine particulate matter (PM_{2.5}) emissions, and the resulting impact on humans. With the use of pulmonary function testing, a more holistic understanding of respiratory consequences will be obtained. In this proposed study, test subjects within ten miles of the Altamira region of the Amazon Rainforest will undergo pulmonary function testing in order to gather data on the effects of the fires on their respiratory health. This experimental group will be tested against various control groups outside of the specified region in order to isolate the cause of respiratory deficiencies or consequences. If the control groups yield normal and unremarkable results to the pulmonary function tests while the experimental group exhibits abnormal results, we expect to find that the effects of pollutants such as fine particulate matter, carbon monoxide, and ozone are likely causal factors for the decline in respiratory health with increasing proximity to the forest fires.

Faculty sponsor: Beth Vinkler, ,

♦ **Mariya Khan**

“Political Socializing Agents and the Changing Political Identities of University Students”

The purpose of this study is to investigate the ways in which college students’ political identities are influenced by competing and changing socializing agents. Students’ political views are influenced by socializing agents that include their environments, religious and education backgrounds, family dynamics, and media preferences. My primary aim is to examine the effect of students’ upbringing and their parents’ political views on their own political identities and behavior. In this study, I distributed an 18-item Qualtrics survey, targeting a sample size of N=300 college students. Respondents were asked a series of questions related to their social interactions, family dynamics, and religious backgrounds pertaining to their political perspectives.

Faculty sponsor: Phil Hardy

♦ **Jeffrey Korbitz**

“Chemical Internship Experience at Nanophase Technologies”

Nanophase Technologies is a nanotechnology company headquartered in Romeoville, IL, that produces nanomaterials for a wide range of applications. The company produces products as diverse as nanomaterials marketed for industrial use and personal skincare products under the label Solesence. A chemical internship was conducted at the company beginning in January 2022 that continues to the present day. The internship was within the quality control department. Tasks conducted at the internship included FT-IR raw materials testing in addition to ICP training, as well as various projects to update and modernize the retain logging system. The internship has resulted in an expanded understanding of chemistry and how it is uniquely implemented in the corporate sphere, with additional components including pharmaceutical testing protocols that become paramount within a corporate quality control environment.

Faculty sponsor: David Rubush

♦ **Madison Kuban**

“Air Pollution and its Effects on Women’s Mental Health”

Air pollution has been shown to affect humans physically, but it may also pose risks to mental health. If pollution negatively affects the chemicals in someone’s brain, then there is a chance for an increase in mental health disorder symptoms. However, there is not an extensive amount of research on this correlation. Here we propose a study that observes 2,000 female subjects in the U.S. that are exposed to pollution, also known as PM_{2.5}, for 8 years. The reason our subjects are female is due to the fact that women are more susceptible to experiencing a mental health disorder compared to men. The group that will be used as a comparison in the study will be a separate group of 2,000 female subjects who are exposed to less pollution than the testing group. All subjects will complete a Beck Depression Inventory assessment to establish a baseline of where their mental health is before the study takes

place. Every participant will give annual feedback on their mental stability using the same assessment they used to give their initial information. We expect to find that more women will experience an increase in depression symptoms with increased exposure to PM_{2.5}.

Faculty sponsor: Jean-Marie Kauth

♦ **Sumaya Mansour, Alisha Syed**

"A Derivative Analysis of Piperazine-Induced Polar Modification of Lidocaine"

Lidocaine is typically utilized as a numbing agent in the medical field. Its ability to navigate and restrict the flow of ion channels allows it to temporarily relieve pain by blocking nerve signals. Through this research, an extremely polar nitrogenous derivative of lidocaine was formed. By altering a critical chemical property, further research can determine the polar derivatives efficiency. The research was performed through a two step synthesis. The first product created was 2-chloro-N-(2,6-diisopropylphenyl) acetamide through combining and isolating 2,6-diisopropylphenyl and 2-chloroacetyl chloride. After allowing the product to dry extensively, the first product was further reacted with piperazine, resulting in a final polar product of N-(2,6-diisopropylphenyl)-2-(piperazin-1-yl)acetamide yielding 43.25%.

Faculty sponsor: David Rubush

♦ **Amirah Mohiuddin**

"Air Carcinogens and Breast Cancer: A Study of Environmental Exposures"

Airborne carcinogens are substances that carry the potential to promote uncontrolled cell reproduction, more commonly known as cancer. The impact of carcinogens on human health is significant, often compounded by a lack of awareness among individuals regarding the presence of such substances in their environment. With this being said, studies have found a connection between air toxin exposure and the development of breast cancer. The proposed study will look at incidences of breast cancer in India's highest industrial zone, New Delhi, India. Karnataka, India will serve as a control as this district is not an industrial zone. I will look at both controls, which will be randomly sampled from the population in Karnataka, and breast cancer cases, which will be taken from hospital records in New Delhi, and relate the development of breast cancer to the air quality from where the participants reside and work. Age, family history, and lifestyle choices will also be considered. I will mainly focus on measuring the air quality in homes and workplaces. It is expected that the exposure of air toxins through inhalation has a direct connection to the onset of breast cancer.

Faculty sponsor: Jean-Marie Kauth

♦ **Agne Nakvosaite**

"Supernova Identification Using Spectroscopy"

The 4.1-meter Southern Astrophysical Research (SOAR) Telescope located in Cerron Pachon, Chile, is one the most advanced research facilities available to astronomers, capable of capturing optical to near-infrared wavelength imaging. In order to be able to identify the type of supernova captured in an image, its light signature (or spectra) must be analyzed. If this spectra contains hydrogen lines, a significant dip in the curve at a particular wavelength, it is an indication that the image contains a Type II supernova. We worked with calibrating a program to quickly reduce and analyze such images in an effort to identify the type of supernova captured.

Faculty sponsor: Matthew Wiesner

♦ **Angeline Nato**

"Urban Greening and its Disproportionate Effects on Minority Communities"

Urban greening is an environmental practice in which existing urban communities are made to integrate green space via the construction of public parks or the incorporation of greenery into polluted areas. Research has demonstrated urban greening's ability to reduce surface temperatures in cities through the availability of canopy cover. However, while urban greening has traditionally been presented as a sound method to combat the negative health effects of urban pollution, researchers also note how such practices can produce racially gentrified communities through the rise of property values. I propose a study that involves the collection of data regarding the health, race, and income

of adults residing in communities near the Chicagoland area. Data will be sorted between two types of communities, those with implemented green space and those without, to determine whether urban greening truly provides a health benefit, as well as determine if urban greening produces racially segregated communities that are unable to reap the benefits of urban greening itself. I hypothesize that differences in racial demographics and health outcomes will be noted between the two types of communities when income levels are controlled for.

Faculty sponsor: Jean-Marie Kauth

♦ **Ryann O'Malley**

"Bridging the Partisan Climate Gap: Dissecting the Republican Perspective"

It is quite evident that the attitude towards the environment is ideologically polarized. It is often assumed that the Republican Party, in particular, does not possess concern for the environment due to issues of that matter being rarely discussed by the Party's leadership. This is not necessarily true, however. With conversation built into the word 'conservative,' care and stewardship for the well-being of the environment is, in fact, a crucial aspect of conservatism. This study will address the following questions: are conservatism and environmentalism mutually exclusive? How can the environmental movement benefit from appealing to both liberals and conservatives as they both have a stake in the health of the environment, even if their motivations are different? How do they accomplish inclusivity? I hope to encourage both conservatives and liberals to join together to rectify environmental issues by establishing common ground and eliminating the extreme polarization surrounding the topic of environmentalism.

Faculty sponsor: Jean-Marie Kauth

♦ **Jacob Pipowski**

"Body Mass at-Death Estimates for KNM-WT 15000 from Juvenile Growth Data"

Body mass is an important parameter that underpins many aspects of an organism's physiology and ecology. However, it is difficult to predict body mass in hominins (human ancestors and close relatives) that are represented only by fragmentary skeletal remains. The 1.6-million-year-old *Homo erectus* specimen KNM-WT 15000 is mostly complete, providing a unique opportunity to accurately estimate body mass in an early hominin specimen. Previous estimates of KNM-WT 15000's body mass are based on adult comparative data, even though this specimen is a juvenile. Our study focuses on using anthropometric data such as stature, hip breadth, shoulder width, sitting height, and lower limb length from a worldwide sample of children between 1 and 17 years of age to predict KNM-WT 15000's body mass. We used Generalized Additive Modeling (GAM) regression in R to develop predictive equations from these cross-sectional growth data, which are inherently nonlinear. We suggest that these new estimates, derived using juvenile growth samples, are more accurate models for KNM-WT 15000's body mass-at-death.

Faculty sponsor: Robert McCarthy

♦ **Ebaad Rehman**

"*Wolbachia* Bacteria in *T. melanarius*: Investigating the Potential for Biological Control of Mosquitoes"

Wolbachia bacteria are frequently found in insect reproductive cells and can cause cytoplasmic incompatibility, a fascinating phenomenon in which male eggs infected with the bacteria can only produce viable offspring when mated with female eggs that are similarly infected. This infection can be used to control mosquito populations, thereby reducing the spread of dengue fever and the Zika virus. Notably, estimates indicate that *Wolbachia* may be present in up to 20-70% of all insect species. This study looked into the presence of *Wolbachia* bacteria in *Tasgius melanarius*, a rove beetle found in moist environments in the Northern Hemisphere. Because *Wolbachia* primarily targets reproductive cells, the abdomen of the specimen was chosen for DNA analysis. PCR was utilized to amplify the extracted DNA segments with CO1 and 16S rRNA primers, which were used for arthropod identification and detection of *Wolbachia*, respectively. Even though contamination problems were found in the gel electrophoresis, chromatogram and BLAST analyses confirmed that the specimen was part of the *T. melanarius* species and a potential *Wolbachia* infection. Molecular phylogenetics analysis revealed that the sample was closely linked to the red flour beetle.

Faculty sponsor: Phil Novack-Gottshall

♦ **Madeline Russelburg**

“Validating the Use of Bacterial Killing Assays to Investigate Immune Health of Spotted Turtles Living in Contaminated Environments”

Heavy metals such as mercury, lead, and arsenic enter into and contaminate freshwater ecosystems via anthropogenic industries like agriculture, urbanization, and mining. These heavy metals build up in sediments as long-term chemical deposits and can enter aquatic food webs via bioaccumulation. For freshwater turtles, bioaccumulation occurs through their dietary and sedimentary lifestyles, and can have adverse health effects. Our study is the first to investigate immune responses of wild, endangered spotted turtles (*Clemmys guttata*) inhabiting contaminated wetlands in northern Indiana using bacterial killing assays (BKAs). We used BKAs to directly measure growth of the microorganism *Escherichia coli* in the presence and absence of spotted turtle plasma, which provides a measure of bactericidal capacity (i.e. immune status). We hypothesized that bactericidal capacity of plasma would vary seasonally, between sexes, and among individuals. Furthermore, that bactericidal capacity would be lower in turtles with higher heavy metal concentrations. We have performed BKAs on 13/70 spotted turtle plasma samples collected from June, Aug, Oct 2022, Mar 2023. Preliminary results reveal high bactericidal capacity, with mean proportion *E. coli* killed \pm SD = 0.89 \pm 0.25 after 8 hours exposure to plasma. We will continue to optimize spotted turtle-specific BKA methods.

Faculty sponsors: Leigh Anne Harden, Tiara Pérez Morales

♦ **Madeline Russelburg**

“Veterinarians: Beyond the Scope of Doctoral Education”

Veterinarians possess a variety of medical skills that save animals’ lives, yet those are not the only skills veterinarians need to possess. Veterinary medicine is composed of a multitude of interdisciplinary fields to provide the patient and client with the best care. These skills include foundational knowledge on cultural competency and gender dynamics in relation to perceptions of animal welfare and effective communications skills, which aid in the delivery of diagnoses and treatments, as well as bereavement support. This project will make recommendations to veterinary schools and veterinarians regarding curricula, continuing education, communication, additional bereavement services for owners, and animal welfare for the purpose of cultivating more well-rounded veterinarians.

Faculty sponsor: Jean-Marie Kauth

♦ **Marya Shamas**

“Hepatitis Outbreaks in India Due to Water Pollution”

Hepatitis viruses are the most common cause of hepatitis worldwide, and hepatitis A (HAV) and E (HEV) are usually caused by ingesting contaminated food or water. However, there has been little investigation on the correlation between HAV/HEV and fecal water pollution in India, which has one of the world’s worst cases of fecal water pollution. Across India, over half a billion people defecate freely, often in stinking pits leaking into water sources. This practice contributes to numerous types of illness, affecting a person’s ability to develop, function, or go to school. This proposed study aims to assess the risk of exposure to contaminated fecal water in Rajasthan state areas and to determine the association between HAV and HEV in the outbreak of waterborne hepatitis. With this study, we expect to see a correlation between water pollution and hepatitis A and E.

Faculty sponsor: Jean-Marie Kauth

♦ **Arman Svoboda**

“The Kilonova Data Challenge: Identifying Transients in Simulated Images”

Kilonovae are rare transient astronomical events that occur when two dense objects such as neutron stars merge, producing an enormous amount of energy. In this research, we focused on creating code that will allow us to determine the location of kilonovae in simulated data. This research uses simulated images produced from an image set built for the Legacy Survey of Space and Time Dark Energy Science Collaboration (LSST-DESC) called the second data challenge, or DC2. These data are a precursor to the LSST, which will be conducted at the Vera C. Rubin Observatory. LSST, once completed, will gather data every night while it conducts observations of the sky. Our group

previously added simulated kilonovae to DC2 images, now we want to test how well these objects can be found. We want to test if our discovery algorithm can detect all of the twenty kilonovae that we added to the data. However, given that there are multiple kinds of transients (time-varying objects) in the images, we may find objects that are not kilonovae, or we may not find all of the kilonovae. This project is our attempt to answer that question and determine how well kilonovae are found in the simulated images. This will allow us to constrain how well kilonovae will be found in LSST when it begins taking data next year.

Faculty sponsor: Matthew Wiesner

♦ **Samiha Syed**

“Illinois Board of Higher Education: Statewide Advocacy and Student Leadership”

The Illinois Board of Higher Education’s Student Leadership Committee is committed to advocating for the needs of the students of Illinois such that all students are provided equal and equitable opportunity to pursue and complete their education in Illinois, while being supported by Illinois’ higher education environment. Facilitating a campus culture and climate such that student basic needs, health and wellness, mental health, and diversity, equity, and inclusion (DEI) and interfaith needs are met with the Illinois higher education institutions, agencies, and higher education system, working not only for, but with students as partners, to reach these goals. This presentation describes a year-long research-based project incorporating a mixed methods approach of interviews and surveys of Illinois college and university students state-wide to develop a resolution and propose Illinois higher education budget allocations, advise policies and implementation, vital engagement and championing of the student voice in all Illinois higher education affairs.

Sponsor: Marco Masini

♦ **Gabrielle Magdalena Tan**

“Clinician Needs and Preference Assessment for Oncology Mobile Health Apps”

Diet tracking apps can be a beneficial tool to help patients to manage chronic diseases, yet more needs to be known about how to design apps effectively. We conducted a survey of clinicians to assess diet-tracking apps and how to improve them in clinical practice. A Qualtrics online survey was distributed in February 2023 through the Oncology Nutrition Dietetic Practice Group, LinkedIn, and a dietitian subreddit. Participants were excluded if they did not complete the survey, had nonsensical responses, or had evidence of ballot stuffing. The survey, completed by oncology dietitians, consisted of 3 domains: 1) demographic information and nutritional practice ($n = 7$), 2) interests in and beliefs about mobile nutrition apps ($n = 5$), and 3) preferences for app features ($n = 4$). Survey items were formatted as Likert scale, multiple choice, and open-ended questions. Descriptive analyses were performed to investigate the mean \pm standard deviation and count (sample%) using SPSS. Of the 50 oncology dietitians enrolled in the study, 88% ($n = 44$) worked in an outpatient setting and had practiced an average of 13.8 ± 8.4 years. Dietitians recommended publicly available mHealth apps to $\sim 1/3$ of cancer patients and/or survivors, with 44% using app data to set patients’ nutrition goals. Most dietitians somewhat/strongly agreed that they were interested in using mHealth apps as a nutrition source and to facilitate discussions about diet ($n=45$, 90%). They believe that an app will improve their productivity and performance (both $n=43$, 86%). Notably, 84% felt that many apps were not tailored for the cancer population. Dietitians were mostly interested in app features that delivered behavior change prompts, increased self-monitoring diet habits, and provided diet data to facilitate conversations about diet quality and energy needs (range % = 72-82%). Dietitians also reported strongly preferring data about macronutrient intake ($n=31$, 62%) and gastrointestinal symptoms ($n=40$, 80%). Our findings suggest that oncology dietitians are interested in using a cancer-specific mHealth app to support energy and macronutrient intake goals, while monitoring for gastrointestinal symptoms. Future studies with larger sample sizes will be needed to confirm these findings.

Faculty sponsor: Annie W. Lin

♦ **Sofija Tunkevicius**

“Long-Term Microplastic Toxicity in Institution of Cancer Research Mice”

Microplastics are classified as plastic pollutants 5mm or less in length. Microplastics (MPs) are harmful to aquatic life. They have the ability to accumulate and in some cases create blockages within living organisms. MPs can

progress through the food chain, indirectly causing health risks to humans as well. Although short-term studies have been done to analyze health risks concerning microplastic exposure, there is a lack of research on long-term effects. I propose a study utilizing Institution of Cancer Research (ICR) mice, tested in a laboratory setting over a year, to assess effects of MP exposure over the long term. In this study, lung inflammation, digestive tract blockages, along with other increasing health effects are expected. Mouse health will be monitored, and organs will be sampled and weighed. The mice will be exposed to MPs in low, intermediate, and high dosages. This study aims to increase research regarding the health effects of long-term exposure to MPs and MP toxicity.

Faculty sponsor: Jean-Marie Kauth

♦ **Jordan Vanarsdale**

“Marine Debris and Litter Pollution in the Great Lakes”

The effects climate change, loss of biodiversity, and contamination have on our marine and freshwater environments continue to be a nationwide problem affecting ecosystems and human health. Marine and freshwater debris and pollution particularly affect environments like oceans, rivers, and lakes. An educational campaign will be conducted to limit the amount of litter and debris that is being added to freshwater environments from urban beaches on Lake Michigan in Chicago. South Shore Beach and North Avenue Beach will be the two beaches assessed. Additional signs advocating no litter on the beach will be added to South Shore Beach, and additional trash disposals will be added along the beach each weekend during the summer. North Avenue Beach will have no added signs and no additional pickups. After three, six, and nine weeks, measurements will be taken to see which location accumulates more litter and debris on the beach and in the water by the shoreline of the lake. We expect to find less litter and debris on the South Shore Beach after the intervention.

Faculty sponsor: Jean-Marie Kauth

♦ **Arline Vargas**

“Is She Disinterested or Discouraged?: The Effects of Education on the Gender Gap in Political Science”

The purpose of this study is to investigate the effect of today’s pedagogy on women’s political participation, and whether our education system undermines gender equity. I examine whether education systems in the United States are indirectly teaching, or suggesting, that politics is a field more accessible to men. My hypothesis is that there will be shared experiences amongst young women of having felt discouraged to pursue male-dominated fields, such as politics, during their time in primary and higher education. I distributed a Qualtrics digital survey instrument for use in this class project, with a sample size of approximately n=250. I aim to determine (1) the extent to which women perceive educational practices that steer them away from political science, and (2) if men and women have different opinions on how their educational experiences have shaped them.

Faculty sponsor: Phil Hardy

♦ **James Yelo**

“Overexpression of Methionine Adenosyltransferase (MAT) Using Recombinant DNA Techniques”

SAM, also known as S-Adenosyl methionine, is a versatile cofactor that serves as a donor of the methyl [-CH₃] group in various biochemical processes. Methylation reactions are significant in cancer and epigenetics research. Methionine adenosyl transferase (MAT) is an enzyme that links methionine and ATP, which results in the production of SAM. This study aims to investigate whether MAT can link methionine to fluorescence ATP analogues to generate a modified fluorescent SAM. Fluorescence analogues of SAM can be used in the study of methylation reactions. We report our progress on the overexpression and purification of MAT. We have utilised recombinant DNA techniques to incorporate the MAT gene from E. Coli into PET19b, a protein expression vector. This was done by introducing NdeI and XhoI restriction sites to match the same restriction sites found in PET19b. The MAT gene was then ligated into the PET19b plasmid, with a histidine tag to enable a single step purification. We then transformed the desired plasmids into BL21-competent cells for subsequent protein expression and purification.

Faculty sponsors: Madhavan Narayanan, Mark Poch

♦ **Usra Zafar**

“Religion, Gender, and Political Efficacy: A Study of Religion’s Role in Teaching and Inspiring Women to Engage (or Not) in U.S. Politics”

This study aims to assess whether religion plays a role in women’s motivation to participate in U.S. politics. Women’s opinions and beliefs have historically been downplayed, and ample research has demonstrated that women are underrepresented in politics and government. However, for several decades women have also been shown to be more religiously involved than men. In the present study, I aim to examine if religious traditions differ in how they educate and inspire women to become politically engaged. A 14-item survey instrument was disseminated to Benedictine students using Qualtrics, with a targeted sample of N=300. In this survey, students were asked a battery of questions relating to whether they believe women are underrepresented because of religion or a choice.

Faculty sponsor: Phil Hardy

♦ **Zohaib Zubair**

“Method Development to Study Presence of a Cysteine Protease Modulated by the RopB/SIP Quorum Sensing System in *Streptococcus pyogenes*”

Quorum sensing (QS) is a type of cell-cell communication used by microorganisms in response to their environment and population density. When activated, it leads to expression of target genes and social responses. Our work focuses on the Rgg family of transcriptional regulators alongside their signal molecules or SHPs (short hydrophobic peptides). Rgg/SHPs are a type of QS pathway expressed only in Gram-positive bacteria. We specifically study the RopB/SIP QS pathway present in the human pathogen *Streptococcus pyogenes*. Activation of the RopB/SIP QS system leads to increased expression and production of the cysteine protease SpeB, a known virulence factor in *S. pyogenes*. We are interested in modulating the effects of this QS pathway using small molecules libraries. Past work identified a small molecule, M-0446, with potential QS modulatory activity. Analogs of this molecule were synthesized and one, JM22, showed inhibitory speB expression. We hypothesize that reduced speB transcription will lead to less protease production. This work explores multiple methods to determine protease activity in the presence of SIP or JM22. This work aims at determining the mechanism by which JM22 exert effects in this Rgg QS system and ultimately how it can act during a bacterial infection.

Faculty sponsor: Tiara Pérez Morales

Arthur J. Schmitt Future Leaders Scholars

The Arthur J. Schmitt Future Leaders program enables undergraduate students to develop their leadership skills and culminates in the design and implementation of a major service learning project. The following posters describe the projects undertaken by this year’s Arthur J. Schmitt Scholars.

Faculty sponsor: Julie Bjorkman

♦ **Shay Baker-Watson**

“Unity Day: A Walk Through Uniqueness”

Unity Day, held on January 22, 2023, was a program aimed at helping people gain information about diversity, equity, and inclusion, as well as learn how to report and be an ally when faced with difficult situations. The project focused on the Benedictine athletic department, including administrators, coaches, and student athletes, allowing the attendees to learn from one another and the different views they represented. Our guest speaker was Anthony Ramos, the Director of EDI at Elgin Community College. Both a pre- and post-survey was administered to student to see if their awareness and understanding of the topics increased following the event. The event resulted in the development of a campus group for BIPOC athletes as well as discussions about hosting more Unity Days.

♦ **Amir Blanchard, Trevor Montiel**

“Benedictine Basketball Shooting With The Stars: The FUN-damentals”

For this project, we held a free basketball camp for boys and girls in grades 1 to 8 on Sunday, January 29, 2023, from 4:00 to 6:00pm in the Benedictine University Rice Center. The camp was a unique opportunity for young athletes

from around the Chicagoland suburbs to improve their skills, foster teamwork, and develop sportsmanship. The camp, which was organized by the Benedictine Men's Basketball Team, aimed to provide a safe and fun environment for kids to learn and grow. The camp's curriculum included fundamental basketball skills such as dribbling, shooting, passing, and defensive techniques. The coaches designed drills and games that challenged campers while keeping the atmosphere enjoyable. Additionally, campers learned about the importance of teamwork and sportsmanship through some of our activities. Coaches also emphasized the importance of hard work and dedication on the court and in life. It was a great success, with 130 campers attending from over ten different schools around the western Chicago suburbs.

- ♦ **Zohaib Farooq, Samreen Hussain, Nathan Klimisch, Asbah Moosani**
"Let's Talk Mental Health: A Multicultural Conversation"

While mental health is a topic of increased awareness in the U.S., it sometimes isn't addressed in different cultures. This project, "Let's Talk Mental Health," involved an event to raise awareness of mental health concerns across cultures, while also discussing the importance of transparency in this rarely-discussed topic. Our event was held on the Benedictine University campus on February 13, 2023, from 4 pm to 6 pm, with four panelists who had various backgrounds dealing with mental health in their own lives. The speakers were Peggy Tomchek, a Caucasian Licensed Clinical Professional Counselor, employed at Benedictine; Shirin Ahmed, a South Asian graduate student in clinical psychology completing her internship at Benedictine; Jennifer Brown-Griffin, a Black Benedictine student with a triple major; and finally, Abdullah Damra, an Arab fourth-year medical student at Rosalind Franklin University, hoping to specialize in Psychiatry. Seventy-five students attended the event, and, with the anonymous questions submitted, it was evident that the event provided the attendees with a better understanding of the importance of discussing mental health.

- ♦ **Cachet Grady**
"STAR Leadership Program: Leadership Development, One Dancer At A Time"

The STAR Leadership Program is a way to build up the leadership roles and qualities within young students. Xtreme Dance Center has been a dance company for a little over 20 years, and in 2022, they had the opportunity to bring this program into their studio. This program goes over the five key points which makes up the STAR: Trust, Serve, Love, Excellence, and Growth. Each week we have a lesson based on one of the points of the STAR and how it relates to the students in their daily lives. Through in-class activities, readings, videos, and even small homework assignments, the kids have not only grown closer to one another, but they have learned the value in standing out from the crowd. Ultimately, the goal of bringing this program to our dance studio, which has been successful, was to create an environment where our students can grow and be great assistants to their teachers in different classes. We pour into these kids so that they can pour into others.

- ♦ **Tywan Hollis**
"The Student-Athlete Experience: Tips For Teens"

"Tips for Teens" was a service project to return to my high school and provide information to graduating seniors at Bishop McNamara Catholic High School about the ins and outs of college football as a student-athlete. This was something I wish I had before entering college as a student-athlete. I provided advice on what to do in certain situations and offered them advice on both academic and athletic matters from my personal experience. The results were what I expected. The kids did not have many questions, but they did look a little scared. These results were useful because they let me know what advice to give kids in the future if I choose to do this again. Around 10% of the senior class attended the event held on Monday, February 27, 2023. While this was a smaller number than expected, it was still a good turnout that enabled me to give insider tips to the next group of freshmen.

- ♦ **Hannah Mondel**
"Community-Clean: Having An Environmental Impact"

The Community-Clean project was an initiative to remove trash from local communities. Our group selected and pursued sites where garbage was especially prevalent. Needing only the materials to remove trash, logistics like

transportation, and good spirits, it was a simple yet effective way to make a positive impact. The first site we pursued was a park in Naperville where we collected five pounds of litter and received compliments from visitors. The second location, a shopping plaza in Bolingbrook, was a great success as we collected over thirty pounds of garbage! Another aspect of this project involved researching and sharing how others can become involved in their environment. One opportunity is joining S.E.E.D.S., an ecological and environmental development group at Benedictine University. An additional option is to visit your city's website where environmental-related events, clubs, and organizations are shared. Overall, the Community-Clean project was a valuable learning experience and great way to make a positive impact in the community.

- ♦ **Samiha Syed**

- "Creating a UN Student Chapter: A Mixed Methods Case Study"

This service project resulted in the creation of a United Nations Student Chapter at Benedictine using mixed methods research on global leadership needs with student leaders who have a vested interest or passion for global leadership service. As a result, leadership training with a global focus was developed and will be institutionalized as the official UNA-USA on-boarding and executive board training process and as a research repository published work available as a resource for interested students. An inaugural event and continued programming with a global affairs and policy focus will be held featuring global leadership practitioner professionals and activists as panelists, followed by the Scholar's presentation on global leadership, as well as, a unity walk and discussion circles on unity, peace and leadership. Fellowship and grant opportunities through community partners tied to global affairs, activism and peace-making will also be made available for students. The UNA-USA is currently under review by Student Activities to be approved. A packet of mission and vision materials was submitted including: a constitution, first year events calendar, longevity and strategic plan and interested student leaders were recruited to join the BenU UNA-USA.

- ♦ **Anella Willis**

- "Art Therapy: Poetry for Seniors"

Art therapy has been proven to help reduce feelings of depression, stress, and anxiety in all age groups. It is especially helpful for seniors because it helps them divert their focus and free time to something productive. Poetry is used to connect people through the incorporation of universal themes relating to the human experience. Effective poetry relies on curiosity, both in the writing process and in the engagement of the reader. Bringing this same feeling and experience to the senior citizens in our community was an idea I had early on in the Fall 2022 to bring a form of "art therapy" to the elderly. I introduced an experience on March 10, at a local retirement community, Villa St. Benedict, to focus specifically on helping residents write their own poems. My goal was to reintroduce poetry to the seniors to inspire creativity and interconnectivity and worked together with them to create their own original poems.