YOUNGSTOWN STATE UNIVERSITY

OFFICE OF RESEARCH SERVICES

# 33rd Anniversary Quest

a forum for student scholarship

## 2023 Program Guide & Abstracts

# Welcome to QUEST 2023:
# A Forum for Student Scholarship

QUEST is a Youngstown State University (YSU) tradition. This year is the 33rd Anniversary of an event that exhibits the achievements of our students in creativity, innovation, discovery, research and scholarship.

The QUEST organizing committee and university administration gratefully acknowledge the guidance and commitment of YSU's talented faculty provide inspiration, motivation and support to their students to make QUEST 2023 possible. This year's program includes 92 projects representing the individual and group effort of almost 250 students.

While you interact with our students, as they enthusiastically present their project, please bear in mind that the work they do is also supported by many faculty grants from federal, state and local funding agencies, industrial and community partners, many friends of Youngstown State University and by the Office of Research Services University Research Council grants.

We encourage all QUEST participants to actively engage in and appreciate each other's work, seeking to discover new knowledge through interdisciplinary collaborations. In addition to serving as a forum summarizing prior success, we hope that QUEST serves as a starting point for new partnerships, collaborations, and discovery among students and faculty from all our academic disciplines.

Severine Van slambrouck
Director of Research Services
Youngstown State University

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Dr. John Hazy, Professor and Chair, Dept of Criminal Justice and Consumer Sciences
Dr. Matt O'Mansky, Associate Professor, Dept of Humanities and Social Sciences
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# Acknowledgements

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- YSU Board of Trustees
- YSU Interim President, Dr. Helen Lafferty
- YSU Provost, Dr. Brien N. Smith
- YSU Faculty Members
- YSU Foundation: Mr. Paul McFadden, Ms. Heather Chunn
- YSU Honors College
- Beeghly College of Liberal Arts, Social Sciences and Education
- Bitonte College of Health and Human Services
- Cliffe College of Creative Arts
- College of Science, Technology, Engineering and Mathematics
- Williamson College of Business Administration

# QUEST 2023: A Forum for Student Scholarship Schedule, sessions, disciplines

## April 5, 2023

## 8.30 – 8.45 am: Opening Remarks

Dr. Brien Smith, Provost and Vice President for Academic Affairs


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Chemical and Biological Sciences, Humanities and Social Sciences, Engineering, Environmental Sciences, Health Professions, Mathematics and Statistics, Physics


## 1 – 2.30 pm: Poster Session 2


Chemical and Biological Sciences, Humanities and Social Sciences, Engineering, Environmental Sciences, Health Professions, Mathematics and Statistics, Physics **43**


## 5 – 6.30 pm: Best of QUEST

# Oral Presentations: Session 1a

**Session 1a** **8.45 am – 10.15 am**

**Engineering and Engineering Technology (Electrical Engineering)**

## 1 - Firmware Development for a Bluetooth Low-Energy DataAcquisition Device

Aidan Mitchell[1], Kyle Schubert[1]

[1]STEM, Engineering *Faculty Advisor: Vamsi Borra*

Our project is a Bluetooth Low Energy (BLE) data acquisition device that operates as an automatic sensor hub for users to acquire data such as temperature, pressure, humidity, gas resistance, impedance, and accelerometer data. Additionally, the hardware within this project involves a sensor capable of detecting electrochemical changes, which we use to approximate cortisol concentrations through its impedance measurements. Furthermore, the gathered data can be recorded and exported onto any device that connects to it via Bluetooth through a custom application that can run on almost any operating system.

## 2 - Wind Turbine Charging Station

Tanner Matig[1], Maxamum Masaki[1]

[1]STEM, Engineering *Faculty Advisor: Robert Caven, Frank Li*

Electric Vehicle Supply Equipment (EVSE) are devices used to charge the batteries for electric cars. These systems generally receive their power supply from the local power grid, which is not only expensive, but can draw additional power from the grid during times of peak demand. One way to become less dependent on this power is to utilize renewable energy sources to power EVSE charging stations. For our project, we have designed a small-scale model of one such EVSE using a wind turbine as a source and a Li-ion battery as a load. We also plan to build this model, which will demonstrate the possibility of charging electric vehicles using renewable energy resources such as the wind turbines / solar panels on YSU's campus.

# 3 - Battlebot

Nathan Hando[1], Edward Odom[1], Keith Smith[1], Joshua Porter[1]

[1]STEM, Engineering *Faculty Advisor: Robert Caven*

Our project is our senior design project which aims to create a battlebot which includes both mechanical and electrical systems and is sponsored by FirstEnergy. This project was divided into two teams who are responsible for different aspects of the robot. A mechanical engineering team, who developed and manufactured the frame of the robot, as well as all of the physical mechanisms. And an electrical team, responsible for the development and implementation of electronics, including a thermal monitoring system. This will be used to sense the robots speed controller and motor temperatures to ensure optimal performance. This project provides a great opportunity for engineers of different disciplines to collaborate together to complete a project, just like a real world application.

# 4 - IES Quadrature Encoder Replacement

Cole Engle[1], Ryan Gates[1], Stephen Engle[1]

[1]STEM, Engineering *Faculty Advisor: Robert Caven, Frank Li*

IES currently uses two quadrature decoders to calculate motor positions on their industrial's machines. These two decoders are no longer manufactured, and the supply is out so they can no longer be replaced. IES reached out to us for a senior design project to design and replace these two decoder chips with our own solution. This will help with the longevity of their product and allow them to service the older models of machines that use these chips. Our solution is using two PIC microcontrollers two calculate the motor position in place of the old decoder chips. This project involves PCB design, coding and troubleshooting in a laboratory and industrial environment.

# 5 - FirstEnergy Smart Micro Grid Senior Capstone

Jacob Eucker[1], Ethan Gill[1], Daniel Goist[1], Sean Livingston[1], Breeze Stec[1]

[1]STEM, Engineering *Faculty Advisor: Robert Caven*

This project sponsored by FirstEnergy is designed to demonstrate the basic functionality of a smart grid, and how the retrofitting of older grid technologies with smart grids decreases the number of total outages, the duration of said outages, and the number of customers affected. A small-scale replica of a town and smart grid is used to accomplish this, allowing users to simulate faults along the grid and see how a smart grid reacts swiftly and automatically to deenergize fallen power lines and restore power to customers not affected by the fault.
The scaled-down replica itself contains residential, commercial, and industrial buildings, as well as grid elements with indicator lights which allow for an easy understanding of how the smart grid responds to faults, and how it is able to restore power to customers that a standard grid would not be able to.

# 6 - Digital Temperature Monitor

Anthony Rek[1], Bryce Fluent[1], Anthony Ricottilli[1], Jacob Kruppa[1]

[1]STEM, Engineering *Faculty Advisor: Frank Li*

This project will utilize a thermistor that changes resistance based on temperature to sense and control the MOSFET power module that is connected to the thermistor. An analog circuit will be built to reduce voltage and increase sensitivity of the voltage from the power source. The output of this circuit will be ran into an ADC (Analog to Digital Converter) and into the Spartan-7 FPGA board. This voltage will be transformed into a readable value so that the board can calculate the temperature of the thermistor and send the value to a viewable display using a CANbus. Our board will be able to trip the power module if it were to get too hot. Ajax TOCCO Magnethermic Corporation has sponsored this project as it is for equipment that they use and make. This project would make those products safer by preventing overheating of the power module and other hazards that could be produced by this.

# 7 - Remembering Past Cultures: The Lucayan People on San Salvador, Bahamas

Darcy McTigue[1]

[1]BCLASSE, Humanities and Social Sciences

*Faculty Advisor: Thomas Delvaux, Matt O'Mansky*

The Lucayan People were the first people that Columbus contacted in the Americas. However, as there is not much information about them, the artifacts recovered, most notably on San Salvador Island, Bahamas, showed signs of what their everyday life was like. Pigeon Creek, for example, was one notable site that showed indications of shamanism. However, the most intriguing site that was examined over December 2022 was the Fresh Lake site. The artifacts recovered here indicated that the Lucayan people relied on a variety of marine life as part of their diet, as well as showed material evidence that their culture is most known for: their pottery and beads.

# 8 - Mass Shooter

Priya Dhakal[1]

[1]BCHHS, Criminal Justice and Consumer Sciences *Faculty Advisor: Richard Rogers*

The purpose of this presentation is to describe an examination of text created by two mass shooters, Elliot Rodger and Peyton Gendron. The text of these two is analyzed, their manifestos which outlines their state of action relative to their mass shooting. This paper covers psychological analysis of the mass shooter Elliot Rodger in detail, relating to misogynist theory. The hypotheses are if there is presence of elements of crime in written text of manifesto and the age range 16-24 are likely to develop radical thoughts. For the text analysis, KH-coder and NVIVO is used to connect the link between the words of manifestos and their different ideologies which contributed crime. The elements of crime are visible in these texts whereas, the narratives of Rodger and Gendron cannot be defined as radical the ideas within their narratives suggests they are developing into radical state. The journals and secondary sources are referred and further investigation is required as this paper is constraint to only two mass shooters.

## 9 - The Impact of Rape Myth Acceptance Among University Students: A Literature Review

Nino Shubitidze[1]

[1]BCHHS, Criminal Justice and Consumer Sciences *Faculty Advisor: Christopher Bellas*

Sexual violence is a significant problem in the United States. The term "rape myths" describes inaccurate assumptions and notions that are frequently held about rape, the rapist, and the victim. Acceptance of the "rape myth" has been found to be a powerful indicator of general attitudes toward sexual assault and willingness to assist survivors. This paper tries to review the existing literature on rape myth acceptance among university students. The introduction of the paper defines rape myths before reviewing earlier research on the topic. The paper examines the causes and the effects of rape myth acceptance, as well as the methods for reducing rape myth acceptance. The literature review emphasizes the necessity of educational interventions to lessen rape myth acceptance among university students.

## 10 - Carceral System Mapping: Community Involvement to Create S.T.E.M. Pathways

Jason O'Malley[1]

[1]BCLASSE, Humanities and Social Sciences *Faculty Advisor: Matt O'Mansky*

S.T.E.M. education and careers are a significant and growing pathway to success in our economy. While this true, access to these pathways is hindered for many of our citizens. One population that is systematically excluded from inclusion in much of our economy, including S.T.E.M. fields, are the justice-involved. This project is a part of an NSF-funded grant awarded to STEM-OPS (STEM Opportunities in Prison Settings) to map the carceral system with a community-based research methodology and to use the information gathered during the mapping process to inform the design and implementation of interventions to create robust pathways to S.T.E.M. education and careers for the incarcerated and formerly incarcerated. This presentation will focus on the mapping phase of the research—looking at both the community-based methodology utilized as well as the stakeholders chosen to represent the community, which in this case is the carceral system. Finally, there will be attention given to the findings and how this information will be utilized during the design of interventions' phase.

## 11 - Populism and Neo-Nazi Literature

Nickiforos Mastorides [1]

[1]BCHHS, Criminal Justice and Consumer Sciences *Faculty Advisor: Richard Rogers*

The purpose of this analysis to study utilization of populist techniques in Neo-Nazi Literature; specifically, George Lincoln Rockwell's *White Power* and James Nolan Mason's *Siege* compared to that of 7 of Adolf Hitler's works and speeches. Hitler undeniably created a radical movement in an extremely advanced society using several populist techniques. For example, Hitler used many techniques to instill feelings of nationalism and the need to revolutionize against the status quo while simultaneously targeting specific groups of people. Rockwell focused more on targeting groups of people while Mason focused more on revolutionizing. Neither Rockwell nor Mason in either of their works were able to balance those two components nearly as well as Hitler. While these are very narrow selections of works from all parties, this analysis could imply that Neo-Nazism is struggling to gain traction in the United States and other countries if certain key components of populism are not balanced correctly.

## 12 - Declining Labor & Delivery Centers in Northeast Ohio: How the Accessibility of Hospitals Providing Delivery Care Impacts Maternal & Infant Mortality

Emily Swift[1]

[1]BCLASSE, Humanities and Social Sciences *Faculty Advisor: Loren Lease*

In recent years, a number of labor and delivery care centers have closed in Ohio due to a rise in costs. At the same time, maternal mortality rates have been rising, wand both maternal and infant mortality rates are much higher in the United States in comparison to other developed nations. A pilot study was conducted on 17 counties comprising Northeast Ohio to determine if a connection between the growing mortality rates and proximity to labor and delivery care center exists. As a result, the maternal and infant mortality rates of each county were compared using two variables: the geographic location of a labor and delivery care center and the population size each hospital serves.

# Oral Presentations: Session 2a

**Session 2a** **10.30 am – 12 pm**

**Engineering and Engineering Technology (Mechanical Engineering)**

## 13 - SAE Baja Powertrain

Katie Chludzinski[1], Dante Flak[1], Colin Heinrich[1], John Gula[1]

[1]STEM, Engineering *Faculty Advisor: Hazel Marie, Anthony Viviano*

Penguin Baja Racing, Youngstown State University's SAE Baja team, designs, builds, tests, and competes with an all-terrain vehicle each year. The team is divided into three sub teams: frame and ergonomics, powertrain, and suspension, steering, and brakes. The powertrain team must design a way to deliver power from a 14 horsepower Kohler engine to the front and rear wheels of the vehicle. Following the engineering design loop, a continuously variable transmission (CVT), reduction gearbox, and differential system were developed for the 2023 vehicle. Testing of the previous season's car began the design process, with collection of data including of torque transmitted to the rear wheels, suspension travel, acceleration values, and wheel speeds. This information was used to determine areas of weak performance, to be optimized for the 2023 season. Areas of focus included adjusting the gear ratio for the new Kohler engine, tuning the CVT for improved acceleration and torque transmission, and reworking the fourwheel drive system to allow for improved steering and front power output.
The team then manufactures and assembles the systems designed, through both in-house and outsourced methods. Rigorous post-manufacturing testing is also completed, validating finite element analysis, by-hand calculations, and the overall team requirements defined at the beginning of the season.
Penguin Baja Racing competes again in early May, at Oshkosh, Wisconsin. The team is excited to continue the winning tradition at YSU, and continue to perform as a top-ten team internationally.

## 14 - Baja Suspension Steering and Brakes Testing and Analysis Correlation

Jesse Irons[1], Joshua Entrikin[1], Landon Morucci[1], Ahmed Mousa[1]

[1] STEM, Engineering *Faculty Advisor: Alexander Pesch*

Suspension, steering, and brake systems are critical components of any vehicle, and their performance is essential for ensuring passenger safety and comfort. This presentation will discuss the correlation between testing and analysis of these systems, with a focus on a 4-pin

kinetic analysis and a braking test. The 4-pin kinetic analysis uses an angle sensor to measure the position of suspension members and calculate the pin forces experienced during an impact. Although we have not yet validated the model, we have tentative plans to do so before graduation. By comparing the results of the analysis to physical testing, we hope to validate the accuracy of the model and ensure that the suspension system functions as intended.
The braking test measures the pressure and wheel speed to find the forces in the system. This test evaluates the braking performance of the vehicle and identifies any issues that require attention. Although we have not yet correlated the results of the test with computer simulations, we plan to do so to better correlate the real-world results with the computer simulations conducted to design the Baja 2023 vehicle.
Overall, the correlation between testing and analysis is crucial for ensuring the performance and safety of suspension, steering, and brake systems. With the use of advanced technologies and careful analysis, we can identify potential issues and develop effective solutions to ensure that these systems function as intended. In addition, this increases the accuracy of predictive models and ensures they are a conservative estimate of the state of stress experienced in testing.

# 15 - Chassis and Ergonomics

Jared Bryarly[1], Reece Wilson[1]

[1]STEM, Engineering *Faculty Advisor: Hazel Marie, Anthony Viviano*

The Chassis and Ergonomics sub-team is a mechanical engineering senior design team which is a part of the student competition team Penguin Baja Racing, which designs, builds, and races with an off-road vehicle every year. The chassis is the entire frame assembly, which includes a roll cage for driver safety and mounting points for other components such as powertrain, suspension, steering, and brakes. Ergonomics includes driver comfortability between the fifth percentile female and the ninety-fifth percentile male, and the ability for drivers to access and operate all necessary controls of the vehicle. This year, the Chassis and Ergonomics team put a large emphasis on validation of Finite Element Analysis (FEA), a method of simulation which resembles real life conditions based on various inputs and can verify that the design will not fail. To do this, modal analysis testing was performed on the 2022 vehicle frame to obtain mode shapes and natural frequencies of the vehicle. Using a load cell instrumented hammer and accelerometers, the frame was struck at various locations and a Test Display Model (TDM) was compared to a Finite Element Model (FEM) that was created using geometry from SOLIDWORKS which was imported to ANSYS software. This comparison resulted in a discrepancy between the TDM and the FEM at the weld locations on the frame. The FEM was then iteratively changed using material properties in ANSYS until a resulting validated model was created.

# 16 - Penguin High Power Rocketry

Matthew Kinkela[1], Brandon Thomas[1], Wade Richards[1]

[1]STEM, Engineering Faculty Advisor: Eric Haake

The Youngstown State University Rocketry Team designed and is building a high-powered rocket to compete in the 2023 Spaceport America Cup, hosted by the Experimental Sounding Rocket Association in Truth or Consequences, New Mexico. This year's competition vehicle, Peng-One.2, has a target apogee of 10,000 ft while carrying an 8.8 lb. payload. The rocket airframe is constructed of G10 and G12 Fiberglass and is 5.5" in diameter and approximately 11' tall. The rocket will have a weight of 58 lbs. when full loaded to competition specifications. It will launch on an Aerotech M1845 solid propellent motor which is projected to carry the rocket to slightly above the target apogee. To accurately achieve a 10,000 ft flight an active aerodynamics system will be deployed to increase the drag force acting on the rocket. The effectiveness of this system has been verified using Fluid Structure Interaction which utilizes computational fluid dynamics and finite element analysis. Once apogee is achieved, a drogue parachute will deploy using a CO2 ejection system. Once the rocket has descended to 1,000 ft, the main parachute will be triggered using a similar system. Recovery events will consist of the airframe being separated at select coupler locations to allow for the deployment of recovery equipment.

# 17 - Aerospace DC Generator Cooling System

Brendan Thoreson[1], Nathan Humphrey[1], Brenna Blanchard[1]

[1]STEM, Engineering *Faculty Advisor: Stefan Moldovan*

Modern aircraft rely on electricity for critical functions, so reliable generation of power is crucial to their safe operation. This project investigates a novel aircraft generator cooling system for the client in two ways: an experiment to prove effective cooling of an oil-cooled rectifier heat sink, and a mathematical heat transfer model to analyze cooling of a generator's internal components. For the experiment, a test apparatus was designed and built to demonstrate effective cooling of the rectifier heat sink. This was done to validate previous computational fluid dynamics (CFD) simulations of the rectifier heat sink cooling system and better understand how the heat sink is cooled experimentally. To further assess cooling within the generator, a mathematical model was created to determine heat transfer between components through conduction and convection. The heat transfer model will be used by the project's client to verify their testing of a generator and ensure the cooling system maintains internal temperatures within acceptable limits.

# 18 - AIAA Design Build Fly 2023 Competition Team

William Todd[1], Mohamed Konate[1], Natalie Spalding[1]

[1]STEM, Engineering *Faculty Advisor: Stefan Moldovan*

The AIAA Design Build Fly competition is a yearly event that takes place in varying locations across the United States. The premise and rules for the event change every year to coincide with real-life events. The 2023 competition was dubbed 'Electronic Warfare'. This is in direct correlation to the events in Ukraine and the need for carry-on or smaller-sized planes to correctly and efficiently fly over war-torn zones with the intention of surveillance and jamming signal flights. In the competition itself, Universities from all over the world are eligible to compete in multiple rounds for flight, as well as a ground test.

As a general rule of thumb, all flight missions include a coin toss for wing selection, the plane must enter staging in a closed shipping box, and it must land successfully. The initial flight mission is a minimum of three laps completed within a five-minute window. The second mission is a surveillance flight in which the electronics package is put aboard the plane with a minimum of three laps completed within a ten-minute window. The third mission is a jamming flight, in which the jamming antenna must to mounted to the wing opposite the flight safety line and teams are timed for a total of three laps.

The ground mission is slightly different because it does involve a coin toss for wing selection, but other than that is structurally focused. The assembly crew has a ten-minute window which includes the assembly of aircraft, installation of payload, and installing the ground test fixture and weights. Then, the pilot verifies that the electronics are working properly after a thirtysecond hold at the maximum called weight applied. Any structural failure, deformation or lack of working electronics is a failure.

Idea formulation, prototyping, and build process are discussed.

# Oral Presentations: Session 2b

**Session 2b** **10.30 am – 12 pm**

**Chemical and Biological Sciences and Engineering (Chemical Engineering)**

## 19 - Analysis of Dormitory Wastewater for Levels of SARS-CoV-2

Kira Bowman[1], Samantha Bachochin[1], Dhruvi Shah[1], Alexis Albrecht[1]

[1]STEM, Chemical and Biological Sciences *Faculty Advisor: Chester Cooper*

Prior studies have shown that a community's health can be monitored through wastewaterbased epidemiology. These community-centered concepts are being used to monitor levels of the COVID-19 virus (SARS-CoV-2) from five Youngstown State University (YSU) residence halls. Initially, levels of SARS-CoV-2 from dormitory wastewater (WW) samples were analyzed by a commercial firm. However, the time from sample submission to the data delivery was determined to be untenable. Subsequently, an on-site digital polymerase chain reaction (dPCR) assay was employed to more efficiently and effectively detect levels of SARS-CoV-2 in WW. Doing so shortened the receipt of results from 3-6 days to less than 6 hours. To achieve this, autosamplers collected WW over a 24-hour period twice per week. When deemed necessary, “grab” samples were drawn between scheduled autosampler collections. Using the “4S” method developed by Whitney *et al*. (*Environ. Sci. Technol*. 55: 4880-4888, 2021), nucleic acids were extracted from each WW sample. A portion of the extract was subjected to reverse-transcription polymerase chain reaction to detect SARS-CoV-2 nucleocapsid genes N1 and N2, as well as the human fecal control target, Pepper Mild Mottled Virus (PMMoV). The assay was conducted using the QuantStudio Absolute Q dPCR System. The resulting data were normalized to PMMoV as well as the stated census within a particular dormitory. Throughout the sampling periods, variations in SARS-CoV-2 levels were noted from each WW sample. However, no obvious associations were noted with semester breaks in which residents would be traveling (e.g., winter break). Moreover, the absence of concurrent COVID-19 testing precluded the establishment of a definitive relationship between active/asymptomatic cases and the presence of SARS-CoV-2 in WW.

## 20 - The Growth Impact Effects of Calcium in Working Woods Forest Soil

Rachel E. Ward[1]

[1] BCHHS, Graduate Studies in Health and Rehabilitation Sciences

*Faculty Advisor: Richard Rogers, Shannon Dudash*

The chemical makeup of forest soil greatly impacts plant growth. Here, the concentration of calcium ions in a post-agricultural forest is explored in Northeastern Ohio across three forest management treatments. The Working Woods Learning Forest at The Holden Arboretum is a relatively young forest, having been taken out of agricultural use approximately sixty years ago, and is now a part of an experiment testing the impacts of forest management. Three one-hectare plots of each of three management treatments are tested: canopy tree thinning (IC), canopy tree thinning with nonnative shrub removal (IC+TSI), and control (C), and split into Northern (N), Middle (M), and Southern (S) blocks. In 2018 and 2019, soil samples were collected from the top 0-20 cm of topsoil near the base of 122 trees spread throughout the blocks. The concentration of calcium, a metal cation, was analyzed via atomic absorption spectroscopy. In a post-agricultural forest that had been previously fertilized, limestone (calcium carbonate; $CaCO_3$) may have been used to increase soil pH and in turn stimulate more abundant crop growth, but calcium ions alone decrease the soil pH. Highly acidic soils contain lower concentrations of calcium. There is a much lower concentration of calcium in the IC+TSI treatment ($p<0.1$) when compared to the other two treatments, and there is a significantly lower concentration of calcium in the N blocks ($p<0.1$). The known concentration of calcium is important for the forest to sustain growth because of the overall effect it has on soil health and nutrient availability when compared to the Working Woods forest management treatments (Ward et. al., 2022).

# 21 - Production and Cost Analysis of DME for Transportation

Makayla Zets[1], Jennah Markovitch[1]

[1]STEM, Engineering *Faculty Advisor: Holly Martin*

The use of dimethyl ether (DME) can be used in the form of transportation fuel while also reducing carbon emissions creating a positive environmental impact. Our team was tasked to create a simulation of a plant to produce 250,000 US gal/day of DME from a feedstock of pure methanol, ensuring to maintain production quotas with 50% turndown. Using an indirect process of methanol dehydration, pure methanol is converted to DME and water in the presence of a solid-acid catalyst. Two catalysts were studied (gamma alumina and amberlyst 35), where only one was chosen based on conversion, operating conditions, and cost. The reaction will take place in packed bed reactor where the exiting DME, water, and unreacted methanol will enter a series of distillation columns. The first distillation column is where DME will be recovered in the distillate and the second column is where methanol will be recycled back into the system while the water in the bottoms will be sent to a wastewater treatment facility. The recovered DME must meet the ISO DME Fuel Plant Gate Standard where the minimum requirement is 98.5 mass percent. To optimize the plant, all safety and environmental concerns were considered as well as all capital and operational costs (including labor) in the economic analysis assuming a plant life of 20 years.

# Oral Presentations: Session 3a

**Session 3a** **1 – 2.30 pm**
**xxxxx**

## 22 - Cerebellar Control of Autonomic Function

Rocco Bruno[1]

[1]STEM, Chemical and Biological Sciences Advisor: Ronald Seese

Complex neuropsychiatric disorders such as Autism and Post-traumatic stress disorder are often characterized by dysautonomia, or a sporadic, misfired adrenaline rush. As a result of this ill-occurring “fight-or-flight” response, individuals frequently experience symptoms such as elevated heart rate, blood pressure, or a sense of fear. Unfortunately for many, current medications are often ineffective and accompanied by a host of potential side effects resulting from drugs’ non-specific and misunderstood mechanisms of action. Recent advancements in non-drug therapies, like Transcranial Magnetic Stimulation (TMS), provides clinicians with a novel approach to treating these types of patients; however, in order to potentially implement this type of therapy in the treatment of clinical dysautonomia, the specific sites responsible for control of the adrenaline rush, and thus targets of interest for TMS, must first be identified. Utilizing Rabies Virus (RV) as a transneuronal tracer, the sites directly controlling autonomic output were defined in non-human primates (NHP), a model organism whose nervous system is most representative to that of humans. The data were then employed in the two-dimensional reconstruction of NHP cerebellums and the development of cerebellar hotspot maps, providing the preclinical foundation for future studies aimed at better examining the anatomic foundations of dysautonomia or its treatment with non-drug therapies.

## 23 - Robotic Prosthetic Arm Design

Alex Ramirez[1], James Wolfe[1], Hannah Harris[1]

[1]STEM, Engineering Faculty Advisor: Alexander Pesch, Annie Tapp

One of the central issues that plagues upper extremity amputees is the ability to complete daily tasks and find upper extremity prosthetics that are affordable and easily accessible. The goal of this project was to create the first iteration of a middle transradial prosthetic robotic arm. The design was created around the most susceptible age group and gender, along with emphasis on affordability. The design team partnered with the YSU Physical Therapy Department's, Dr. Annie Tapp, who served as the client for the project. The target specifications of the arm were based off of the needs of the client. The engineering design was completed under the advisement of Dr. Alexander H. Pesch by utilizing CAD and analysis softwares. The design was then optimized through the use of 3D printed prototypes. It is currently in the process of being manufactured through additive manufacturing, manual and CNC machining, and controlled through pre-programmed controls as well as Electromyography sensors. The end goal is to showcase a functioning robotic arm prior to May 2023.

# 24 - Electrochemically controlled polyelectrolyte complex hydrogel and its applications for antibacterial wound dressings

Prakriti Dhungana[1], Kyle Duke[1], Victoria Messuri[1], Kyle Preusser[1], Byung-Wook Park[1]

[1]STEM, Engineering Faculty Advisor: Byung-Wook Park

The main goal of this research is to address the urgent need for a new treatment approach with on-demand control for chronic wounds. The hydrogel's electro-responsiveness can be improved with the addition of ferrocene, enabling controlled drug release, and eliminating bacterial biofilms, making it a potential solution for chronic wounds. This hydrogel releases model drugs via an electrochemical process and is composed of an electrochemically active polyelectrolyte (E-PEC) made by crosslinking ferrocene with chitosan and alginate. Various characterization methods were performed to evaluate the hydrogel's properties, including ninhydrin, turbidity, viscosity, FTIR spectroscopy, EDS/SEM imaging, swelling ratio, and gel content tests. The addition of ferrocene improved the hydrogel's electro-responsiveness, enabling enhanced drug and water molecule movement towards the anodic terminal. The release of low molecular weight drugs was expedited up to two times with the addition of 54 µg of ferrocene, and the release became electro-responsive when an electric stimulus of 2 V was applied, shortening the release time by one-third. The addition of ferrocene also helped in the release of larger drug molecules, such as FITC-Dextran and FITC-BSA, improving the release time by 20 % and 25 % times faster, respectively. The release of antibiotics (e.g., ciprofloxacin) from the E-PEC hydrogel with an electric field eradicated the biofilms of Gram-positive (S. aureus) and Gramnegative (P. aeruginosa) and reduced the CFU from 140 to 41. The release was higher with the electric field, resulting in greater eradication of biofilms compared to release without the electric field. The developed electrochemically controlled hydrogel is found to be effective in controlling the release of antibiotics and eliminating bacterial biofilms.

# 25 - Core Muscles Electromyographic Analysis in Collegiate Athlete on Performing Deadlift On Different Unstable Surfaces

Fnu Fozia[1]

1STEM, Chemical and Biological Sciences Faculty Advisor: Jack Min

Aim: Muscle activity analysis during deadlift is an important tool for assessing the effectivity of the exercise. Some studies indicate difference in muscle activities when collegiate athletes perform it on unstable surface. Materials and Methods: In this study, thirty collegiate male athletes were recruited. MVIC was recorded for each deadlift exercise. Results: Isometric deadlift executed on BOSU ball resulted in greater % MVIC change in core muscles ($p<0.05$), i.e., transversus abdominis and multifidus while no statistical difference was found when dynamic deadlift was executed on both surfaces ($p>0.05$). Conclusion: Isometric deadlift exercise result in significant change in muscle activity as compared to dynamic deadlift.

# 26 - Label-free impedimetric determination of cortisol using gold nanoparticles functionalized laser induced graphene electrode

Kyle Duke[1], Kyle Preusser[1], Prakriti Dhungana[1], Byung-Wook Park[1]

[1]STEM, Engineering Faculty Advisor: Byung-Wook Park

Wearable biosensors have become an important tool for their promising applications in personalized medicine. Cortisol is a biomarker for various diseases and plays an important role in metabolism, blood pressure regulation, and glucose levels. In this study, we fabricated a laser-induced graphene (LIG) biosensor for the non-faradaic impedimetric detection of cortisol in sweat. A direct laser writing technique was used to produce the LIG. Gold nanoparticles (AuNPs) were electrochemically deposited onto the surface to enhance impedance response. A Self-Assembled Monolayer (SAM) was formed with on the AuNPs via MPA thiol chemistry. The carboxylic acid (-COOH) groups of the MPA were activated using EDC/NHS chemistry. Following activation, anti-cortisol antibodies were immobilized on the surface. Lastly, the LIG was incubated in the blocking agent bovine serum albumin (BSA) to avoid unwanted detection. Surface characterization of the LIG was performed at each step of modification by Electrochemical impedance spectroscopy (EIS) in a phosphate buffered saline (PBS) solution containing a 5 mM Fe(CN)63-/4- (1:1) redox couple. Further characterization of the modified LIG electrode was achieved through Fourier transform infrared (FTIR), surfaced-enhanced Raman spectroscopy (SERS), and X-ray diffraction (XRD). The detection experiment using EIS was carried out in increasing concentrations of cortisol (0.1 pM-100 nM) in PBS. The $Z_{Mod}$ decreased logarithmically ($R_2$=0.89) with a 1.83 nM limit of detection. Reproducibility was examined by percent change of $Z_{Mod}$ at 100 nM and a 10.21 %RSD (n=5) was observed . Additional analysis of sensor specificity and interference studies showed no substantial effect on detection. This research establishes the feasibility of using the gold nanoparticle decorated LIG electrode for flexible, wearable cortisol sensing devices, which would pave the way towards an end-user easy-to-handle biosensors as point-of-care diagnostics.

# Oral Presentations: Session 3b

**Session 3b** **1 – 2.30 pm**

**Engineering and Engineering Technology (Mechanical Engineering)**

## 27 - The Development, Design and Manufacturing of a Heavyweight Combat Robot

Tanner Tsvetkoff[1], Brandon Malahtaris[1], Noah Paszkowski[1]

[1]STEM, Engineering Faculty Advisor: Alexander Pesch

Combative robotics consists of facing off two or more robots meant for maximum destruction and strength in battle till one robot can no longer compete due to complete mechanical or electrical failure. A team of three students under the group name “Penguin Combat Robotics (PCR)” evaluated the state of the current and past competitions to find trends of success and failure, and then was able to determine statistically valid design criteria. PCR took on the project of designing and manufacturing a heavyweight robot with the intent to compete on the show BattleBots. Project management was completed prior to major design work, allowing for a detailed project timeline and budget, leading to many forms of fundraising and community engagement. The team followed this by creating multiple revisions of a robot design that continuously improved with each revision. Each revision was driven by the team’s design criteria and associated simulations and complications. After designing, the team worked with many local manufacturers to assemble the robot, allowing for exposure to new industry practices and methods. The robot was completed with the final competition in mind, which required multiple considerations including travel, spare parts, and sponsor publicity. The project also contains failure analysis of any mechanical or electrical failures of the robot.

## 28 - Redesign of Existing Seam Welder to Improve Client’s Overall Marketability

Oluwatumininu Adeeko[1], Jenna Jacobson[1], Carly Weiss[1]

[1]STEM, Engineering Faculty Advisors: Hazel Marie, Anthony Viviano

In the past years, our client, Taylor-Winfield Technologies (TWT), manufactured the *Twin*Lap Resistance Seam Welder for many of its clients’ operations. However, the current design has several shortcomings. It operates on an embedded floor rail system, which could pose a trip hazard for workers in the machine shop. Additionally, installation costs related to the excavation of the concrete to embed the floor rail greatly influence the marketability of TWT. Finally, the client wants an edge over its competition by presenting a unique design that can also be applied to their other seam welders with a similar application. In response to the customer’s needs, the team developed a model which utilizes a retractable, cantilevered weld carriage with a redesigned base. Engineering constraints were placed on the redesigned model, such as maintaining interior welding components within the “O-shaped” carriage, guaranteeing

acceptable weld deflection and quality, and ensuring accessibility to interior components during machine service. This presentation summarizes the outcome of the redesign, including project 17 management, 3D design work, finite element analysis, optimization procedures, and a 3D printed prototype.

## 29 - Crane Wheel Change-Out Device

Ilayan Ilayan[1], Dean Austalosh[1], Alex Shaginaw[1]

[1]STEM, Engineering *Faculty Advisor: Eric Haake*

The purpose of this project was to make the necessary and suitable changes to the crane wheel change-out device without hindering the device functionality.
Our client provided us with drawings of a previously constructed maintenance device for a warehouse gantry crane wheel. We were tasked with improving the device, with the focus on a location of material failure. The device was required to fit different railway profiles, requiring a significant alternation to the original mounting bracket assembly. The crane wheel change-out device experienced a failure on the mounting bracket. We ran iterative designs through FEA to ensure the function of the mounting bracket, before developing a single-piece component at the advisement of our client contact.
Other improvements were applied to the design to meet a factor of safety specified and major components of the design were remodeled and analyzed for failure. Components such as the shaft, wheel support, and rachet mechanism were redesigned to improve the project.
A CAD model was created to ensure the proper fits and interferences.

## 30 - Pneumatic Paint Bander

Jared Puhalla[1], Nathaniel Bailey[1], Nicole Diegan[1]

[1]STEM, Engineering *Faculty Advisor: Alexander Pesch*

The company Vallourec produces pipes for the oil and gas industry. Vallourec makes several grades of pipe that have different load ratings and tolerances. To identify the grade of pipe, colored bands are painted at the end of each pipe. The bands are currently painted via a manual process. To improve reliability and consistency, while increasing productivity, an automated solution was developed. Key aspects of the automated design include the use of pneumatic cylinders. The cylinders move paint rollers which apply paint bands to rotating pipes. A second, larger pneumatic cylinder moves the main body of the automated painting system in and out of the production line for reconfiguration or maintenance. The automated painting system also includes a newly designed frame which includes two sets of linear rails. The paint is supplied to the paint rollers by a system of gravity fed tanks. This greatly increases the production rate versus the current system, which requires each roller to be filled with paint manually. The tanks are located nearby the system. The system is designed to be adjustable to account for all casing products produced by Vallourec.

## 31 - Heavy Duty Truck Lift Axle Adaptation

Jeremy Fumerola[1], Mihai Aron[1], Constantin Padure[1]

[1]STEM, Engineering *Faculty Advisor: Eric Haake*

The project is dealing with commercial transportation for heavy duty highway trucks. The main issue is efficiency with these giants cruising down the road delivering everyday needs. The scope of the project is implementation of an affordable and universal lift axle system that could be adapted on 6x2 semi-trucks. There are very little over the road trucks that come with a lift axle. This system could prove to be anywhere from 7-15% increase in fuel efficiency and less tire/ brake wear. The idea is to lift a non-driven axle off the ground when the truck is operating with a light load that would not surpass the axle weight limit trucks have to abide by; this would result in huge yearly savings for large companies. The axle adaptation would basically pay for itself within the first two years of use. This setup is also ideal for owner operators that will increase their downtime of maintenance for the axle drastically as there is no more differential work or driveshaft work.

## 32 - The Optimization of a 36-foot Diameter, 60,000-pound Commercial Vehicle Turntable

Joshua Sargent[1], Giovanni Dunlap[1], Norberto Cosme[1]

[1]STEM, Engineering *Faculty Advisors: Hazel Marie, Anthony Viviano*

A commercial vehicle turntable, also known as a CVT, is an engineering solution that allows large vehicles, such as box trucks, to be orientated in specific positions in areas with limited space. The CVT is free to rotate on top of statically mounted rollers, 360 degrees clockwise or counterclockwise, when driven by the drive system. It is comprised of frame sections, or pie sections, a flat track, top plate, center post, slewing bearing and drive system. The scope of optimization was set in place by the project sponsor, which included, reduction of overall cost, the exploration of alternate materials and/or components, and an updated version of the drive system, while maintaining the structural integrity and reliability of the CVT.
A recreation of a 28-foot diameter CVT was modeled in SolidWorks from reference drawings to understand how a CVT worked and to perform preliminary analysis. Contact stresses between the flat track and rollers were calculated and finite element analysis was used to analyze reaction forces, stresses, and deformations. After iterating the design, it was found that 17 rollers and 16 pie sections was adequate, compared to the previous 24 rollers and 18 pie sections. When decreasing the number of rollers needed for the CVT, the moment of inertia decreased, allowing for a reduction in horsepower. This decreased the speed at which the CVT rotates and increased the torque output. With that, the desired torque output was calculated using the horsepower and speed of the motor, which determined the gear speed reducer needed.

# Oral Presentations: Session 3C

**Session 3C** **1 – 2.30 pm**

**Computer Science, Health Professions, Management and Marketing**

## 33 - A Comparison of AutoML Hyperparameter Optimization Tools For Tabular Data

Prativa Pokhrel[1]

[1]STEM, Computer Science, Information and Engineering Technology

*Faculty Advisor: Alina Lazar*

The performance of machine learning (ML) methods, including deep learning, for classification and regression tasks applied to tabular datasets, is sensitive to hyperparameters values. Therefore, finding the optimal values of these hyperparameters is integral in improving the prediction accuracy of a machine learning algorithm and the model selection. However, manually searching for the best configuration is a tedious task, and many AutoML (Automated Machine Learning) frameworks have been proposed recently to help practitioners solve this problem. Hyperparameters are the values or configurations used to control the algorithm's behavior while building the model. Hyperparameter optimization is the guided process of finding the best combination of hyperparameters that delivers the best performance on the data and task at hand in a reasonable amount of time. In this work, we compare the performance of two frequently used AutoML hyperparameter optimization frameworks, Optuna and HyperOpt, on popular OpenML tabular datasets to identify the best framework for tabular data. The results of the experiments show that Optuna runs faster than HyperOpt while providing similar accuracy.

## 34 - Strategies to engage older adults and YSU faculty, staff and students in intergenerational learning opportunities at the Ohio Living Vivo Center

Roberta Cykon [1]

[1]BCHHS, Graduate Studies in Health and Rehabilitation Sciences

*Faculty Advisor: Tiffany Hughes*

The Ohio Living Vivo Center is an intergenerational center that connects YSU students with opportunities to interact with older adults, often in ways to enhance their educational and professional development. The center was established in 2022 after rebranding the Ohio Living senior center, and efforts are now needed to promote the intergenerational focus between older adults and YSU students. As part of my field practicum in Gerontology, I am part of a team consisting of Ohio Living and YSU members charged with developing strategies to increase

engagement of older adults in the community as well as faculty, staff, and students at YSU. Strategies that I have contributed include: updating and researching email list servers, developing promotional flyers and brochures, creating print and digital correspondence to increase awareness about the center to specific target groups, and additional outreach events such as Pete the Penguin visiting the center and interviews with YSU faculty and students engaged with the center. I have also made several recommendations and developed material to improve the center's website and social media presence. Finally, I am using my community connections to build a list of organizations to contact for support of the Vivo Center and advertise in the newsletter. Taken together, increasing awareness about the Vivo Center and its benefits for all age groups will have an important impact on the Mahoning Valley community as well as student attitudes and beliefs about aging and older adults.

# 35 - Brains & Brawn: Influence of Muscle Strength on Speech Production

Anahni Harris[1]

[1]BCLASSE, English and World Languages *Faculty Advisors: Cynthia Vigliotti, Nicole Pettitt*

If you have ever attempted to learn an additional language, chances are you have encountered a sound you just could not quite "get." Or perhaps you have learned a language but struggle to have "native-like" pronunciation. These are not unique challenges, but rather problems that affect a vast number of language learners, some of which find themselves unable to overcome this hurdle despite countless attempts at improvement. In response to these issues, this submission attempted to explore and identify the significance of training and strength of articulators of speech (e.g. mouth and tongue muscles) for the level of facility with which additional language learning occurs. Conclusions suggest that a potential solution to the said frustrating phenomena could be as simple as a change in one's exercise regimen -- that is, working out the muscles of the mouth!

Strength or weakness of speech articulators can result in less or greater difficulty producing speech. While it appeared that not much research has yet been done particularly linking mouth muscle strength and training to enhancing language learning and production outside of use as treatment for speech disorders, the research findings of this submission support that the well established Speech Pathology technique of employing NSOMEs (Non-Speech Oral Motor Exercises) to aid general speech production difficulties have untapped potential for expansion beyond traditional usage and application to this very purpose.

Through the analysis and synthesis of scholarly literature from expert speech pathologists, medical professionals, and renowned medical databases and universities among others, this presentation shares cross-disciplinary threads established that indicate exploitation of the unexplored versatility of existing techniques could be immensely advantageous when applied to the language learning process, providing easy, fun, actionable methods to improve language teaching and learning experience and efficacy in additional language instructional settings such as TESOL or foreign language classrooms.

# 36 - Handel's Business and Human Resource Strategic Alignment

Jade Tibbs[1], Colleen Davis[1]

[1]WCBA, Management and Marketing *Faculty Advisor: Helen Han-Haas*

This presentation examines both the business strategy and the human resource strategy of Handel's and defines the strategic alignment. The company's business objectives and HR practices are explained to incorporate information gathered from a Raymond Miles and Charles Snow article, "Designing Strategic Human Resources Systems". The overall strategic alignment will show how Handel's is currently successful in their practices and recommendations will be made to support continued achievements.

# Oral Presentations: Session 4a

**Session 4a** **2.45 – 4.15 pm**

**Health Professions**

## 37 - An Investigation of Charcoal Dental Products on the Social Media Platform TikTok

Victoria Kobbe[1], Gwynne Frazer[1], Eric Beal[1]

[1]BCHHS, Health Professions *Faculty Advisors: Jennifer Pieren, Diane Kandray*

Patients are turning to social media and popular influencers for reviews and recommendations of many products, including dental products. The promotion of charcoal-infused dental care products is increasing in popularity on social media. Previous research confirms the abrasiveness of charcoal-infused dental products and their potential harm to tooth structures, but this information is typically not included in social media content promoting the use of these products. This study examined the information being distributed about charcoal-infused dental products on the social media platform TikTok. Fifty videos under the hashtag “dental charcoal” on TikTok were reviewed for content and accuracy. The results of this study showed that 76%(n=38) of the TikTok's had an overall message that promoted charcoal products for teeth whitening purposes, while just 24% (n=12) of the TikTok's had an overall message of how the use of charcoal is abrasive and can cause sensitivity. Only 28% (n=14) of TikTok's provided warnings regarding the potential risks of the products. Additionally, the presenter received compensation in 18% (n=7) of the TikTok's. Over half the videos reviewed were promoting charcoal products to millions of followers with no evidence or supporting research. This topic should be further researched to continue monitoring the accuracy of the promotion of dental products, including regulated products, through social media.

## 38 - A Comparison of Anti-Fogging Products

Rebecca Carey (Gill)[1], Kylee Sayers[1], Rihana Miller[1], Megan Constanzo[1]

[1]BCHHS, Health Professions *Faculty Advisors: Diane Kandray, Jennifer Pieren*

Eyewear fogging is a common problem among a variety of professionals who wear safety glasses in the workplace. This is a multi-factorial issue caused by a temperature imbalance; it is commonly prevented by mechanical or chemical solutions. The purpose of this study was to analyze a variety of anti-fogging products and identify the most effective method to eliminate eyewear fog. A study was completed to test the longevity of five different anti-fog products: a wet wipe, dry cloth, balm, spray, and dishsoap. This study was completed in time increments to observe if each product was still effective after 90 minutes. This project was approved as except by YSU IRB. The results of this study showed that all five products presented some level of effectiveness in reducing fog over a short-term, 90-minute period. More research is needed to find the most effective and long-term anti-fogging product.

# 39 - Hand Hygiene Compliance in a Dental Hygiene Educational Setting

Kaylee Rodgers[1], Kendra Pampus [1], Kaitlin Gibson [1]

[1]BCHHS, Health Professions *Faculty Advisors: Jennifer Pieren, Diane Kandray*

Hand hygiene is one of the most effective ways to prevent the spread of diseases and infections. According to the Centers for Disease Control and Prevention, some healthcare providers may need to wash their hands as many as 100 times during a work shift. Proper hand hygiene procedures in healthcare may include hand washing before and after donning gloves, when changing gloves when gloves are visibly soiled, and when a glove becomes torn or punctured. Studies have suggested that proper hand hygiene protocols may not always be followed in medical and dental practices. The purpose of this study was to identify if students follow hand hygiene protocols within the educational clinic setting. Researchers observed and recorded the students' hand hygiene practices at the YSU Dental Hygiene clinic. During the observation period, seniors had 137 opportunities to perform proper hand hygiene protocols whereas juniors had 241 opportunities. Results indicated that the senior class followed the protocols more frequently 53% (n=73) than juniors 36% (n=88). The most common breach in the protocol in the junior class was not washing before leaving the operatory (8%, n=20). Among senior students, the most common breach was not washing hands when gloves were changed after becoming visibly soiled during a procedure (25%, n=35). Since hand hygiene procedures are reinforced in educational settings, clinical hand hygiene compliance is thought to be higher in the educational setting than what has been reported in private practice settings. However, limited research exists examining these practices in either educational or private practice dental settings. Therefore, more research is needed to ascertain and improve compliance rates in dental settings.

# 40 - The Effectiveness of Toothbrush Storage Containers

Sierra Prest[1], Karalissa Lemasters[1], Arianna Carroll[1]

[1]BCHHS, Health Professions *Faculty Advisors: Jennifer Pieren, Diane Kandray*

Toothbrushes harbor microorganisms and should be stored in a manner that allows air circulation and the ability to dry between uses. The purpose of this study was to test different toothbrush storage methods to see which one accumulated the least number of bacteria. Three storage methods were tested. A toothbrush was used as recommended by each of the three participants for three days, twice a day, and stored in a container after use. A toothbrush cap, case, and Ziploc bag were used to store the toothbrushes. After the toothbrushes were stored into each container for three days, the toothbrushes were left for 24 hours to air dry before being swabbed onto an agar plate. The researchers were then able to count the bacterial colonies to determine which storage method produced the least number of bacteria. Results indicated the Ziploc bag grew the least number of bacteria as compared to the toothbrush cap and case. However, to achieve more accurate results a long-term study would be suggested.

# 41 - An Investigation of Dental Offices in Northeast Ohio who offer Non-Dental Cosmetic Procedures

Christina Vescera[1], Teal Burchfield[1], Caitlin Kunkle[1]

[1]BCHHS, Health Professions *Faculty Advisors: Jennifer Pieren, Diane Kandray*

Non-dental cosmetic procedures, including Botox and Derma filler use, are being offered and performed more frequently in the dental setting. The purpose of this study was to determine the prevalence of cosmetic procedures offered in dental offices in Northeastern Ohio. The researchers reviewed the websites of dental practices in Northeastern Ohio counties to determine if the dental practice indicated that it offered non-dental procedures on the website and the type of non-dental procedures that they offered. After reviewing the websites of 285 dental offices in nineteen counties, the researchers found that 14% (n=39) of dental offices offered Botox in their dental offices. The remaining 86% (n=246) of dental offices did not offer Botox or derma fillers in their dental offices. Sixty nine percent (n=27) of the dental offices in Northeast Ohio that offer non-dental cosmetic procedures were general dental offices. Five percent (n=2) of the dental offices that offer non-dental cosmetic procedures had information about the cost of the products and appointments. While the research revealed that most dental offices in Northeast Ohio do not offer non-dental cosmetic procedures, the trend of offering Botox and derma fillers is reportedly more prevalent in other locations and may become more prevalent in Northeastern Ohio in years to come. A repetition of the study may be merited as trends change.

# 42 - pH of Water

Taylor Cruise[1], Taylor Mayorga[1], Grace Gainey[1]

[1]BCHHS, Health Professions *Faculty Advisors: Diane Kandray, Jennifer Pieren*

Drinking water with a low pH may have harmful effects on the oral cavity. Frequent exposures of beverages that have acidic properties may cause dental erosion which may lead to a breakdown of tooth enamel. This study measured the pH of different drinking waters to find the ideal choice to maintain the correct pH in the oral cavity. Sixteen water samples were chosen from local establishments such as gas stations, grocery stores, etc. Four tests were conducted on each water sample with two separate pH measuring devices: a pH meter and pH reagent drops. Each test was conducted on the water sample as soon as it was collected, and then again, an hour later. After completion of these tests, results showed a pH range of 5.06 to 10.27. Data revealed that there are several drinking water sources with an acidic pH. Patient education on the different pH levels of bottled and municipal water sources in need to help consumers make informed decisions.

# 43 - A Study on the Relationship Between Periodontal Status and Having an Established Dental Home

Karina Rowan[1], Kara Kearns[1], Alexis Swain[1]

[1]BCHHS, Health Professions *Faculty Advisors: Diane Kandray, Jennifer Pieren*

Periodontal disease is a prevalent health problem that many people face around the world. Unfortunately, many people do not have a dental office that they regularly visit. The purpose of this study was to look for a correlation between people who have periodontal disease and those who do not have an established dental home. “Dental home” was termed by the Council on Clinical Affairs and is characterized by an office that can provide easily accessible anticipatory guidance, preventative education, and collaborative care on a continuous basis. For this study, active files from the past four years of patients with periodontal disease were analyzed from the Youngstown State Dental Hygiene Clinic file room and patient information was de-identified. Information from these files were put in an excel sheet to track the following data: periodontal status/type, dental home, last appointment, age, OHI-S (plaque score), tobacco use, reported dental anxiety, and physician in separate columns. From the 280 files pulled there were 106 (37.86%) patients that did not have a dental home. Research suggested that patients that did not have a dental home had a worse OHI-S score than those that did have a dental home. Further research is needed to look at the correlation between periodontal disease and having an established dental home.

# Oral Presentations: Session 4b

**Session 4b** **2.45 – 4.15 pm**

**Engineering and Engineering Technology (Mechanical Engineering)**

## 44 - Optimizing Central Boiler and Steam Plant Operations with Data Analysis and New Qualitative Tools

Ian Norman[1], Luke Nilsson[1], Darrin Smith[1]

[1]STEM, Engineering *Faculty Advisor: Hazel Marie*

Operating legacy industrial energy systems efficiently is challenging due to original equipment constraints, changed operating environments, and economic realities. The analytical methods presented in this paper made for no-cost operational changes that allow for cost savings of over $500,000 annually, significant carbon emissions reductions, and water savings for a 60-year-old industrial boiler house facility. While this facility operates high-pressure steam turbine generators and burns multiple fuels, the methods discussed offer optimized operating strategies for any industrial central steam generation facility, with or without power generation. The applied methods utilized both quantitative and qualitative analysis tools. The quantitative methods include analyzing and confirming philosophies for configuring turbines versus motors using free DOE-developed modeling software, creating KPIs (key performance indicators) for turbine heat rates, and considering the combined combustion and thermal efficiencies of different boiler combinations. The qualitative tools developed included a software auditing app and a low-cost $400 infrared iPad tool. The auditing app allows for more meaningful and complete inspection rounds when operators are conducting regular field inspections. The infrared imager allows operators to screen equipment conditions against reference images. Overall, this allowed paper logs to be converted to iPad apps providing valuable real-time operating decision information for the staff.

## 45 - Design of Below-The-Hook Double Roll Lifter

Coleman Buchanan[1], Vanessa Morro[1], Gabriel Fitch[1]

[1]STEM, Engineering *Faculty Advisor: Anthony Viviano*

Below-The-Hook lifting devices play an important role in many industries, but an especially important role in material handling. Steel Equipment Specialists, LLC supplied a project to design a double work roll lifter that can accommodate a stacked pair of steel finishing rolls weighing up to 40 tons. The ASME BTH-1 standard outlines the minimum requirements for design safety, but lifting this type and size of load presents some unique challenges that aren't present in general lifting applications. Engineering software such as Autodesk Inventor, Ansys, and Mathcad were utilized to design the double work roll lifter to meet minimum safety requirements and optimize to reduce weight and overall material needed to manufacture the

lifter. Attention was focused on the main lifting beam to connect a lifting hook to the rest of the lifter, a set of lifting tongs to securely maintain grip on the rolls, and a latching system that automatically locks and unlocks the mechanism to reduce the chance of injury during operation. The design process primarily focuses on static stress analysis of the lifting device.

## 46 - Butech Bliss Hydraulic Press Scale-Up Design

Anthony Corrin[1], Marshall Calvin[1], Jacob Thomas[1]

[1]STEM, Engineering *Faculty Advisor: Stefan Moldovan*

The goal of this project was to create a scaled-up and improved version of an existing hydraulic press for Butech Bliss and their new rebuild facility. This press is used for the disassembly of Butech's patented scrap chopper, which is a machine that takes edge trim of steel coils from coil processing lines and chops it into small, manageable pieces. The various models of scrap choppers have a large size variety, ranging from roughly 12 inches tall to upwards of 70 inches tall, and the current press used cannot handle the larger sizes. The goal of the design was to create a larger, higher capacity, and more efficient to use hydraulic press. The design process involved 3D modeling, stress and deformation calculations, material selections, finite element analysis, cost analysis, and manufacturability analysis. Initial designs were created through research of existing presses and then refined using the listed methods to create a suitable design for the customer.

## 47 - 40-Ton L-Shaped Coil Car for SES

Aaron Hays[1], Timothy Wirtz[1] [1]

STEM, Engineering *Faculty Advisor: Stefan Moldovan*

The steel industry is continuously evolving and the need for transportation of 84-inch diameter steel coils that weigh 40-ton is needed. The need is to design and prototype a 40-ton L-shaped coil car using important design parameters. These parameters include: 40-ton and 84-inch coil, coil width of 74 inches, rail gauge and size of 72 inches and #60 respectively. Ensure a proper design by using a factor of safety of 3 on yield strength and 5 on ultimate tensile strength. Calculations of allowable stress, allowable shear stress, allowable bearing stress, and bearing life are needed. The sizing of a hydraulic cylinder and electric motor is also needed. The use of finite element analysis reassures that the design will withstand the 40-ton coil and validates all the calculations performed throughout the process.

# 48 - The Superstorm Vacuum Attachment

Constantine Denas[1], Wilson Cannon[1], Edward Shellogg[1]

[1]STEM, Engineering *Faculty Advisor: Eric Haake*

The objective of the presentation is to present the redesign of a specialized car wash vacuum attachment for the startup company Confinity Robotics Inc. The attachment combined an air compressor which propelled air through an air-knife with vacuum suction to create an efficient cleaning process. Due to the patent pending nature of the original design and the patent pending nature of the revised design, this presentation will be purposefully broad and slightly vague. At the start, the original design was depending on several factors, chief of which was a very specific air-knife. An air-knife is a device that discharges pressurized air in order to clean and/or dry a given product or surface. This dictated how the design was constructed as well as manufacturing constraints. The redesign revised the air knife design which in turn opened the possibility of scaling up and down the revised design, improved efficiency, and significantly lowered manufacturing costs.

## Poster session 1 10.30 am – 12 pm

# 101 - Investigations into the Function of BglX Protein from E. coli

Alexis Chiandussi[1], Justin Spatar[1]

[1]STEM, Chemical and Biological Sciences *Faculty Advisor: Nina Stourman*

BglX is a family of β-glucosidases found in fungi, bacteria, and certain species of plants. Located in the periplasm of bacteria, these glycoside hydrolases are capable of breaking glycosidic bonds, notably those of glucose and galactose. In E. coli, the function of BglX is unknown. Recent studies indicated that in the bacteria P. aeruginosa, BglX is involved in biofilm formation. It was hypothesized that the protein would have the same function in E. coli. To investigate that, several experiments were performed involving E. coli bacterial cells expressing wild-type or BglX mutants. Cells overexpressing BglX or its mutants were grown for three days at 37 oC in a 96-well plate. The wells were washed with water, and the biofilms were stained with crystal violet. After dissolving the stained films in acetic acid, the absorbance of the solutions was measured. Our results suggest that BglX is not involved in biofilm formation. Further investigation is required to determine the true function of BglX in E. coli.

# 102 - Chromatographic Separation of Carbohydrates

Taylor Barber[1], Lauren Maciag[1], Huanhuan Wang[1]

[1]STEM, Chemical and Biological Sciences *Faculty Advisor: Nina Stourman*

Carbohydrates have a multitude of applications in various fields, such as the food industry and cosmetics. In order to analyze and utilize sugars, they must first be separated from their complex mixtures. Separation of sugars is difficult due to similarities in their structures and properties. Currently, most methods of separation are complex and expensive; thus, it is of great interest to find more efficient techniques. A mixture of glucose and sucrose was used to test the abilities of three chromatographic matrices to separate mono- and disaccharides: Sephadex G-25 gel, activated charcoal, and Dowex 1 borate complex. The fractions that eluted from the columns were collected and analyzed by the thin layer chromatography (TLC) method. The tested strategies were unsuccessful in separating the saccharides. Current work is underway to explore the use of silica gel as a separation matrix.

# 103 - Development of a Method to Evaluate Trace Metals in Environmental Sediment Samples by an ICP MS Approach

Cameron Watkins[1]

[1]STEM, Chemical and Biological Sciences *Faculty Advisor: Josef Simeonsson*

Metals such as iron (Fe), mercury (Hg), and lead (Pb) are often found in soils and sediments that have been contaminated by industrial activities involving metals production and manufacturing. High level exposures to many of these metals can cause serious health problems due to their toxicity and tendency to accumulate in the body. This project's focus is on the development and application of analytical methods for characterizing trace elements in sediments from three locations along Yellow Creek in Poland, Ohio. The sample sites include locations near a local cemetery, the town library, and an undeveloped area in Poland Woods. Once the sediment samples have been collected, they can be digested with heat and strong acids to solubilize all of the metals, which allows the measurement of the total concentration of each element in the sample. Sample measurements of the metals are performed by ICP MS (Inductively Coupled Plasma Mass Spectrometry), which allows high sensitivity measurements at low concentrations for all of the elements. As the mobility, bioavailability and toxicity of metals in the environment depends on environmental conditions, it is important to evaluate the chemical states of each element in the sediment samples. In this project, a sequential extraction procedure based on the European Community Bureau of Reference (BCR) three-step sequential extraction is used to characterize the availability of each element under different chemical conditions. Comparisons of the total concentrations of the elements to the amounts that become available during each step of the sequential extraction procedure, not only give insight into the presence of the metals, but also these elements' chemical availability under different ambient conditions in nature. The current project's focus is on characterizing the quantitative sensitivity of these methods and evaluating measurement interferences. Techniques for overcoming these interferences will also be developed.

# 104 - How Communication Theories Impact American Politics: The Democratic Peace Theory

Sofia Myers[1]

[1]BCLASSE, Humanities and Social Sciences *Faculty Advisor: Elyse Gessler*

I will present an academic poster regarding how communication theories impact American Politics. I will specifically be covering the Democratic Peace Theory, how it influences the current day politics in the United States, and its impact on international relations and wars that the United States has been involved in. Overall, not many people understand the function of American Democracy or how it works. I want to share my findings on where the Democratic Peace Theory originated from and how it is applicable in our modern day government. Understanding our government and the way it works is crucial for people to be informed citizens and voters, I hope that my presentation will allow more insight and understanding to our government. As there is a lot of hostility and aggression regarding different political parties, this

presentation will be neutral, or non-partisan. The goal is to deepen my peers' knowledge of the ways that communication is essential in our government and the way that it has influenced political philosophy. The poster will include graphics, text, and important quotes regarding The Democratic Peace Theory. I have found that the United States does follow the Democratic Peace Theory, but many people have misconceptions about our government's relations with other countries. I hope to be able to clear up the misconceptions with my presentation.

## 105 - A Comparative Study of Imputation Methods for Time Series Data

Daniyal Khan[1], Alina Lazar[1]

[1]STEM, Computer Science, Information and Engineering Technology

*Faculty Advisor: Alina Lazar*

Missing and incomplete values pose a significant challenge in analyzing tabular and time-series data. Dealing with missing values is time-consuming and tedious, especially when working with data from real-world applications. While some imputation approaches estimate missing values based on existing observations, these methods often rely on strong assumptions about the data distribution, which only sometimes improves downstream accuracy. Although tabular imputation methods can be applied to time-series data, incorporating the time component can enhance accuracy. This study evaluates various techniques for missing data imputation in time-series data. We run experiments on four multi-variate time series datasets using five imputation methods. We report training time and testing accuracy.

## 106 - Simulating Particle-Based Physics Using a Graph Neural Networks Through Python

Anna Colgrove[1], Alina Lazar[1]

[1]STEM, Computer Science, Information and Engineering Technology

*Faculty Advisor: Alina Lazar*

Simulating complex particle-based physics using Graph Neural Networks (GNNs) (an algorithm that graphs connections in code) can be a beneficial tool for measuring scientific experiments digitally or for projects such as game development or independent filmmaking. Computer-based physics simulations are faster and cheaper than realistic physics simulators making them ideal for such tasks if they provide the same accuracy. Simulating physics through a GNNs is also a much smaller code file to implement in the aforementioned projects rather than a traditional physics simulator. To achieve this, the GNNs will be trained through the use of Python and PyTorch, and the results are expected to be accurate particle-based physics models (of particularly liquid substances with different viscosities) and trajectories of particles that can be used in versatile ways. In essence, the substances that will be programmed and tested are made up of dots, or particles. This way, trajectory of the substances (and parts of the substances) will be easy to measure, compare, and determine. The training and inference time

of the simulation will be recorded and will depend on how many particles are simulated. The particle amount is directly depend on how much of a substance will be tested. More of the substance requires more particles and more measuring, though it will produce more data. Data will also be recorded to compare the tradeoff of how long the simulation takes to train versus how accurate the results may be. The best outcome of this research will be if the simulation takes a short time to train and produces accurate particle physics simulations.

## 107 - Text Analysis of Two Mass Shooter Manifesto's

Charles Sayre, Jr.[1]

[1]BCHHS, Criminal Justice and Consumer Sciences *Faculty Advisor: Richard Rogers*

Mass shooting has become a common and unwanted occurrence in America. Mass shootings in January 2023, as of time of writing (01/24/2023) total 40, the number of deaths total 73 (Gun Violence Archive, 2023). This comparison will analyze the “manifesto” writing of two individuals that have been identified as mass shooters. The El Paso Walmart shooter, Patrick Wood Crusius, manifesto from August 2018; and the Buffalo Tops Grocery shooter, Peyton Gendron, manifesto from 2022 will be analyzed.
Analysis will reveal word use frequency in the documents of both writers, co-occurrence network of words, hierarchical cluster analysis of word, and multi-dimensional scaling of words. Declarations of both individuals prior to the acts are shown; shooter reasonings and goals of committing such acts are also discussed.
Both shooter “manifesto” words are analyzed and contain information about the shooter intentions, preparations, plans, and mentality prior to the acts. Both shooters believed that they were completing an act on behalf of others, or in service to society; to prevent invasion of the United States and cultural diminution.

## 108 - Racism/White Supremacy in Law Enforcement

Thurston Winbush[1]

[1]BCHHS, Criminal Justice and Consumer Sciences *Faculty Advisor: Richard Rogers*

The Presentation will examine the early infiltration of Racism/White Supremacy in law Enforcement.
As well as the enduring effects Racism/White Supremacy has on current attitudes towards law Enforcement.

# 109 - Enzyme kinetics determined by a low-cost microvolume spectrophotometer

Razan Al Qallaf [1], Byung-Wook Park[1]

[1]STEM, Engineering *Faculty Advisor: Byung-Wook Park*

The present project describes a fiber optic based microvolume spectrophotometer for measuring enzyme kinetics. Using research-grade instrumentation for the teaching of instrumental analysis is often limited due to the high-cost device required. Therefore, the development and application of low-cost instrumentation are necessary for research and teaching laboratories. The design and application of the developed microvolume spectrophotometer are presented using Arduino microcontroller operated by a custom-built LabVIEW code and LINX software and an innovative design to hold the fiber optics in place. To determine enzymatic reactions, a user-friendly interface was developed. The device was used to simulate the usefulness in a wide range of uses, such as the enzyme kinetics of horseradish peroxidase (HRP) activity using Amplex Red and Pyrogallol reagents and detection of hydrogen peroxide produced from biological cells.

# 110 - BMP Application Of Various LIDs To Reduce Storm Water Run-off In Coastal Ohio

Rajati Dahal[1]

[1]STEM, Engineering *Faculty Advisor: Suresh Sharma*

The conventional drainage system relies on the design of a network of curb gutters and underground pipes. Such gray infrastructure may not be environmentally suitable, as they do not fully avoid problems but transfer the problem leading to intense flooding downstream. As the precipitation intensity and frequency are expected to increase in the future due to climate change within the Lake Erie Basin, the capacity of the drainage system designed using the conventional design approach may not be able to accommodate the increased runoff resulting in the failure of storm drainage systems. Consequently, there is a critical need to explore the extent to which GI or LID can be beneficial over the gray infrastructure to reduce flooding problems downstream. Therefore, this study will be conducted in the Town of Willoughby-HUC12 watershed of the Lake Erie Basin by experimenting with various green infrastructures (GI) in Storm Water Management Models (PCSWMM) in order to develop resilient storm drainage system and avoid the flooding problems in the cities. Currently, the implementation of different LIDs such as Rain Barrel, Rain Garden, and Permeable pavement has been considered to minimize the runoff based on the feedback received from the communities in terms of its suitability for maintenance, cost, and site conditions. Our preliminary investigation suggests a positive correlation between runoff reduction with the implementation of the rain garden and permeable pavement. Since GI improves sustainability by lowering flood risk, improving water quality, and lowering community infrastructure costs, this knowledge will be transferred to the communities with proper outreach and community awareness. It is expected that communities will be encouraged to use GI as a tool for improving storm drainage

infrastructure resiliency after we demonstrate the impact of GI implementation in runoff reduction through simulation models.

## 111 - Production and Cost Analysis of Dimethyl Ether for Transportation

Nathanael Warren[1], Muhammad Riaz[1], Omar Alessa[1]

[1]STEM, Engineering

*Faculty Advisor: Holly Martin*

The use of dimethyl ether (DME) is the new alternative to diesel fuel. DME is not a greenhouse gas, it evaporates into the air when spilled, and is non-toxic/non-carcinogenic. On the other hand, diesel is a greenhouse gas, as well as a carcinogenic, and does not evaporate when spilled. This capstone attempts to model a manufacturing facility, for DME, from start to finish. It will correctly model the price to run the facility including worker, land, and machinery costs. Finally, the capstone will discuss, in detail, the safety aspects surrounding the facility.
The software known as ChemCad is utilized, along with available research, to correctly model the production of DME. The units needed in this simulation include heat exchangers, valves, pumps, a reactor, and separatory towers. Each of these units were optimized utilizing the techniques mastered in previous courses. This capstone will also discuss two conditions involved in the production of DME. One of these conditions is using a reactor that is ran at a high temperature ensuring that everything is in the gas phase. The other condition will require the reactor to be at a low temperature so that everything is in the liquid phase. Along with ChemCad a program known as Capcost was used to accurately simulate the costs associated with a manufacturing facility.
Overall, this capstone will showcase the ability to accurately model DME production with ChemCad, Capcost, and the techniques mastered in previous courses. This capstone is only intended for us to showcase the simulations and techniques mastered throughout the curriculum.

## 112 - Additive Manufacturing Using Copper Screen Printing and IDS Aerosol Jet Printing

Evan Smith[1]

[1]STEM, Engineering

*Faculty Advisor: Vamsi Borra*

Additive manufacturing has been used in multiple studies, producing good results for the purpose of printing using new methods. With the use of these methods, new items can be made using additive manufacturing to make previously hard to produce items. Many companies out there use additive manufacturing to produce items by need of universities and other companies. But as a university we can do the additive manufacturing ourselves by printing the items needed here at the university. We have used methods such as screen printing and aerosol jet printing to produce microstrip antennas and baluns for student projects. Aerosol jet printing uses an aerosol based system to dispense a silver ink onto a substrate in a small area with little to no mistakes on the antennas design. This can be used to produce necessary components for

larger circuits and machines, while printing in a small area, or to even produce flexible antennas needed for flexibility in projects. Screen printing uses a mesh in order to dispense copper paste through the holes in the mesh to make the design while holding the extra paste on top of the thicker mesh. We are using these methods to produce very reliable antennas, baluns, and more by printing in the lab without the need to get help from outside sources. These antennas can be made to fulfill the needs of projects by design in a three dimensional printing software, then converted into the print for the IDS Aerosol Jet Printing machine, or made by a company for the mesh for copper screen printing. These methods can make it very easy to prepare an antenna on demand rather than working with other companies to get them printed.

## 113 - Shape Memory Alloy (SMA's) Heat Engine

Allison Stanko[1], Matthew Fabian[1], Spencer McGarrity[1], Tyler Miller[1]

[1]STEM, Engineering *Faculty Advisor: Constantin Solomon*

Shape Memory Alloy's (SMA's) are part of the next generation of engineering materials. Nitinol is a nickel-titanium (NiTi) alloy known for its shape memory and super elastic characteristics. Shape memory refers to Nitinol's ability to undergo deformation at one temperature, then recover its original, under formed shape upon heating above its transformation temperature. The purpose of this project is to design and manufacture a heat engine consisting of a pulley system activated by SMA's wires. To create a heat engine, the appropriate transformation temperature gradient was researched, as different commercially available SMA's wires have different activation temperatures. Part of the engine is placed in a hot environment, and the other part of the engine is placed in a cool environment to activate the temperature gradient of the material. When the material is activated, it will want to go back to its original shape, allowing it to pull on the wheel and have it begin to turn the engine. The heat engine was designed in SolidWorks and the components have been printed on a Prusa MK3S 3-D printer using a PLA filament. Two SMA's geometries have been considered for this work. A SMA wire having 1 mm diameter and upper transformation temperature of 45°C, and a SMA coil having the following dimensions of 0.5 mm wire coiled about a 4.75 mm mandrel that will stretch to 1250mm. Two heat engine designs were considered, one with two different sized wheels and the other with four wheels of the same size. The goal of designing and manufacturing two different engines is to determine which engine would convert most efficient the transformation energy of SMA wires into mechanical energy.

## 114 - Investigating Mechanical Properties of Pi-conjugated Polymers with Varying Amounts of Dopant

Natalie Dando[1], Gianna Lattanzio[1]

[1]STEM, Chemical and Biological Sciences *Faculty Advisor: Christopher Arntsen*

Pi-conjugated polymers are good semiconductors, making them of interest for use of biomedical devices. However, their crystalline nature makes them too brittle for use in a moving, stretching, and living body. However, adding dopants to these polymers can change their mechanical

properties to make them a more viable option in conditions where they need to be stretched. By running molecular dynamics simulations through Linux, we can compare the mechanical properties of pure semiconducting polymers with varying levels of a dopant capable of forming hydrogen bonds. These can be compared with different sizes of the polymers in a crystalline structure or amorphous morphology.

## 115 - Impact of Rainfall on Water Quality in the Mill Creek Watershed

Adrianna DeVite[1], Destiny Smith[1], Ellen Cox[1]

[1]STEM, Environmental Sciences *Faculty Advisor: Felicia Armstrong*

The Mill Creek Watershed, located in northeast Ohio, covers a large and diverse area that has land uses from agricultural and residential use, while other areas are developed and used as industrial and commercial land. It is hypothesized that the different land uses will have an impact on the local water quality due to runoff caused by precipitation. Following precipitation events, excess particles, nutrients, and bacteria runoff from surrounding areas resulting in lower water quality. Nine sampling sites were identified based on the land use from headwaters with agriculture to low and high intensity development where Mill Creek joins the Mahoning River. Several parameters were assessed including pH, E. coli, solids, soluble phosphorus, biochemical oxygen demand, turbidity, and nitrate post rainfall on four different dates. Results indicate that most of the measured parameters met warmwater criteria. Mill Creek has a history of high bacteria, and this was found throughout the watershed with excessive levels of E. coli. Previously these high bacteria levels were blamed on combined sewer overflow (CSO) levels but water from regions without CSO also had excessive bacteria. Other concerns were the turbidity levels on several sampling days that were > 36 NTU, the recommended level for aquatic life. In addition, high soluble phosphorous levels that were observed can lead to algal blooms and low dissolved oxygen. Phosphorus levels at the headwaters were high and decreased downstream. Although further investigation is required, the hypothesis is tentatively accepted that land use is impacting the water quality of Mill Creek. By studying the water quality of Mill Creek watershed, the specific impacts are better understood, and the sources of these pollutants can be identified.

## 116 - Using Fingernails as a Bioindicator for Heavy Metals

Madeline Rosile[1]

[1]STEM, Environmental Sciences *Faculty Advisor: Felicia Armstrong*

Heavy metals are found in the earth's crust and can be exposed to the environment due to soil erosion and weathering. Various industries, such as industrial, agricultural, medicinal, and technological, have contributed to the amount of heavy metals found in the environment. Consequently, living organisms are being exposed to heavy metals which can work their way up the food chain through bioaccumulation. Heavy metals can be found in drinking water sources as well as some food sources due to herbicides, pesticides, preservatives, and more. These heavy metals can be absorbed into the body and deposited into fingernails over time, becoming

a biological indicator for heavy metals. Volunteers from YSU took a survey regarding individual's daily activities in order to determine possible heavy metal exposure. Nail samples collected went through a cleaning cycle before being dissolved in nitric acid and peroxide in order to be analyzed by inductively coupled plasma (ICP). The heavy metal levels found in the body can depend on various factors, such as route of exposure, chemical species, dosage, age, gender, genetics, and the health of the individual. The examination of participants' location, diet, and personal habits were used to establish a correlation to heavy metal levels.

## 117 - Analysis of Microplastics from Sandy Riverbanks in Mill Creek and the Mahoning River

Nicholas Fuese[1]

[1]STEM, Environmental Sciences *Faculty Advisors: Felicia Armstrong, Colleen McLean*

In recent years, the study of microplastics has gained much attention both in the scientific community as well as the general population. Microplastics are considered a pollutant, and they are defined as plastic particles that are smaller than five millimeters in diameter. There are five types of microplastics which include fibers, microbeads, fragments, nurdles, and foam. Microplastics are everywhere, and their impact on human and environmental health is not yet fully understood. Sand samples were collected in Youngstown, Ohio around four different riverbank locations on Mill Creek and the Mahoning River. The sites sampled are all located within a half mile of industrial or anthropogenic activity which provides a strong likelihood to find microplastics in the sand/sediment. To analyze microplastics, organic matter was burned off using a wet oxidation peroxide method followed by a density separation. Density separation is achieved by adding sodium chloride to a sample to cause the plastics to float in the water layer. Various methods were tested to determine which was the best way to separate the liquid containing microplastics from the sand mixture. The first method involved pipetting the supernatant liquid directly off of the top of the separated sand sample. The other two methods tested involved filtering the sand samples. One method of filtration involved the use of a 37 um sieve, and the other utilized a glass filter paper and vacuum filtration to capture any particles larger than 1.2 um.

## 118 - An Analysis of Benthic-Macroinvertebrate Assemblage Diversity of a Tributary in the Mahoning River Drainage Basin

Zachary Felger[1]

[1]STEM, Environmental Sciences *Faculty Advisor: Felicia Armstrong*

The health of a waterway can be determined by assessing its aquatic benthic-macroinvertebrate assemblages, which act as biological indicators of stressors to water quality. Hines Run, a tributary of the Mahoning River drainage basin in Struthers, Ohio, has been monitored since it was designated as having Coldwater Habitat (CWH) aquatic life use in 2002. The study aimed to assess the suitability of its CWH designation by evaluating the diversity and abundance of benthic-macroinvertebrate assemblages using multiple biotic indices, including the Hilsenhoff

Biotic Index, Shannon-Weaver Diversity Index, and Pollution Tolerance Index. Macroinvertebrate samples were collected three times during summer, fall, and winter, and analyzed using the Surber sampler method. The results indicate a diverse benthic macroinvertebrate community, with mayflies and caddisflies being highly abundant. The high abundance of Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa suggests that Hines Run's macroinvertebrate diversity is consistent with Ohio's CWH aquatic life use criteria. The study provides valuable insights into the current health of Hines Run and informs management and conservation efforts in the Mahoning River watershed.

# 119 - Impact of Land Use on Water Quality

Caden Barone[1]

[1]STEM, Environmental Sciences *Faculty Advisor: Felicia Armstrong*

The distribution of nutrients and sediment in streams can be affected by land use changes such as urbanization, industrialization, and agricultural expansion. Anthropogenic influences such as nutrient runoff of fertilizer utilized in fields and yards can cause algal blooms and decreased dissolved oxygen. Elevated sediment pollution caused by agriculture, construction, and impervious surfaces reduces light penetration and smothers benthic organisms. Yellow Creek located in Northeast Ohio, is a warm water habitat tributary of the Mahoning River. Following rainfall events, samples were collected and analyzed to measure nutrients, biochemical oxygen demand, and solids from various land-use locations along Yellow Creek. It was hypothesized that Yellow Creek will meet warm water habitat criteria while being affected by different land uses. The results support the hypothesis that the creek meets most warm water habitat requirements among the parameters tested except bacteria. In comparison to the other sampling sites, levels of E coli were higher at the commercial sampling site, not meeting the criteria for primary or secondary contact recreation water. It may be due to the presence of septic systems in the watershed. Overall, Yellow Creek's water quality does not seem to be adversely impacted by its land use therefore refuting the second part of the hypothesis. The vegetation in the riparian zone acts as a buffer which is beneficial to maintaining water quality in Yellow Creek. As land use patterns continue to undergo significant modifications, it remains critical to understand the impact of these changes on water resources such as Yellow Creek.

# 120 - The Effectiveness of Various Materials used for Phosphate Removal from Water

Jason Silvestri[1], Serene Awad[1], Jason Ngo[1], Zoe Figinksy[1]

1STEM, Environmental Sciences Faculty Advisor: Felicia Armstrong

Phosphate water pollution is a concern in many regions of Ohio. When phosphate gets into waterways it can cause algal blooms, which can result in lowering dissolved oxygen that is detrimental to aquatic life. Sources of phosphate include agricultural runoff, animal waste, and sewer and septic effluent, as well as other natural sources. If the phosphate can be removed in tributaries before reaching major waterways, these adverse effects can be prevented. The goal of this study is to identify readily-available and low-cost materials that are efficient phosphate

removers.
Multiple materials were evaluated using phosphate adsorption experiments: eggshells, biochar, drinking water residuals (DWRs), and wood-paper ash. Drinking water residual and wood-paper ash were found to have the highest adsorption capability and removal efficiency (83-99%). DWRs form when coagulants composed of aluminum- or iron-based chemicals react with suspended solids during the drinking water treatment process. The resulting residuals have the ability to bind with phosphate, removing phosphorus from runoff waters and mitigating adverse effects.
Since this has been an ongoing project from 2020, the drinking water residuals and wood-paper ash were recently retested to ensure consistent levels of phosphate adsorption. The recent material testing results were similar to the initial results. This indicates the material's ability to adsorb phosphate has not decreased with time. With fresh data, submersion simulations will be run to determine the removal efficiencies of the materials utilizing a sorbent boom-type apparatus.

# 121 - Mahoning Valley Reproductive Health Pediatric Care Service and Policy Analysis

Jacqueline Palusak[1], Delaney Panigall[1], Daniella Hosack[1], Pantelis Pizanias[1], Emily McNicol[1], Divya Warrier[1], Julianna Sandine[1]

1STEM, Graduate Studies in Health and Rehabilitation Sciences

*Faculty Advisor: Nicolette Powe*

Background: Infant mortality is a key indicator often used to measure the health and well-being of a population. In order to decrease infant mortality, longstanding challenges and factors that maintain the disparity among women must be addressed directly. The purpose of this study is to identify barriers to obstetric and gynecologic care for women of childbearing age and assess the barriers to pediatric care for infants less than one year in Mahoning Valley, Ohio. Methods: A comprehensive literature search was conducted on 12 January 2023 and included six major health sciences electronic databases. We chose these databases because articles are entered and tagged in a uniformed and structured way to maximize search results. The search query consisted of terms considered by the authors to describe the terms focused on drug use, sleeping habits, and obesity. Semi-structured key informant interviews were completed. The interviews were transcribed and then analyzed in Quirkos Software. Thematic analysis was used to identify common themes across agencies. Results: The search yielded 378 potentially relevant journal articles. A total of 97 articles were reviewed. Articles (N=66) were rejected if it was clear from the title and the abstract that the study did not focus on drug use, sleeping habits, and obesity issues related to infant mortality. Thirty-four obstetrics and gynecology and seventeen pediatricians were identified through website search. The key informant interviews identified barriers associated with infant mortality drug use, sleeping habits, and obesity issues. Discussion/Conclusion: The project findings highlight the need for connections between community and clinical sectors to improve population health. This project identified key strategies to implement community-clinical linkages that focus on maternal and child health issues.

# 122 - Blowing Smoke: The Effects of Vaping on College Students

Ava Spano[1], Grace Eucker[1], Kelsey Hackstedde[1], Mike Sattler[1], Nick Wogan[1], Sophia Komara[1], Trevor Strohmeyer[1]

[1]BCHHS, Nursing *Faculty Advisors: Lori Fusco, Nancy Wagner*

The team is conducting a survey on the widespread use of vaping and college students' knowledge of the effects of using such a device. The survey will be conducted on the grounds of Youngstown State University and will apply to the students who are currently attending YSU. The survey will be provided on a QR code which will connect them to a survey that spread across campus through multiple means. The students will use the QR code to take the survey in which the student will answer demographic questions pertaining to what college they attend within YSU, their gender, age, and if they currently vape or have vaped before. The participant in the survey will be anonymous while completing the survey. Before the participant answers the survey, an attached video pertaining to the effects of vaping will be linked in the survey intended to be watched before completing the questions on the survey. The video will provide an explanation of the harmful health effects of vaping using facts obtained from the group research conducted. The participant will then be asked if they were aware of the health effects mentioned in the video. The final question will ask the participant if the video has changed their view of vaping for future use of electronic nicotine devices. The data will then be collected and analyzed by the team for any potential trends. Although students' answers to the survey will remain anonymous, they can choose to provide their YSU email in order to be entered into a raffle for the chance to win a gift card. The students who provide their email give permission to be notified if they have won and to use the data collected. All data collected will remain anonymous. The analyzed data will be summarized and translated to the team’s poster.

# 123 - Lunar City Power Microgrid Design

Ina Walker[1], Courtney Frye[1], Kristen Grunden[1]

[1]STEM, Engineering *Faculty Advisor: Robert Caven*

Since the first humans touched down on the moon in 1969, there has been increasing interest in a long-term human lunar settlement. As technology continues to advance, the National Aeronautics and Space Administration (NASA) is working to make this a reality under the Artemis mission. The mission started with robotic exploration of the moon’s south pole, and the sights are set on commercial operation on the moon, utilizing the resources found in the regolith on the lunar surface. In order to reach this goal, electricity is needed to power the various robotics as well as to support human life, which will be accomplished by creating a lunar microgrid. This microgrid will have the capability to supply between 1-10 MW of power to approximately 20 loads, including the various mining robots, in-situ resource utilization (ISRU), human habitat units, and other loads necessary for commercial and/or manufacturing use. Renewable energy sources such as solar power and small fission reactors, or fission surface

power (FSP) will generate the required energy to maintain lunar operations. Different microgrid architectures will be simulated to determine the most reliable and efficient transmission of electricity to maintain the long-term settlement and lunar surface operations.

## 124 - Electrochemical Detection of Multiple Heavy Metal Ions Using a Metal Organic Framework and Biohybrid Nanocomposite Modified Electrodes

Joseph Macejko[1], Kyle Preusser[1], Alex Corona[1], Anthony Meranto[1]

[1]STEM, Engineering *Faculty Advisor: Byung-Wook Park*

Heavy metal pollution has become a worldwide problem. Particularly, lead ions (Pb2+) have received growing concerns due to their increased discharge and deleterious effects on the environment as well as human health. Cadmium ions(Cd2+) may cause renal dysfunction and metabolism disorders. Copper ions (Cu2+) is an essential element of biological processes. However, higher concentrations of Cu2+ may lead to cancer and genetic disorders. Mercury ions
(Hg2+) can interfere with the nervous, immune, and endocrine systems.
In this study, a novel biohybrid nanocomposite was fabricated through a simple one-pot hybridization method, and the square wave anodic stripping voltammetry (SWASV) was used as the electrochemical technique for the detection of lead ions. In this study, the developed electrodes using the metal organic framework and cellulose nanocrystals (MOF-CNC) proved to be an effective material to detect leads ions at levels down to sub-ppm in aqueous solutions. Various electrochemical tests such as cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) were performed to characterize the fully modified electrode to compare it with bare glassy carbon electrodes (GCE). The experimental parameters were optimized for detection such as accumulation time and potential range. Research was done to determine the optimal pH of 5 for detection. Selectivity and reproducibility tests indicated an excellent anti interference ability of the electrode to otherinterfering ions. Individual and simultaneous calibration tests determine linear relationships between the concentration and peak current detected. Real samples such as Mahoning River and tap water were tested. The real samples were spiked to determine the electrode's ability to detect ions in them. The MOFCNC/ PEDOT:PSS/GCE modified electrodes offer portable and efficient methods of safely detecting heavy metals in aqueous medium.

## 125 - Low Velocity Impact Testing on EOS Lattice Structures

Mason McVicker[1], Jeremy Moore[1], Jacob Burkey[1]

[1]STEM, Engineering *Faculty Advisor: Pedro Cortes*

In the modern world of automotive manufacturing, many engineers seek to have the strongest and safest vehicle possible, without adding large amounts of weight and keeping the cost down as much as possible. In this research project, we focused on the study of low velocity impacts, from a range of heights, onto 23 different aluminum lattice structures. Using a highspeed

camera and an oscilloscope, both force and position data was able to be recorded. Using excel, calculations were conducted to transform the position and force, with respect to time, into a multitude of values and graphs. The five main graphs created were: time versus displacement, force versus displacement, time versus energy, time versus velocity, and time versus acceleration. With this data and research, automotive manufacturers would be able to adapt their current designs, or create new ones, which incorporate the lattices tested, to maintain the strength and durability, while dropping the overall weight. The drop in overall weight will allow the cars to be manufactured more efficiently and more cost efficient, which will benefit the consumers and the company when it comes to purchasing, especially when repairs are needed to be made. Also, when it comes to fuel efficiency in the long run, giving the consumer for miles to the gallon compared to cars with heavier bodies. The overall safety plays a big role as well, the lattice structure designs will give the driver more support in case there was some sort of accident or crash, which will put less stress and strain on the body of the car due to the improved design.

## Poster session 2 1 – 2.30 pm

# 126 - Analysis of Dormitory Wastewater for Levels of SARSCoV-2

Alexis Albrecht[1], Dhruvi Shah[1], Kira Bowman[1], Samantha Bachochin[1]

[1]STEM, Chemical and Biological Sciences *Faculty Advisor: Chester Cooper*

Prior studies have shown that a community's health can be monitored through wastewaterbased epidemiology. These community-centered concepts are being used to monitor levels of the COVID-19 virus (SARS-CoV-2) from five Youngstown State University (YSU) residence halls. Initially, levels of SARS-CoV-2 from dormitory wastewater (WW) samples were analyzed by a commercial firm. However, the time from sample submission to the data delivery was determined to be untenable. Subsequently, an on-site digital polymerase chain reaction (dPCR) assay was employed to more efficiently and effectively detect levels of SARS-CoV-2 in WW. Doing so shortened the receipt of results from 3-6 days to less than 6 hours. To achieve this, autosamplers collected WW over a 24-hour period twice per week. When deemed necessary, “grab” samples were drawn between scheduled autosampler collections. Using the “4S” method developed by Whitney et al. (Environ. Sci. Technol. 55: 4880-4888, 2021), nucleic acids were extracted from each WW sample. A portion of the extract was subjected to reverse transcription polymerase chain reaction to detect SARS-CoV-2 nucleocapsid genes N1 and N2, as well as the human fecal control target, Pepper Mild Mottled Virus (PMMoV). The assay was conducted using the QuantStudio Absolute Q dPCR System. The resulting data were normalized to PMMoV as well as the stated census within a particular dormitory. Throughout the sampling periods, variations in SARS-CoV-2 levels were noted from each WW sample. However, no obvious associations were noted with semester breaks in which residents would be traveling (e.g., winter break). Moreover, the absence of concurrent COVID-19 testing precluded the establishment of a definitive relationship between active/asymptomatic cases and the presence of SARS-CoV-2 in WW.

# 127 - Detecting Vancomycin Resistance of Enterococcus Species in Wastewater

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Wastewater epidemiology is important in the detection of community-wide spread of infectious diseases (e.g., Covid-19) as well as antibiotic resistance. Vancomycin resistance has emerged as a serious concern in that this antibiotic is often considered the “drug of last resort” in the treatment of infections caused by antibiotic-resistant strains of Enterococcus. Another consideration is the rise in vancomycin-resistant strains of Staphylococcus aureus, which resulted from the genetic transfer of the vancomycin-resistance genes, vanA and vanB, from Enterococcus.

To assess the presence of vancomycin resistance within a selected portion of the student body at Youngstown State University using a digital polymerase chain reaction (dPCR) assay. Wastewater (WW) from Kilcawley House was collected twice per week over a 24-hour period. DNA was extracted from each WW sample, from which a portion of the extract was assayed by dPCR to detect vanA and/or vanB genes. Experimental controls included known strains of Enterococcus possessing either vanA or vanB. Analysis of the wastewater from Kilcawley House showed that the presence vanA and vanB genes fluctuated over the past semester and a half. Despite the variation, the presence of vanB was generally greater than that of vanA indicating no apparent correlation between either gene. Collectively, these data suggest that vancomycin resistance is common among Kilcawley House residents and that rigorous hygienic practices should be followed to mitigate the potential spread of antibiotic-resistant bacteria.

## 128 - Laser Treatment of Metallic Particles to Kill Bacteria

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Pathogenic E. coli can lead to sepsis which affects the elderly and immunocompromised populations. Sepsis affects approximately 1.7 million Americans per year, with about 270,000 deaths attributed to it. Some strains of E. coli have continued to build antimicrobial resistance which makes them impossible to treat. With such hazardous strains without a cure, the CDC encourages educational institutions to work towards finding a way to destroy these strains. Using gold coated iron-oxide nanoparticles, attaching them to these strains, and heating them with a laser, these strains of E. coli have successfully been destroyed. This research has also been successful on proteins found in elevated levels in neurological diseases such as Alzheimer's Disease and Post-Traumatic Stress Disorder. Scanning electron microscope imaging can be used alongside an ELISA immunoassay to demonstrate these techniques were successful. Additional techniques such as removing the gold nanoparticles using magnets can be seen in this project. The project's main goal is to demonstrate the need and techniques used for eradicating these harmful bacteria.

## 129 - Tissue-specific expression of dopamine-related genes in the burying beetle, Nicrophorus orbicollis

Dustin Moffett[1], Cailey Tingler[1], Madison Barton[1], Blayne Brownfield[1], Dane Abraham[1]

[1]STEM, Chemical and Biological Sciences *Faculty Advisor: Carmen Panaitof*

Burying beetles, Nicrophorus orbicollis, have extended biparental care of young, a feat that is very rare in insects. To breed a male-female pair of beetles bury and prepare a small vertebrate carcass as food for their young. Upon hatching, larvae are fed by both parents, and parental behavior is coordinated at appropriate times to provide effective care for offspring. The neurophysiology of this remarkable caregiving behavior is, however, poorly understood. Since they are known to mediate a wide range of insect behaviors, biogenic amines, such as serotonin and dopamine, are likely candidates to be involved in the neuromodulatory control of

reproduction in burying beetles. Brain levels of dopamine increase significantly in parental beetles after 24 hours of care, compared to unmated controls, suggesting a role for dopamine in mediating the expression of parental behavior. We also found that dopamine receptors (dopR)1, dopR2 and dopR2r are expressed in the male and female beetle brain, as well as in female ovaries. To further test the role of DA signaling in burying beetle reproduction, in this study we will specifically investigate the gene expression patterns of several dopamine-related genes, including those encoding enzymes (tyrosine hydroxylase, aromatic L-amino-acid decarboxylase and dopamine N-acetyltransferase) involved in the biosynthesis and degradation of dopamine in neural and reproductive tissues.

# 130 - Immobilization of vegetable catalase using chemically modified or cross-linked chitosan films

Mackenzie Lewis[1], Graham Seditz[1], Korey Kihm[1], Dale McGoogan[1]

[1]STEM, Chemical and Biological Sciences *Faculty Advisor: Nina Stourman*

The push for greener chemistry comes with a need for preparation of treatments for common ailments, like minor wounds, from renewable bioresources. Chitosan, a product of shellfish, provides a transdermal system of drug delivery with its film-forming properties. These films are capable of immobilizing enzymes assisting in keeping the wound sterile and preventing microbial infection. Catalase is an enzyme which produces oxygen gas, an antiseptic agent, through the decomposition of hydrogen peroxide. This enzyme can be found in a variety of natural sources. In this experiment, both cross-linked and chemically modified chitosan films were created and tested for their ability to immobilize catalase. The activity of immobilized catalase was examined by measuring the amount of oxygen produced and by evaluating its effect on the bacterial growth.

# 131 - Password Encryption and Security

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[1]STEM, Computer Science, Information and Engineering Technology

*Faculty Advisor: Todd Johnson*

There are several methods of encrypting and decrypting passwords and other messages in today's computer driven world. Throughout our research we have worked to understand and decode some older ciphers such as the Caesar and Vigenere Cipher in order to figure out how encryption methods work on a base level. After a time, we were able to comfortably decrypt these ciphers by hand and even created programs to automatically decipher them for us. Having thoroughly understood how ciphers and encryption work, we moved on to researching higher level encryption methods that are used for password storage today. We looked into various encryption methods such as Bcrypt and SHA and worked to successfully implement the encryption methods into a program. In order to ensure that the method of encryption we chose was secure, we used the program Hashcat to try and break through the encryption and figure out what the encoded password is. Throughout this process of cracking the encryption and

fixing the program, we also researched topics such as salting in order to help make the encryption stronger. Through salting you add extra characters to the beginning or end of a message before encryption in order to make it even more difficult for someone to determine what the original password is. By incorporating this into our program, as well as adding some good security checks such as making sure there are capital letters and a number, we were able to create a program that accurately mimics how a password is created, encrypted and stored safely.

# 132 - YSU College Student Diet Quality and Patterns

Laina Mager[1], Zara Rowlands[2]

[1]BCLASSE, [2]BCHHS, Consumer Sciences *Faculty Advisor: Zara Rowlands*

College student diets can be erratic and less than wholesome for many reasons, including freedom to self-select their diet as they leave parental influence for the College environment, unstable finances and housing options for shopping and food prep, body dissatisfaction related to societal beauty ideals, and the availability of healthy food choices in the campus environment (Sogari et al., 2018; Szczuko et al., 2014). This study looked at patterns of intake among YSU students (110) who completed diet self-assessments as an assignment for the Normal Nutrition General Education course taken in the Fall 2021 and Spring 2022 semesters. Their intake of macronutrients (protein, lipids and carbohydrates), fluid, dietary fiber, vitamins and minerals, and servings consumed from the Vegetables, Fruit, Grains, Meats or Alternatives, and Dairy or Alternatives food groups were examined. Students recorded all food, beverage and supplement intake for three non-consecutive days and analyzed average nutrient intake data using the Diet Analysis Plus app provided through their course E-book LMS link. Dietary patterns were compared with the Dietary Guidelines for American 2020-2025 and nutrient intakes with Dietary Reference Intakes (DRIs) for key nutrients related to risk of chronic diseases. In general dietary patterns that followed the high protein, low carb approach was prevalent among both male and female subjects, and consumption of nutrient dense foods from the vegetable and fruit groups was deficient.

# 133 - Meta-Analysis of Low Impact Development Strategies (LID) for Runoff Reduction

Sean Clark[1], Vincent Kacir[1], Alayna Martinez[1], Kayelyn Crofford[1]

[1]STEM, Engineering *Faculty Advisor: Suresh Sharma*

Stormwater management is crucial for controlling surface water overflow in order to protect physical infrastructure, property, wildlife habitats and avoid the transport and deposit of hazardous pollutants. For the last few decades, various Low Impact Development (LID) strategies have been widely used across the world in order to avoid storm water flooding. This research is a meta-analysis of the implementation of various Low Impact Development (LID) strategies performed across the globe using Stormwater Management Modelling (SWMM). The objective of this study is to analyze the effectiveness of different combinations of LIDs in reducing surface runoff in different durations of storm events. Data was analyzed from over 35

studies conducted in 15 countries across four continents. All peer reviewed journal articles were found via a systematic literature search. A range of search engines were utilized including Web of Science, and Google Scholar. Search terms and keywords employed in the search included "permeable pavement", "stormwater management model", "runoff reduction", "SWMM", "porous pavement", "green infrastructure", "low impact development", and "LID". Articles were filtered by language (English) and publication year (2010-2022). The required criteria for article selection included: publication in peer reviewed scientific journals, discussion of permeable pavement in relation to runoff reduction, and modelling studies performed using SWMM. A range of Best Management Practices (BMPs) were investigated, including green roofs, permeable pavement, and bioretention cells. The study found that the use of LIDs can be effective in reducing both the volume and peak runoff for shorter storm durations. The volume reduction ranged from 5% to 91%, while peak runoff reduction ranged from 4.5% to 86%. The effectiveness of BMPs varied depending on site-specific conditions such as soil type, slope, and land use. The combination of LIDs was found to be the most effective approach to achieve more significant runoff reduction.

# 134 - Feasibility study on the use of geopolymers for additive lunar construction

Kenneth Vigorito[1], Jared Koenig[1]

[1]STEM, Engineering *Faculty Advisor: Richard Deschenes*

The development of building techniques for lunar application is the first step in making the moon habitable and traversable. Incorporation of in-situ building materials is vital to construction of Lunar roads and structures. Additive manufacturing, such as 3-D printing, is a building technique that could be used to construct said roads and structures using a lunar regolith-based geopolymer concrete. This study aimed to develop a geopolymer concrete suitable for 3-D printing with minimal resources. Creating a geopolymer with adaptable set times and viscosity using aluminosilicate-rich materials, an alkaline activator, and a low water content proved challenging. The strength of the geopolymer concrete in just 7 days is similar to normal portland cement concrete at 28 days, roughly 3,000 psi. Once this strength was achieved, the geopolymer was tested using a viscometer to record viscosity over time until the concrete began to set. Printability was also measured using a nozzle and a compression machine to record the force required to print through a nozzle over time. Each batch was oven cured at 45℃ and compression tested at 7 days, 14 days, and 28 days. Based on the data, the mixture was modified and refined by increasing or decreasing the water content or introducing admixtures such as sucrose to benefit the set time. The data indicate that printing geopolymer requires frequent mix optimization to maintain both printability and strength factors. Reducing the set time from 30 minutes to one hour was possible with the addition of sucrose to delay the reaction between the 8 M alkaline activator and the fly ash. 3-D printing geopolymer is feasible, but further testing of the layered concrete in extreme temperature conditions and its overall durability on the lunar surface is required. The future of lunar habitation is set on the feasibility of 3-D printing geopolymer concrete.

## 135 - Structural Health Monitoring of Active Magnetic Bearings Through the Internet of Things

Christine Zheng[1], Michael Anderson[1], Alayna Cuevas[1]

[1]STEM, Engineering *Faculty Advisor: Alexander Pesch*

The purpose of our research can be summarized as such: to remote control and remote condition monitor an active magnetic bearing (AMB) through the internet of things (IoT) with a Raspberry Pi computer. Previous outside research was conducted on this topic; however, a fully functioning system through which we can both control and monitor the active magnetic bearing with a Raspberry Pi has yet to be constructed. We do not expect to achieve the construction of such a system by the end of this semester but in the future, through further research, we hope for this to be made a reality. With this objective in mind, we began where research made during the previous year was left off, formulated a plan to make further progress on the research, and optimize our schedule as such. To accomplish our goal, we must wire and program the analog digital converter (ADC) to write converting code, conduct a remote levitation experiment, and process the collected data. To analyze the data, we will read the potentiometer and AMB online, and then create a plot of each. As of late, we have successfully established a connection between a PiicoDev potentiometer and the Raspberry Pi such that adjustments made on the potentiometer are detectable through the Pi and displayed on the monitor. We also successfully established a connection between the Raspberry Pi and our personal devices so that we can control the Pi remotely, which lays the groundwork for further progress in our research. We are in the process of writing code in the Python coding language to convert analog data into digital, allowing us to read and analyze the signals from the active magnetic bearing more easily.

## 136 - Capacitance Sensors for Biomedical Applications Involving Hydrocephalus

Gabriella Gensamer[1]

[1]STEM, Engineering *Faculty Advisor: Farzad Ahmadi*

Cerebrospinal fluid flows through the ventricles of our brains and covers the brain and spinal cord. Hydrocephalus is a condition where there is an excess of this fluid, causing pressure within the brain. This pressure can damage the brain tissue and lead to numerous brain function issues. Treatment for this condition involves surgical implantation of a flexible tube called a shunt. This shunt is a drainage system from the brain to another body part where fluid is absorbed, such as the stomach. Debris such as blood cells, tissue, or bacteria, can clog the shunt, obstructing fluid flow. Currently, symptoms such as visual disruptions, vomiting, cognitive changes, and headaches are the only alert to a malfunctioning shunt. My project focuses on testing previously designed sensors that attach to a shunt to alert to an obstruction. Using a microcontroller fitted with capacitance sensing abilities, a change in capacitance can alert to a change in fluid flow. By testing each of the eight sensors in identical situations including controls and artificial obstructions, the ideal sensor design is evident. These results are significant progress towards a comfortable and prosperous life for hydrocephalus patients.

# 137 - Designing lean manufacturing methodologies using integrated discrete event simulation and machine learning for small additive manufacturers

Elizabeth Williams[1], Jarod Zillinger[1]

[1]STEM, Engineering *Faculty Advisor: Osama Aljarrah*

This project proposed an integrated scheme consisting of three popular methodologies: (1) discrete event simulation (DES), (2) machine learning (ML), and (3) lean manufacturing (LM) to improve the cost-effectiveness and resilience of small additive manufacturers (SAM). Additive manufacturing (AM) increases process flexibility, allowing businesses to adopt innovations without disrupting the supply chain. This technology enables businesses to adjust to supplier outages without maintaining costly inventories or delaying product development. On the other hand, small additive manufacturers, as small businesses, are more vulnerable to risks, uncertainties, and potential misfortunes. LM reduces material waste and simplifies production processes, while its on-demand performance improves supply chain agility by delivering finished products closer to the customers. When LM is deployed, FlexSim will illustrate SAM's operations for both present and future states; these models will assist managers in analyzing the influence of different LM aspects on the organization's key performance measurements. We deployed value stream mapping (VSM) process analysis from a local SAM as input to construct the DES models.
This project delivers digital management tools to help small additive manufacturers organize their operations, facilities, vertical and horizontal integration plans, and partnerships more effectively. Integrating DES, ML, and LM methodologies provides a more comprehensive system analysis by studying the process flow using VSM, using LM to identify potential process improvements, and then using DES to model the system's behavior and evaluate different improvement scenarios.

# 138 - Meta Analysis on Storm Water Management Strategies

Alayna Martinez[1], Vincent Kacir[1], Sean Clark[1], Kayelyn Crofford[1]

[1]STEM, Engineering *Faculty Advisor: Suresh Sharma*

Stormwater management is crucial for controlling surface water overflow in order to protect physical infrastructure, property, wildlife habitats and avoid the transport and deposit of hazardous pollutants. For the last few decades, various Low Impact Development (LID) strategies have been widely used across the world in order to avoid storm water flooding. This research is a meta-analysis of the implementation of various Low Impact Development (LID) strategies performed across the globe using Stormwater Management Modelling (SWMM). The objective of this study is to analyze the effectiveness of different combinations of LIDs in reducing surface runoff in different durations of storm events. Data was analyzed from over 35 studies conducted in 18 countries across four continents. All peer reviewed journal articles were found via a systematic literature search. A range of search engines were utilized including Web of Science, and Google Scholar. Search terms and keywords employed in the search included

"permeable pavement", "stormwater management model", "runoff reduction", "SWMM", "porous pavement", "green infrastructure", "low impact development", and "LID". Articles were filtered by language (English) and publication year (2010-2022). The required criteria for article selection included: publication in peer reviewed scientific journals, discussion of permeable pavement in relation to runoff reduction, and modelling studies performed using SWMM. A range of Best Management Practices (BMPs) were investigated, including green roofs, rain gardens, permeable pavement, and bioretention. The study found that the use of LIDs can be effective in reducing both the volume and peak runoff for shorter storm durations. The volume reduction ranged from 5% to 91%, while peak runoff reduction ranged from 4.5% to 86%. The effectiveness of BMPs varied depending on site-specific conditions such as soil type, slope, and land use. The combination of LIDs was found to be the most effective approach to achieve more significant runoff reduction.

# 139 - Frequency and Severity of Airline Delays

Madison Ricciuti[1]

[1]STEM, Mathematics and Statistics *Faculty Advisor: Alicia Prieto-Langarica*

Commercial airline travel started in 1926, and it became the most common way for Americans to travel in 1955. Since the start of airline travel, there have been daily delays. A delay can occur for any reason including staffing issues, weather, plane mechanics, or issues with the schedule. Using data from the American Statistical Association on Airline on-time performance we will aim to create a model that will predict the frequency of delays and the severity of a delay. We examined patterns in the data to determine which variables would be the most useful in determining the possibility of delay and the length of the delay. Furthermore, we created two generalized linear models to predict the frequency and severity of potential delays. The results from this project will be a breakthrough for travelers because they may be able to avoid certain factors including the time of departure, origin or destination city, or airline carrier.

### 140 - The Application of 2D and 3D Prints into STEM Educational Puzzles

Samantha Bucholtz[1], Scott Johnson[1], Hadley Gilles[1]

[1]BCLASSE, Education *Faculty Advisor: Snjezana Balaz*

STEM-centered education has shown its prevalence through time, but are there always applicable resources to model various concepts and challenge students further? Having STEM-centered models and puzzles allows for students to grasp concepts easier, see them visually, and create questions to expand their knowledge throughout STEM subjects. Creating these puzzles and models have been a priority in bridging the gap between verbal and visual communication with respect to science, technology, engineering, and mathematics concepts in grade-school education. These 2D and 3D models and puzzles allow grade school students to have hands-on interaction with concepts taught verbally as well as creating a platform to challenge themselves further outside of the classroom.

# 141 - Math Behind Medical Imaging

Nora Habo[1], Nicholas Capuzello[1], Yara Habo[1]

[1]STEM, Mathematics and Statistics *Faculty Advisor: Alicia Prieto-Langarica*

Our project is focusing on explaining the function of various medical imaging screenings such as
MRI, X-Ray, CT scans, PET scans, and Ultrasounds. Medical imaging is a rapidly evolving field that involves the creation of visual representations of internal anatomical structures of the human body for the purpose of diagnosing and treating medical conditions. Our project focuses on the mathematical background of the function of these testings to help understand the function from a mathematical point of view. Mathematics plays a crucial role in medical imaging, providing the theoretical foundation and computational methods necessary for analyzing and interpreting the complex data generated by imaging devices. Many individuals are unaware of how these common testings function. Our project involved us researching the mathematics and physics involved in addition to the basic knowledge of these testings to put together a presentation that was presented to a high-school age group. Various methods of teachings were used such as a coloring activity that was able to be related to the function of medical imaging which is also included in this project. There are different types of science and equations directed to each type of medical imaging which is what we focused on for our project. Our project also discusses the dangers of long exposure from the radiation involved in these imaging techniques. It is important people understand the danger of long exposure so the right precautions can be taken to protect the patients and doctors. Medical imaging plays such a crucial role in the advancement of healthcare.

# 142 - Fair Odds Projections in Horse Racing

Nikitas Missos[1]

[1]STEM, Mathematics and Statistics *Faculty Advisor: Nguyet Nguyen*

In this project, we will predict the fair odds of a horse race. The fair odds value is a calculated ratio based on historical factors pertaining to specific horses. The factors included: the number of races, average finish position, and speed measure. The predicted fair odds allow gamblers to predict the probability of winning a given horse in a race. In a live race, the gambler will compare the predicted fair odds to the live odds, provided by the bookmaker, to decide what horse to bet.

# 144 - Understanding Death: Investigating Demographics and their Effects on Attitudes Surrounding Death

Mary Nyers[1]

[1]BCLASSE, Humanities and Social Sciences *Faculty Advisor: Amanda Fehlbaum*

The purpose of this research is to evaluate the core beliefs that affect individual and societal attitudes towards death as a concept, and also as an individual experience. The pertinent hypothesis I propose is that attitudes towards death are dependent on individual demographics. The demographics I wish to study with the most depth are race, age, and sex. There is a desire to see if there is a sense of ageism that comes with relating death to age, and if the stereotypes of sex and gender apply to attitudes and preparedness for death. My research takes on a variable-oriented frame of analysis due to the wide array of concepts surrounding death. There lies a large bank of resources for determining whether demographic information is a strong indicator of preparedness and opinions towards death, regarding both the process itself and the varying culture surrounding it. This research goes beyond the simple view of what individuals think for themselves, but aims to find an explanation of what makes death a varying cultural phenomenon, despite being a process that is universal to all living beings.

# 145 - College Students and their Circadian Rhythm: Developing a Research-Based Program

Emma Dang[1], Sarah Dang[1], Emily Vo[1]

[1]STEM, Chemical and Biological Sciences *Advisor: Asmau Misawa*

The college student demographic is known to exhibit a high percentage of sleep deprivation and irregular sleep habits. Most studies that focus on college students and their sleep patterns consider the effects of such routines and lists potential causes. However, few studies have considered the primary factors responsible for specific sleep patterns such as quality and amount. Furthermore, though studies exist testing various programs aimed to improve sleep patterns, few have been created based entirely on the results of the most significant factors affecting circadian rhythm among a population.
The goal of this study is to identify factors affecting the circadian rhythm of college students. Such factors include the amount of screen time, sleep habits, participation in physical activity, caffeine consumption, etc. The main objective is to research sleep behaviors and related information among college students to find significant correlations that will lead to the development of a research-based program directed towards improving the sleep patterns of college students. This research will use an online-formatted survey with questions related to sleep as well as those compiled from previously existing assessments such as the Morningness-Eveningness Questionnaire (MEQ) and Munich Chronotype Questionnaire (MCTQ). The survey will be distributed to the college student population at Youngstown State University. The research-based program will use previously existing research on the psychology of productivity, motivation, and goal achievement in order to be effective and create significant results. The expectation of this study is to be able to apply the survey to other college populations, allowing for the development of a customized sleep program that can be used to encourage better sleep patterns. Though development of this program is the ultimate conclusion, further testing beyond the scope of this study is required to understand the impact and effectiveness of this program.