



YOUNGSTOWN  
STATE  
UNIVERSITY

OFFICE OF RESEARCH SERVICES

*31<sup>st</sup> Anniversary*

# Quest

*a forum for  
student scholarship*

**2021 Program Guide & Abstracts**

# **Welcome to *QUEST 2021*:**

## **A Forum for Student Scholarship**

QUEST is a Youngstown State University (YSU) tradition. This year is the 31st Anniversary of an event that exhibits the achievements of our students in creativity, innovation, discovery, research and scholarship.

Like mostly everything since the onset of COVID-19, QUEST 2021 will be a little different this year. Rather than gathering at Kilcawley Center on campus, this year's event is held virtually.

The QUEST organizing committee and university administration gratefully acknowledge the guidance and commitment of YSU's talented faculty who even under COVID-19 circumstances provide inspiration, motivation and support to their students to make QUEST 2021 possible. This year's program includes 114 projects representing the individual and group effort of almost 300 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. Stephen Rodabaugh	Professor	Dept of Mathematics and Statistics

## **Acknowledgements**

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- YSU Board of Trustees
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- 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
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- Cliffe College of Creative Arts
- College of Science, Technology, Engineering and Mathematics
- Williamson College of Business Administration

# QUEST 2021: A Forum for Student Scholarship

## Schedule, sessions, disciplines

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President Tressel

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# Oral Presentations: Session 1

Session 1a

8.45 am – 10.15 am

Chemical and Biological Sciences

## 13 - Analysis of alternative splicing events in potato plants

Atinuke Ogungbayi<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences

*Faculty Advisor: Jack Min*

In terms of human consumption, potatoes (*Solanum tuberosum* L.) are the third most important food crop in the world, following rice and wheat. Due to its high calories, it is a good source of energy and nutrients, such as proteins, vitamins and minerals. Thus, potatoes play an important role in providing food, nutritional, and economic security in the world. To further improve the quantity and quality of potatoes as a food crop, it is imperative to understand the transcriptome diversity, gene expression dynamics, and associated developing methods. The aim of this study is to analyze alternative splicing events in the transcriptomes of potatoes in root, stolon, and shoot tissues. The potato genome was completely sequenced, and many short reads were generated by RNA sequencing (RNA-seq) technologies. A total input of 25.36-37.21 million reads per sample were downloaded and mapped to the genome with 37.4 %-56.6% mapping rates. The Alternative Splicing (AS) Landscape in potatoes was analyzed. A total of 33792 AS events were identified from 272435 genomic loci involving 415285 transcripts isoform. Among the four AS events, Alternative acceptor Site (AltA) is the most dominant event (with 28.55% of the events), followed by Intron Retention (24.04%). However, Alternative Donor Site (AltD) and Exon Skipping appears to be close in value, that is 14.97% and 14.75, respectively, while other events accounts for 17.71%. Thus, analysis of AS events in potato plants are critical for quality and quality improvement.

## 32 - Phylogenetic Study of Cystic Fibrosis Gene Mutations among Living Organisms

Anand Korrapati<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences

*Faculty Advisor: Jack Min*

Cystic fibrosis (C.F.) is a genetic disorder that primarily affects the lungs and the pancreas, liver, kidneys, and intestine. Mutations cause both copies of the gene for the cystic fibrosis transmembrane conductance regulator (CFTR) protein. C.F. is also found in non-human species. Comparisons between these human and non-human species are vital to dissecting the complexities of disease pathophysiology in cystic fibrosis. The complete Coding Sequence (CDS) of *Homo sapiens* CFTR is searched in the Nucleotide database from the National Center for Biotechnology Information (NCBI) website. The BLAST program is used to retrieve data. Species based on percentages identical to the selected *homo sapiens* DNA are identified and selected for the study. The Molecular Evolutionary Genetics Analysis (MEGA) tool from MEGA software performs alignment and Phylogeny Analysis. Evolutionary analysis by Maximum likelihood and Neighbor-joining tree methods creates Phylogenetic trees representing evolutionary relationships among selected organisms.

## **75 - Preclinical Applications of the Organ-on-a-Chip Model: Liver and Kidney Toxicity Testing**

Jovith Nelson<sup>1</sup>, Judith Fulton, PhD<sup>2</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences, <sup>2</sup>Northeast Ohio Medical University

*Advisor: Judith Fulton*

Organ-on-a-chip (OOC) is a 3D microfluidic cell culture chip capable of mimicking the human physiological microenvironment. OOC technology has emerged as a physiologically relevant biological model for screening drug candidates in the preclinical phase of drug development. Following a drug candidate's discovery, preclinical studies are systematically conducted to determine the drug's safety and efficacy. *In vivo* animal and *in vitro* 2D cell culture models are traditionally utilized in these preclinical studies; however, they often yield suboptimal comparisons to human physiology due to inherent species differences or the lack of structural complexity in 2D cell cultures. To improve the efficiency and accuracy of this current drug screening process, we propose that the OOC act as a precursor and potentially an alternative to traditional preclinical models. Here, we present toxicity assays that can be applied to OOCs to measure a drug candidate's pharmacokinetic and pharmacodynamic characteristics. We outline the costs, protocols, and equipment necessary to conduct these assays. The liver and kidneys are organs heavily involved in drug-processing pathways; as such, we discuss drug testing specifically with the liver-on-chip, the kidney-on-chip, and the multi-organ-on-chip that integrates both organs. Lastly, we compile and analyze contract research organizations (in-house assay testing) and assay kit manufacturers in a cost-benefit analysis to present an economical, logical course of testing with the OOC model.

## **97 - Time does not heal all: white-tailed deer constrain recruitment of native - but not exotic - forest plants, regardless of canopy age**

Curtis D. Burns<sup>1</sup>, Ian J. Renne<sup>1</sup>, Walter P. Carson<sup>2</sup>, Alejandro A. Royo<sup>3</sup>, Thomas P Diggins<sup>1</sup>, Felicia P Armstrong<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences, <sup>2</sup>Department of Biological Sciences, University of Pittsburgh, <sup>3</sup>United States Forest Service

*Faculty Advisor: Ian Renne*

Anthropogenic habitat modification, predator extirpation, and reduced hunting pressure have pushed white-tailed deer (WTD; *Odocoileus virginianus*) populations to unprecedentedly high densities throughout much of eastern North America. Importantly, their selective foraging depresses preferred plant species, increases the abundance of less nutritious ones, and facilitate exotic, invasive species invasion. However, few have researched areas where WTD densities have been maintained, for decades, at low levels. Moreover, scant data exists on canopy gap regeneration across gap ages, in areas of historically high and low WTD densities, and in different habitats. Here, we ask: 1) does WTD density affect number and relative cover of native and non-native plant species across canopy gap ages, in wet and dry habitats, and 2) does the vegetation structure differ in areas of historically low WTD densities relative to areas where WTD are excluded (exclosures) – here, an answer of 'no' suggests WTD are below their carrying capacity. This study

took place in and outside of Camp James A. Garfield Joint Military Training Base (CG, Ravenna, OH), which has maintained WTD densities three times lower than the surrounding areas, since 1955. Relative to surrounding areas, CG generally had higher native species numbers as well as relative cover, and lower levels of non-native species, across habitats. Excluding WTD at CG did not result in different plant communities, suggesting CG's aggressive WTD management has them below their carrying capacity. Without WTD management, our forests will likely suffer continued native biodiversity loss, altered successional trajectories, and become increasingly dominated by exotic species.

## **99 - Immediately recognizing the Achilles heel of invasive plants, IPMs, and the curious case of Chinese tallow tree etiolation**

Logan K. Gerig<sup>1</sup>, Rabin Thapa<sup>1</sup>, Dylan J. White<sup>1</sup>, Thomas P. Wakefield<sup>1</sup>, Ian J. Renne<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences

*Faculty Advisor: Ian Renne*

Ecological issues associated with non-native, invasive species range from disruption of ecosystem processes to local extinction of native species. Finding a science-based, strategic approach to minimize their adverse effects, while simultaneously maximizing control measure efficacy, is primary to invasive species management. Demographic data on 4,500 individuals were collected over three years from five populations of Chinese tallow tree (CTT, *Triadica sebifera*), one of the most problematic exotic plants in southeastern and Gulf Coast regions of the U.S. Here, we implement integrated population models (IPMs) to elucidate CTT population dynamics, and ask: 1) is there a single most effective management strategy to apply to all CTT populations (e.g., targeting small or large individuals only)?, and 2) is there a populational phenotypic metric which indicates how populations are growing, and thus, which size classes to target for most effective control? Past analyses found CTT annual population growth rate,  $\lambda$ , varied across years and populations, with all but one population having positive growth. Moreover, targeting only one size class resulted in differential control because the relative contribution of various size classes to  $\lambda$  differed as a function of  $\lambda$ . For example, larger individuals disproportionately drove  $\lambda$  in slow-growing populations and vice versa. Importantly, degree of CTT etiolation, as measured by height:diameter-at-breast-height ratios, correlated negatively with  $\lambda$ . This suggests degree of etiolation, an easily measured phenotypic trait, can provide CTT managers with a tool that circumvents laborious data collection, and offers quick guidance to strategically manage populations with different demographics and growth rates. For example, trees with large height:diameter-at-breast-height ratios indicate slow-growing populations, and thus large individuals should be targeted for most effective population growth control. If other relatively shade-intolerant, exotic species exhibit similar patterns, our approach may be extended to those in need of immediate management, but where no demographic data exists.

# 102 - The Transfer of Protons in Imidazole-Ionic Liquid Systems

Aurelia Moses<sup>1</sup>, Christopher Arntsen<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences

*Faculty Advisor: Christopher Arntsen*

Protic ionic liquids (PILs) are disordered systems consisting of protonated charged species. Imidazole has been previously shown to be able to both accept and donate hydrogen bonds. Due to this, imidazole's inclusion in PIL systems is thought to increase proton transfer and create more efficient fuel cells. Proton transfer can occur using two different mechanisms. The vehicular transport mechanism occurs when a proton binds to a charged particle and travels through the system with the charged particle it is coordinated to. The Grotthuss mechanism occurs when a proton hops from one species to the next. Imidazole has the potential to create hydrogen-bonded wires in solution and these wires are thought to be able to transport protons across the system via the Grotthuss mechanism. In this project, two imidazole-doped IL systems were studied with various concentrations of imidazole. Both bis (trifluoromethylsulfonyl)imide (TFSI) -imidazolium and acetate-imidazolium systems were studied using *ab initio* molecular dynamic (AIMD) simulations. Proton transfer via the Grotthuss mechanism is inherently quantum mechanical since bond rearrangement is necessary for the proton to travel along imidazole wires. AIMD shows the quantum mechanical aspects of the bond rearrangement allowing for an accurate study of the mechanism.

## 17 - Potato Cannon

Allison Stanko<sup>1</sup>, Alex Richards<sup>1</sup>, Spencer McGarrity<sup>1</sup>, James Desharnais<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Hazel Marie*

We are examining a combustion potato cannon by running multiple types of tests on the velocity of the potato and the force of impact when the potato hits the force plate. We are also calculating and using different amounts of gas to use in the fuel tank of the combustion cannon to evaluate if the amount of fuel changes the efficiency of energy transferred to the potato. With the velocity tests, we will be collecting data regarding how fast the potato was traveling as soon as it exits the potato cannon from different amounts of fuel.

## 38 - Underfloor Railcar Hoist System

Patrick Rovnak<sup>1</sup>, Joseph Foster<sup>1</sup>, Cody Holland<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Anthony Viviano*

There are several systems used for hoisting railcars in industry because of the diverse needs of the customer, but it would be ideal to combine the advantages of these systems to have a cost-effective and robust design. The industrial client for this project, BBM Railway Equipment, LLC was looking to find a design that incorporated the cost-effectiveness of a rectangular tube-type design for the lifting columns of the system, while also meeting the load requirements that the robust cylindrical tube-type design was able to meet. The method for approaching this problem was to utilize Finite Element Analysis to quantify stresses in an iterative design, until requirements from the client were met or exceeded. The results of this included a low-cost roller system, a custom guide base weldment, and a sturdier lifting column which had a comparable cost to the system currently in place.

## 79 - NASA Spring Tire Rim Design

Nick Sammarco<sup>1</sup>, Nick Scoumis<sup>1</sup>, Anthony Thomas<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Hazel Marie*

The NASA spring tire team was tasked with designing a rim that could interface with the mesh tire design provided by NASA as well as some other strength parameters. The rim itself was to be constrained by a 10.41" diameter and 7.81" width, and the mass of the rim assembly was to not exceed 2kg. The rim was to sustain a continuous normal load of 750N with no damage, an intermittent peak load of 2500N with no damage, and one 11,000N impact load with significant damage but no material failure. A coaxial, or driving, torque of 850Nm was to be sustained along with a 350Nm transverse, or steering, torque. Some fatigue requirements were provided which are 50,000 cycles of the continuous load and 5,000 cycles of the peak load.

The design process leveraged the use of SolidWorks in the CAD design process, and ANSYS for the structural analysis portion. These two tools were critical in iterating the design to address issues as they arose. The design process found that a spoked design would be best to make both a strong

yet lightweight design. This was accomplished by dividing the wheel itself into three main components: the rims, hub, and spokes. The total mass ended up being within tolerance, and the wheel was found to meet all strength requirements.

## **88 - Design and Analysis of a Lifting Device for Operation in a Steelmaking Facility**

Nathan Lin<sup>1</sup>, Nicholas Paolucci<sup>1</sup>, Matheus Balen<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Anthony Viviano*

In the present work, a novel lifting device was designed to remove hydraulic straightening units from a continuous casting machine at company sponsor Tenaris. The continuous casting machine releases molten steel, which cools slightly before being straightened by the hydraulic straightener units. The twelve hydraulic straighteners sit in a casting bay, which is a greasy, hot, dangerous environment with narrow clearances. Presently, workers are required to manually connect chains to the straighteners for removal by crane. The goal of this project was to design a lifting device capable of connecting to and removing the straighteners requiring only a crane operator and a spotter outside of the casting bay at a safe distance. The designed lifting device has multiple parts, including a component that semi-permanently mounts to each straightener and a crane attachment, which can interface with any straightener and its semi-permanent attachment to lift the straightener out of the casting bay. The validity of the design was tested through solid modeling, additive manufacturing (3D printing), and finite element analysis, including by-hand verification. Through these methods and an iterative design process, a final design was created which satisfies the project requirements.

## **95 - Low-Cost Ventilator**

Niyam Bhandari<sup>1</sup>, Sushant Poudel<sup>1</sup>, Saroj Dahal<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Hazel Marie*

Due to the expensive nature of ventilators (around \$10,000), minor respiratory ailments cause many casualties in under-developed nations. Sponsored by the Department of Mechanical Engineering, Youngstown State University, this project is aimed to design a low-cost ventilator suitable for mild respiratory problems. Literature research was done on the pulmonary and respiratory function and available designs. Design ideas included: Invasive, Piston based, and Bag-Valve Mask (BVM) ventilators. Invasive ventilators required tracheostomy, which was beyond the scope of available expertise, piston ventilators had many moving parts making it prone to failure, and BMVs had issues with flow regulation and setup pressure. So, final prototype was a non-invasive ventilator with BiPAP and CPAP modes which could regulate and control the flow pressure. At the start of BiPAP mode, the blower maintains a PEEP (Positive end expiratory pressure) of 5 cm of water. When patient attempt to inhale, a pressure drop is detected by pressure transducer causing the blower to provide a pressure of 15 cm of water to the lungs. In CPAP mode, the blower continuously maintains a pressure of 5 to 10 cm of water in the lungs. Breadboard was used for the circuitry and the final design was completed under \$255. The device was appropriate for sleep apnea and for a COVID patient with mild symptoms as it could provide an initial breathing aid (not for long-term). Further improvements may include PCB, oxygen supply, air filtration, and humidifier to closely replicate commercial ventilator.

# 113 - NASA Excavation Tool

William Gibson<sup>1</sup>, John Dejacimo<sup>1</sup>, Alec Romesberg<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Hazel Marie*

Our project is based on NASA's Bucket Drum Design Challenge which is driven from advancing the filling capability of NASA's RASSOR. RASSOR is a bucket drum excavator used to excavate the very top layer of lunar regolith, a mixture of sand and dust on the moon's surface. This is necessary because a typical backhoe relied on vertical forces that cannot be used in the moon's low gravity. To relieve these forces RASSOR utilizes counter rotating drums to efficiently skim the surface of the moon to excavate the regolith with counter apposing horizontal forces and minimal vertical forces. Our group was tasked mainly with finding a more efficient inner design of the bucket drum to capture more than 50% regolith while remaining within the volume and mass requirements. This design must fill by rotating forward and then the regolith must be expelled rotating the opposite direction. To meet these requirements, we limited our design to the maximum volume requirements resulting in a cylindrical drum with a diameter of 460 mm and a length of 360 mm. Next, using an experimental set up 3D printed drums with different complex internal geometries were created and tested, then reiterated based on understanding the flow until our project yielded a nearly 70% maximum fill. This design also achieved a perfect release, while remaining within the Bucket Drum Design Challenge requirements.

## 9 - HVAC Design with a Concentration in Indoor Air Quality

Caroline Griswold<sup>1</sup>, Sandesh Neupane<sup>1</sup>, Sahaj Thapa<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Stefan Moldovan*

The purpose of this project was to design a heating, ventilation, and air conditioning (HVAC) system with a focus on indoor air quality. It was decided that this should be a main focus of the project given the fact that the project was done during the time of the Coronavirus global pandemic, and the effects of HVAC on COVID-19 spread was a generally unexplored field. This system was designed for an office / data research building in Valley City, Ohio.

Calculations were performed to determine the heating load of each room in the building. These calculations were utilized in order to select HVAC equipment for the building based on the amount of air that was determined to be required in each room. Then, the ductwork system and the equipment were modeled on AutoDesk REVIT – a computer-aided drafting software specific to the Architecture and MEP (mechanical, electrical, plumbing) industries.

To prevent the spread of COVID-19, additional components were added to the system. UV lights, bipolar ionization, and HEPA filters were extensively researched and the most beneficial COVID-19 prevention strategies agreeing with the normal budget for an office building's HVAC system were implemented. The system chosen was a UV light, which fits directly into the duct system.

Finally, a lifecycle cost analysis was performed to determine the most cost-efficient HVAC system for the building. The equipment featured included gas furnaces, electric fancoil units, and a variable refrigerant flow system (VRF). After five years, VRF was found to be the most inexpensive to own and operate -- however, other technical aspects of the system such as its inability to effectively provide outdoor air to a building resulted in the furnace being the next best choice for the office application.

## 60 - Rear Mountain Bike Suspension Analysis

Curtiss Hart<sup>1</sup>, Kevin Yash<sup>1</sup>, Jared Yahnite<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Stefan Moldovan*

The goal of this project was to design a new modern suspension for a mountain bike, by taking a current model and modifying it to improve its versatility and usability. Three modern suspension mountain bikes were researched, a DW link, Delta, and Single Pivot. These designs were then modified in linkage software where several changes were made and reviewed under the following criteria, anti-squat=100% anti-rise=100% and a preferable wheel-path. Once a favorable design was developed calculations were done to find the forces inflicted through the suspension on the rider and the shock. Once the forces are known, the design will then be optimized, and a material can be selected for manufacturing. If the project is continued for future classes a prototype would be built on a universal bicycle welding jig that was designed for the project. Then the bicycle will be thoroughly tested.

## 82 - Deoxidant Nozzle Optimization

Aaron King<sup>1</sup>, Nicholas Hough<sup>1</sup>, Mukesh Kalel<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Stefan Moldovan*

Deoxidizing powders are applied in various metallurgical processes for the purpose of maintaining quality requirements. In this investigation the goal was to redesign a nozzle used in a deoxidant injection system to provide more even effective coverage of the inner surface of a cylindrical tube and to verify the manufacturability of the product through 3-d production methods. Several theoretical fluid flow variables were investigated for the purpose of the structural design. Based on the resulting research the chosen nozzle elements were investigated numerically via the use of computational fluid dynamics software. The new design was then compared with the previous and several aspects were iterated to produce the desired results. The nozzles were then investigated using an experimental method by scaling down the system to a manageable size and using a dye solution into pumped water to model the injected particles. The new design will produce a preferable level of particulate surface coverage compared to previous with minimal injection requirements.

## 87 - Thermal Curing Bed Optimization

Erin Heaton<sup>1</sup>, Sumer Kassim<sup>1</sup>, Casey Gonatas<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Stefan Moldovan*

The goal of this project was to analyze and enhance ExOne's 3D printing process by decreasing the required curing time. ExOne makes 3D printed parts by using binder-jetting technology and can have multiple parts within a fully filled job-box; so, their current process can take up to 48 hours to cure. The main requirements from ExOne were to decrease the curing time by 50%, increase manufacturability, and minimize the amount of necessary equipment.

The current process promotes heat transfer through only conduction with sand and air being low conductors of heat. To achieve these goals the job-box was adjusted to introduce convection through the powder bed by adding micro-perforated plates (MPP) to allow for hot air to flow in and out of the system. Computational fluid dynamics (CFD) models were created and analyzed to optimize the design.

The final design resulted in a curing time of 2.74 hours for a full-sized box, which was a 92.4% decrease from the current job-box design ExOne uses – however, this design is also applicable for smaller prints. This result would allow for ExOne to have an increase in their manufacturability, as well as decrease the equipment quantities required.

## 101 - 3D Printed Aircraft

Donald Cutrer<sup>1</sup>, Wyatt Lipinsky<sup>1</sup>, Nicholas Patoray<sup>1</sup>, Vincent Haniford<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Stefan Moldovan*

The objective of the design project was to fabricate a glider using 3D printing technology and electronic components to compete in the 3D Printed Aircraft Competition hosted by the University of Texas at Arlington (UTA). UTA hosts a 3D Printed Aircraft competition annually where teams from universities around the country compete to see which design can attain the longest flight duration. The competition allows for five seconds of electronically assisted flight via a propeller and utilization

of a remote control, which operates the wings and other control surfaces of the glider. In order to achieve an efficient design that will perform well at the competition, the use of computational fluid dynamics, also known as CFD, allows us to study different wing airfoil shapes to obtain an optimal airfoil shape to maximize the force of lift and minimize the force of drag. In addition to CFD and background research, experimental printing from a 3D printer was also used to prove what temperature, infill, and direction to print the parts in. This helped optimize the weight of the glider but also ensure the structural integrity through flight testing. The continued use of software and 3D printing allowed for the final design of our project to be completed.

## 103 - YSU Dynamometer

Tanner Tullis<sup>1</sup>, Jacob Preston<sup>1</sup>, McKenzie Scheckelhoff<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Stefan Moldovan*

Dynamometers also are used for research design and testing diagnostics which includes testing for horsepower, torque, and RPM outputs in vehicles. The main goal of the project was to get viable results for the Youngstown State University dynamometer for the heat transfer and thermodynamics lab. The project is based around the research design and testing diagnostics of dynamometers. To find these research results, modification, and servicing of the current 350 5.7-liter Chevy engine, Saginaw 343 3-speed transmission, as well as a new water line, and lab safety features were done. After this, the dyno, which was a Taylor HI-EFF DS-32 water brake dynamometer, had to be taken apart and rebuilt to analyze any leaks due to bad gaskets and seals, as well as bearing wear and tear. A new data acquisition system also needed to be created for the collection and calibration of correct readings for reliable lab results for future student experiments.

## Oral Presentations: Session 2

Session 2a

10.30 am – 12 pm

Education, Languages, Counseling, Computer Science and Geography

### 11 - Discussion on the Best Practices Across the Educational Experience and the Implications on the '20-'21 School Year

Hollie Dalton<sup>1</sup>, Lauren Carr<sup>1</sup>

<sup>1</sup>BCLASSE, Education

*Advisor: Amy Cossentino*

After many semesters spent learning about different practices to be used in classrooms, doing research about various practices for assignments, and spending hundreds of hours in local school districts, a teaching candidate begins to accumulate an in-depth knowledge of what works the best. While everyone's list may differ slightly, research agrees that there are a few repeating practices that are highly regarded by the field of education: Play, Social-Emotional Learning, student-centered (student choice), Multicultural Education, differentiation, Universal Design for Learning, Multiple Intelligence Theory, family engagement, appropriate materials, and formative assessment. These practices all have had extensive research put into them over several decades to become known as the reputable practices that they are today. In the following pages, in depth explanation will be given about each of the best practices about their history, their use in the modern classroom, and why they are highly regarded as a practice that works. Along with this, first hand recollections are given about these practices from both a childhood and adolescent educators' viewpoints. Finally, the impact of the Coronavirus pandemic on these practices in the 2020-21 school year will be examined to show how these practices are changing and adapting with the unprecedented time being experienced in schools today.

### 86 - Honors Story Time Board Game

Jenna Menough<sup>1,2</sup>

<sup>1</sup>Honors College, <sup>2</sup>BCLASSE, Education

*Advisor: Mollie Hartup*

Being able to reach out to the community is something special, but with the situation right now, it has become increasingly harder to stay connected. Late last year, the YSU Honors College introduced Story Time to create a way for young people to listen to their favorite stories read by current Honors students and alumni. In an independent study, I designed an incentive program in the form of an educational board game which connects with Story Time for the young children in the community to be more involved. With educators and schools stretched so thin, I have had the difficulty of finding effective promotion strategies. My focus will be on the marketing strategies I have used thus far and whether they were successful. The completion of the board game is an important component to this study, however, there are not enough submissions to comment on the results (as of today). This is an ongoing study which will be completed towards the end of the month; therefore, the results I present will not be final.

## 39 - What Does Multilingualism Look Like in the United States?: The Benefits and Detriments of a Multilingual World

Kathrine Keller<sup>1</sup>

<sup>1</sup>BCLASSE, Languages

*Faculty Advisor: Rachel Faerber-Ovaska*

Even before the founding of the United States, bilingualism and bilingual education has existed in this country, in some form or another. This thesis aims to discuss the current state of bilingual education in the United States, and how that stance came to be. By discussing key topics in bilingualism, such as the cognitive and social advantages and disadvantages of learning multiple languages and the impact that that endeavor has on the world, researchers and scholars can better understand how to potentially move toward a multilingual society. In the analysis of language education in the United States versus that of the rest of the world, barriers and problems can be more easily identified within the scope of the U.S. education system.

## 85 - How Social Media Affects Body Image and What you can do About it

Sarah Marek<sup>1</sup>

<sup>1</sup>BCLASSE, Counseling

*Faculty Advisor: Amy Williams*

**Intro:** Currently, our society promotes and praises the thin ideal - having a small body (Stewart & Ogden, 2020). When we expect our bodies to look one way, and are not pleased when they do not meet the criteria we want, we experience body dissatisfaction (Stewart & Ogden, 2020). The media's role in glamorizing the thin-ideal may create body dissatisfaction in social media users.

**Methods: A literature review reveals the harmful effects of social media on body image.** The media shows messages about what are and what are not acceptable bodies. Acceptable bodies are shown in the media, and not acceptable bodies are left out. Research shows that the ultra-thin models we are exposed to, leads to greater body dissatisfaction (Kim & Lennon, 2007).

**Discussion: Moving forward** People with a positive body image have more love, care and respect for their bodies and accept bodily imperfections of themselves and others (Tylka, 2012), therefore the development of a positive body image is a component of one's healthy well-being. (Stewart & Ogden, 2020) Found that when exposed to the body diversity video, participants had higher body satisfaction as measured by The Face and Body Cathexis Scale. This supports previous research "that repeated exposure to larger body sizes can shift perceptions on body size preferences, and the tolerance and acceptance of obesity" (Stewart & Ogden, 2020, p. 9).

## **91 - Understanding Participants' Feedback from Workshop Promoting Diversity and Inclusion in Computational Science and Engineering**

Bhavya Sree Yadala<sup>1</sup>

<sup>1</sup>STEM, Computer Science

*Faculty Advisor: Alina Lazar*

Collecting conference feedback survey is intended to gauge the participants' thoughts and insights regarding the conference. It is also intended to help organizers improve the content and execution of future conferences. For this project we are statistically analyzing the results of pre- and post-surveys data collected at a workshop organized to promote diversity and inclusion in computational science and engineering. The data was collected using SurveyMonkey, one of the most popular survey platforms. SurveyMonkey exports data that is not necessarily ready for analysis right out of the box, so additional preprocessing is needed before the final analysis. Finally, we need to present the surveys' information in a comfortable and digestible way to communicate, highlight and visualize critical areas using statistics and plots.

## **7 - The Spirit of the Land: Indigenous Peoples and the Sacred Geography of the North American West**

Kelly Baer<sup>1</sup>

<sup>1</sup>BCLASSE, Geography

*Faculty Advisor: Ric Schumacher*

Humans have sought to understand their geographic surroundings in countless ways for thousands of years. They have observed everything from the timing of the seasons to various cycles in the surrounding landscape. Building a basic understanding of the world has come in many forms from science to witchcraft. In many cases, these mysterious cycles and features of the land have become part of the religious cosmologies across the globe. But perhaps among the most fascinating are those of Native American tribes in the western United States. The indigenous tribes of North America worshipped deities and spirits and witnessed them among their physical surroundings long before European settlers stepped foot on North American soil. Examples of sacred cosmologies abound from the American Southwest region, particularly from cultures like the Navajo, Pueblo, and Apache tribes. Not only are these beliefs and practices captivating, but their significance can be observed in numerous ways from historical accounts to modern psychology and political ideologies. In some cases, novels have identified, detailed, and presented these practices to critical acclaim. This project explores what ways the Native Americans of the western United States incorporated their geographic environment into their religions and cosmologies, as well as investigates the effect of the land on the Native Americans and the effect of Native Americans on the land.

## 14 - Industrial Robotix

Caleb Hunkus<sup>1</sup>, Adam Shields<sup>1</sup>, Marty Mckinney<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Kelsey Lyda*

Industrial Robotix designs and builds automated solutions for material handling and welding applications. The company wanted to improve its customer's overall experience. In order to improve in this area, Industrial Robotix looked to YSU for help with designing and building a compact welding cell. The weld cell consists of a custom ferris wheel positioner, fanuc hollow-wrist robot, and a Fronius welder. The completion of the project would allow the company to have a welding robot cell in house to use as a showcase for customers. The welding cell would allow customers to get familiar with the systems Industrial Robotix builds.

Our team was given a concept in the form of a 3-dimensional CAD model. The goals of the project were to refine the 3-D design for manufacturability. This specific goal included completing a Solidworks design, creating all necessary CNC files, creating mechanical drawings for the company's fabrications department, and even the assembly of the final work cell.

Working with Industrial Robotix allowed our design team to tackle a project from start to finish. The ability to get hands on experience fabricating and assembling our own design shed light on the mistakes we made. Since we were responsible for the final product, we were forced to come up with practical solutions to any issues that arose, instead of passing them to the next department.

## 31 - COATING OFF-LOADING PUMP STATION

Pravin Poudel<sup>1</sup>, Jason Keyes<sup>1</sup>, Matt Haas<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Kelsey Lyda*

The goal of our design was to refine the coating-off loading station for Simon Roofing. Cross linked polymer (CLP) was being moved through dip tanks that held coating material. Dip tanks were filled by a double diaphragm pump system while the tank levels were monitored by a nearby operator. The initial setup was totes stacked on top of one another and were emptied into the dip tanks by a pump system. Once the fluid levels began to reach the bottom of the tote, forklifts were used to further tilt the containers. Our objective was to design a stand that held the totes securely, and improve the pumping system efficiently, which operated by a level sensor.

## 78 - Resistance Welder Redesign

Michael Handerhan<sup>1</sup>, Justin Senko<sup>1</sup>, Brendan Fagan<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Kelsey Lyda*

The purpose of this project was to take an existing resistance welder and implement modern and readily manufactured components into the design. With the nonstop manufacturing advances and changing customer requirements, the need to update designs and deliver them faster has driven a need to reimagine the typical machine design. Existing components were large and bulky, making

storage of stock inconvenient for Taylor Winfield. The scope of the project included designing a full floor mounted press welder with a force range of 6,000 – 9,000 lbf. Also, shifting from an outdated pneumatic force generation to an electronic servo motor. Another task was to remove all casted components and replace them with more easily manufactured and modular parts. In addition, a mechanical fast follow up device was upsized to work with the new 6,000 – 9,000 lbf range. A cost analysis was completed comparing the two rams manufacturing costs. The moving parts, specifically the ram, would be guided by a linear guide system compared to the current cam rollers. FEA analysis was conducted for mechanical stresses and deflection to ensure all designed parts are operational. A few design parameters were given to follow Taylor Winfield's design standards. These included a desired force generation through a servo motor driving a ball screw. Also, machine deflection must be less than .010" under maximum load. The design must be modular for varying throat depths and for potential lower force applications. In summary, a final assembly can be further designed and developed into Taylor Winfield's weldment products.

## 81 - Double Pipe Heat Exchanger

Nicholas Ferraro<sup>1</sup>, Lucas Wiesen<sup>1</sup>, Larry Skiver<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Kelsey Lyda*

A double-pipe heat exchanger is a tool used to model heat transfer between flowing water. It is made up of two concentric pipes, one carrying hot water and the other cold water. The temperatures of the water at the inlets and outlets of the system, in conjunction with other given variables such as flow rate and pipe material, are used to model the heat transfer. The senior design project for our group was redesign the current double pipe heat exchanger in the Heat and Thermodynamics Lab in Moser Hall in YSU. There were multiple issues with the old exchanger that needed addressed, including leaks difficult to repair, an unintuitive and disorganized data acquisition system, and a lackluster hot water source with inconsistent and relatively low temperature. After going through multiple design iterations and finding what parts are available online, we came up with a new design that solves all the current issues. For easy assembly, disassembly, and repair, all fittings and connections for the pipes are to be threaded connections. This means all pieces can be screwed on or off, as opposed to a welded connection which cannot be easily disassembled. A laptop with LABVIEW, data acquisition cards, electronic flow meters and thermocouples secured by compression fittings will be included in the setup attached to allow for easy temperature and flow rate recording and modeling. Two hot water tanks are to be included in the setup with recirculating flow so a constant source of hot water can be maintained.

## 84 - Aviation Air Chuck

Tareq Qutail<sup>1</sup>, Abdulrahman Aljabr<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Kelsey Lyda*

The objective of this project was to improve or come up with new design for the Air-Chuck model. The Air Chuck is a small metallic apparatus that used as junction node between the inflation device, and the valve of a tire to allow the air to flow to the tire. However, a new design of the Air Chuck was modified as a replacement of the old design. The old design had different issues that needed to be resolved such as, the total length of the model, the locking feature, the outer diameter, the break dust aeration, and hard to be operated. Based on these requirements, a new design was modified to solve the issues in the old design. The new length of the model was 6 inches, where 1.75 inches

for the old design, the outer diameter was decreased for less contact with the tire's rim, and a cover was added to re-direct the air that flows toward the rims to decrease the break dust aeration. The new model can be used by thick or thin gloves. The only issue that failed to be achieved was the locking feature. The current lock was more secure than the modified design. On the other hand, to test the ability of the new design to operate as the old design or better, the engineering programs such as FEA Analysis, and CFD Analysis were used to do the analyzation. This analyzation was considered a comparative study. Based on the analysis, the new design can replace the old deign.

## Poster session 1

8.45 am – 12 pm

Computer Science, Consumer Sciences, Education, Engineering and Engineering Technology, Mathematics and Statistics, Physics and Astronomy

### 1 - Clinical Applications of the Hagen-Poiseuille Laws

Laren DeProfio<sup>1</sup>, Nora Habo<sup>1</sup>, Kyla Kackley<sup>1</sup>

<sup>1</sup>STEM, Mathematics and Statistics

*Faculty Advisor(s): Stephen Rodabaugh*

This project examines the Hagen-Poiseuille Laws in the applications of laminar flow within clinically relevant conditions. The notion of viscosity derives the Hagen-Poiseuille Velocity Law for blood flow in a blood vessel, which gives rise to the Hagen-Poiseuille Pressure and Resistance Laws. Through extensive literature review and derivation of the Hagen-Poiseuille Velocity and Pressure and Resistance Laws, it was found that the Hagen-Poiseuille Pressure and Resistance Laws are pertinent to the following applications: cirrhosis of the liver, capillary non-perfusion in diabetic retinopathy, maximization of IV performance, and treatment strategies for heart patients. This project reiterates the importance of having a strong understanding of mathematical derivations in today's medical field.

### 21 - A low-cost microvolume spectrophotometer for detection of hydrogen peroxide and enzymatic assay

Kassandra Scott<sup>1</sup>, Bailey Hornberger<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Byung-Wook Park*

The present work describes a microvolume spectrophotometer based on a fiber optic system for determination of enzymatic reactions. It is a simple device combining the fabrication of a low-cost microcontroller for the fiber optic system and a LabVIEW-based graphical user interface with LINX software. The high cost and maintenance involved with industrial grade instrumentation often prohibits the implementation for the teaching of instrumental analysis. Therefore, the development and integration of low-cost instrumentation into research and teaching laboratories is becoming increasingly desired. Here, the design and application of a simple microvolume spectrophotometer will be demonstrated utilizing LabVIEW along with an open-source USB data acquisition device and simple design to sandwich the fiber optics in place. A user-friendly interface is developed for determination of enzymatic reactions. The apparatus is utilized to model the usefulness in various applications such as the detection of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) released from biological cells or horseradish peroxidase (HRP) activity using Amplex Red reagent.

## **25 - Design and Manufacturing of Wind Tunnel Testing Wing with Vortex Generators Activated by Smart Materials**

Tanner Tsvetkoff<sup>1</sup>, Brandon Malahtaris<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Virgil Solomon*

The goal of the project is to integrate shape memory alloys as activators for folding vortex generators in a 3D printed wing designed to produce results in a wind tunnel. The first step of the project was to design, and 3D print a wing that would fit in the available wind tunnel. The wing was successfully 3D printed using a fused deposition modeling technique. The next step was the printing of the wing containing fixed vortex generators and pressure tabs. In the following steps the wing geometry will be modified to accommodate foldable vortex generators driven by thermo-mechanical trained shape memory alloy activators. The wings produced at every step will be tested in the wind tunnel for aerodynamic performance.

## **26 - A Picture is Worth a Thousand Words: NASA's Database on the Stars**

Derek Joy<sup>1</sup>

<sup>1</sup>BCLASSE, Education

*Faculty Advisor: Kathleen Cripe*

The goal of science education in 2021 focuses on modeling the process of scientific inquiry. Inquiry-based education focuses on student interaction with the content as opposed to a lecture/teacher centered approach. This requires the development of strong supporting materials and clear directions for student activities. The learning segment created for this purpose centers around the usage of NASA resources and the development of activities around the data provided there. The activity plan was designed for the 8th graders because of the opportunity to pilot the plan during a student teaching semester. However, the plans and activities can be extrapolated to higher levels of educational instruction as needed. The plan is broken down into five segments, each corresponding with a day. In order, the five segments cover a survey of the planets in the solar system, determination of the origin and properties of the planets based on the data provided, current events in the imaging of celestial objects, Newton's laws as applied to astronomy, and Hertzsprung-Russell diagrams. All five sections of the plan have students collect and interpret data while focusing on the methodology that allows scientist to collect the data they use. The underlying theme of the unit is scientific literacy, with many scientific releases being used as additional information.

## **33 - Toppings Refinery Retrofit Plant Design Project**

Cassandra Huston<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Douglas Price*

This capstone details the expansion of a chemical plant in Kirkuk, Iraq. This expansion allows for the process of cracking naphtha which results in products of benzene, toluene, xylene (BTX), and other hydrocarbons. This presentation includes the process description, safety, and cost associated with the reactors portion of the plant. ChemCAD was used for the simulation of the design and CapCost was used for pricing and economic analyses. As this is the capstone project for my major and is not due until a date later than Quest, I will present on the progress made within this time span.

## 35 - Mathematical Predictions of Simulating Light for Use on Solar Cookers

Cameron Watkins<sup>1</sup>, Katie Chludzinski<sup>1</sup>, Jannah Markovitch<sup>1</sup>, Taylor DeProfio<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Gregg Sturuss*

This research project is a continuation of research done on Copenhagen solar cookers. In 2019, the focus was developing a simple fastening system of the panels for use in Haiti. In 2020, recycled materials were examined to make construction more sustainable. The present focus is determining a method of simulating outdoor testing through an artificial light source and mathematical predictions as well as the optimal conditions for its use. Indoor experiments using a grow-lamp produced results unresponsive of the hypothesis and forced a shift in procedure toward model development. Factors accounted for include solid angle of the sun, intensity, and configuration of the oven. Additional development included investigation of the role of the greenhouse effect on the heating power of the pot. Field testing results collected in Ohio and Haiti were compared to model outcomes to determine accuracy.

## 37 - GRAPE: Handling Missing Data with Graph Representation Learning

Rabin Thapa<sup>1</sup>

<sup>1</sup>STEM, Computer Science

*Faculty Advisor: Alina Lazar*

Handling missing data has been an important preprocessing step for many machine learning tasks. However, existing imputation models tend to have strong prior assumptions and cannot learn from downstream tasks. In this project, we evaluate a graph-based framework (GRAPE) for data imputation. This approach uses a graph representation, where the observations and features are viewed as two types of nodes in a bipartite graph, and the observed feature values as edges between them. The *feature imputation* is formulated as an *edge-level prediction* task and the *label prediction* as a *node-level prediction* task. To evaluate the performance of GRAPE framework, we experiment it on several benchmark datasets and show its accuracy in terms of root mean square error, and compare the results with existing state-of-the-art methods.

## 40 - Alginate/ferrocene-chitosan polyelectrolyte complex for smart wound dressings

Asma Allababdeh<sup>1</sup>, Victoria Messuri<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Byung-Wook Park*

Precise control over the release of drug from devices on the wound sites, such as quantity, timing, is highly desirable in order to optimize wound treatment. The aim of this study is to obtain and characterize an electro responsive alginate/ferrocene-chitosan polyelectrolyte complex (PEC) hydrogel. Natural chitosan was chemically branched with ferrocene moieties and used as part of the wound dressing. First, the PEC composed of alginate and chitosan (or ferrocene-chitosan) with different ratios were tested for optimizing the hydrogel. The PECs were characterized by Attenuated Total Reflection Fourier Transform Infrared Spectroscopy (ATR-FTIR) and Scanning Electron

Microscopy (SEM). To demonstrate the drug delivery potential of the developed PEC-based wound dressing, fluorescence (FITC) and FITC-Dextran as model drugs with different molecular weights were used. The drug loading and release properties of the PEC in solutions and on the agarose gel as a layer of phantom skin were further investigated with fluorescence microscopy and plate reader. On the basis of the physical properties and the controlled release studies, alginate/ferrocene-chitosan PEC can be utilized as smart wound dressing or controlled release applications.

## **42 - Flexible biosensor fabricated via direct laser writing for detection of cortisol**

Anthony Romeo<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Byung-Wook Park*

Wearable sensors have attracted much attention thanks to their promising applications in personalized medicine through remote monitoring of physiological parameters. Cortisol is a biomarker for numerous diseases and is important for blood pressure regulation, glucose levels and metabolism. The current project is to create a flexible, wearable biosensor to detect cortisol in body fluid by skin contact with the sensor. A laser-assisted processing technique is used to produce laser-induced graphene (LIG) by direct laser writing with a carbon dioxide laser on carbon materials. This LIG substrate is transferred to an elastomeric substrate (PDMS). For non-invasive extraction of biomarkers, a hydrogel layer is incorporated onto the electrode surface. An antigen-antibody interaction is fabricated to take place on the working electrode to detect cortisol via surface chemistry. Both cyclic voltammetry and electrochemical impedance spectroscopy are used to characterize the modified electrode and detection of cortisol. Specifically, the characterization will consist of detection limit, selectivity, sensitivity, response time, and linear range. Using 3D printed wristbands and wireless communication devices, it will be possible to monitor personnel in real-time during any sort of situations including long-term exposure to space environments, high G forces, and hard, solid contact during physical activity like between participants in football.

## **43 - Mechanical Properties of Concrete Containing Waste Plastic and Slag**

Vincent Kacir<sup>1</sup>, Jacob Baker<sup>1</sup>, Elizabeth Williams<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Richard Deschenes*

The addition of waste materials, specifically plastic and slag aggregate, reduces the environmental impact of plastic disposal and the dependence on mining of natural stone aggregate. The objective of this research is to evaluate the use of waste plastic and slag aggregate in structural and non-structural concrete. The results are being compared to previous research, in which the matching quantities of waste plastic to slag were used. Each batch of concrete had different quantities of plastic and slag: 10/45, 15/45, and 12.5/20. The mechanical properties considered for comparison to regular structural concrete included: tensile strength, compressive strength, flexural strength, and modulus of elasticity. The results indicate the addition of waste plastic and slag combinations reduce the mechanical properties of concrete. However, the resulting mechanical performance, except for modulus of elasticity, remains adequate for the intended use such as non-structural concrete. The modulus of elasticity was reduced to a greater degree and would preclude the use of

this concrete in structural applications. The batches with 10 percent plastic and 45 percent slag performed better in all three tests, as compared to the mixtures with higher plastic contents.

## **44 - A Virtual Keyboard based on Optical Recognition and Tracking of Digits**

Gabriella Gensamer<sup>1</sup>, Colin Faloon<sup>1</sup>, Joseph Shives<sup>1</sup>, Jacob Kruppa<sup>1</sup>

<sup>1</sup>STEM, Physics and Astronomy

*Faculty Advisor: Donald Priour*

Our proposal is to create a virtual functional keyboard that operates using the camera functions of the Raspberry Pi that tracks the digit positions of the user. The camera's main uses will be to run Python algorithms, which receive input as hand position on the screen, determining the location of the user's hands so the character pressed can be determined as the output. The code uses a pixel cluster growth algorithm to recognize localized bright regions and thereby track digit locations. The camera will take photos of the user's hands and convert the pixels into an array of numbers, each representing a grayscale value that ranges from 0 to 255. Motion will be detected by utilizing a method of frame deltas, or differences in intensity between frames and a reference frame, which is determined during initialization of the program. An additional application is also being developed to determine the velocity, acceleration, and jerk of objects in frame using the same frame deltas method.

## **50 - Performance Evaluation of Calorimeter Clustering Algorithms for Particle Tracking**

Alexandra Ballow<sup>1</sup>

<sup>1</sup>STEM, Computer Science

*Faculty Advisor: Alina Lazar*

The challenge of reconstructing tracks of particles produced in high energy collisions is mainly computational. With the ever-growing data from scientific experiments, it is imperative to have automatic ways to analyze that data. Combinatorics approaches currently used to track particles will become inadequate as the number of simultaneous collisions will increase in the next phase of the High Luminosity Large Hadron Collider (HLLHC). To reduce the complexity of combinatorial approaches we evaluate several iterative algorithms based on clustering algorithms to reconstruct particle trajectories. Specifically, we analyze clustering algorithms based on sparse binning and DBSCAN. The sparse binning algorithm separates the detector space into bins before performing the grouping step. This idea speeds up the algorithm but affects the accuracy. We ran a high performance computing implementation of the proposed clustering approaches on a public dataset containing a large set of simulated collision events. The performance evaluation is done for three different clustering implementations in terms of average accuracy and computational speed.

## **57 - Awareness and Attitudes Towards Sustainable Fashion Among College Students**

Katelyn Murray<sup>1</sup>, Jamie Leming<sup>1</sup>

<sup>1</sup>BCHHS, Consumer Sciences

*Faculty Advisor: Taci Turel*

The fashion industry causes a lot of damage in social, economic and environmental dimensions. The production and consumption of textiles and apparel alone is contributing to 3% of global emissions of CO<sub>2</sub> (Laitala, Boks, & Klepp, 2015). Toxic wastewater used to dye fibers, such as cotton, are often disposed of in water systems, which in result can cause harm to residents and animals within these areas (Bick, Ekenga, & Halsey, 2018). As a result, consumers are becoming more concerned about sustainability issues and putting pressure on apparel companies. The purpose of this study is to understand sustainability development among young adults. The overall objective is to understand future consumers' preferences regarding sustainable fashion. The Social Consciousness Questionnaire (SCQ) with a Likert-style 5-point scale was utilized to examine participants' own perception of sustainability awareness (Knowledge) (K), Attitudes toward sustainability issues (A) and their actual Behavior (B) regarding social, environmental and economic dimensions of sustainability. Our 238 participants were both male (28%) and female (72%), mostly college students between the ages of 18-40. When averages of total responses in K, A, and B categories were analyzed, 46% of participants considered themselves knowledgeable regarding sustainability. Approximately 86% of respondents had a positive attitude toward social, economic and environmental sustainability issues. 33% of participants scored higher on actual sustainable behavior. There was no significant difference between males and females on their sustainability awareness, however females were more likely to have sustainable attitudes and behavior compared to males.

## **61 - The Effects of Covid-19 on Retail Spending**

Kaitlyn Wineman<sup>1</sup>

<sup>1</sup>BCHHS, Consumer Sciences

*Faculty Advisor: Taci Turel*

Many of the precautions we took due to the Covid-19 pandemic such as lockdowns and mask-mandates have caused significant changes in our lives and negatively impacted the economy. The global supply chains became unstable, consumers were forced to remain distanced, and boundaries between work, education and leisure were blurred, while many lost their jobs. These sudden changes caused drastic disruptions in consumption habits. The purpose of this study is to examine the impact of this crisis on consumers and their shopping behavior. By understanding changes in shopping behavior due to Covid, it is possible to forecast future consumer trends that may become permanent and create insight on how to cope with associated challenges. A survey with demographic questions and a Likert-style statements with a 5-point scale was used to understand shopping habits. 148 participants (77% female, 23% male) responded to our survey. Our initial results indicated that 51% of participants had their employment negatively affected by the pandemic. 66% reported that they made changes to their shopping habits due to Covid-19. The most popular shopping venue was Amazon (70%), followed by Curbside Pickup (9.3%) and DoorDash (6.7%). Participants whose employment that was negatively impacted by Covid were more likely to report significant changes in their shopping behavior.

## 83 - Markov Monopoly Chain

Nicolas Andino<sup>1</sup>, Megan Krawick<sup>1</sup>, Skylar Brocious<sup>1</sup>, Trey Klanchar<sup>1</sup>

<sup>1</sup>STEM, Mathematics and Statistics

*Faculty Advisor: Thomas Wakefield*

A Markov Chain is a stochastic model describing a sequence of possible events in which the probability of each event depends only on the state attained in the previous event. We utilized a Markov Chain to calculate the probability of shifting between spaces in the popular board game *Monopoly*. Using that Markov Chain, we developed a matrix based on the probability of advancing from point A to point B. After finding those probabilities, we discovered which properties are valued higher than others based on the probability of landing on it and the potential return of owning the actual property. To model our matrix, we created a computer program that contains a set of probabilities to simulate the likelihood of possible moves in a real *Monopoly* game.

## 105 - Emotional Response and Reaction Time to Autonomous Vehicle Failure

Cameron Howard<sup>1</sup>, Ivan Bosnjak<sup>1</sup>, Griffin Lough<sup>1</sup>, Nathaniel Arthur<sup>1</sup>

<sup>1</sup>STEM, Computer Science

*Faculty Advisor: Abdu Arslanyilmaz*

The range of autonomous vehicles are defined on a five-level continuum from zero to four with different autonomy functionalities implemented at different levels. At level 3, the vehicle is able to take full responsibility over the control of the vehicle, and the driver is allowed to be free of roadway monitoring and focus on the traffic but expected to be ready to take-over control upon a warning, called take-over-request (TOR), prompted when a system failure occurs. The driver is provided with a certain transition or *buffer time* following a TOR.

Because the driver is prompted to pay attention to other tasks at the time of TOR, his/her out of the loop status coupled with distraction with a secondary task leads to deterioration in his/her performance during take-overs. This would be a grave issue if TOR is prompted just prior to an intersection, which is a multi-task situation where the driver needs to interact with other drivers while attempting to take-over control of the vehicle.

There have been many studies into how buffer times affects take-overs at different parts of roads, but no research has been conducted to investigate how buffer time affects drivers' emotional states including engagement, excitement, and frustration, and when it occurs prior to intersections.

Therefore, the purpose of this study is to investigate the effect of two different buffer times (3 and 7 seconds) on drivers' emotional states and to examine the relationship between these emotional states and the quality and duration of take-overs in level-3 autonomous vehicles.

## 107 - Gartley Patterns

Jimmy Lage<sup>1</sup>, Derek Miller<sup>1</sup>, Madi Ricciuti<sup>1</sup>, Nikitas Missos<sup>1</sup>, Morgan Weinreber<sup>1</sup>

<sup>1</sup>STEM, Mathematics and Statistics

*Faculty Advisors: Moon Nguyet, Thomas Wakefield*

The stock market is a major factor in most people's lives whether it be investing, retirements, or their job. In order to determine an effective way to trade we looked at Fibonacci numbers and Gartley patterns that occur naturally within the market. Understanding these patterns will help us

recognize buy and sell points as well as building upon them to program machine learning to identify these patterns and trade on them.

# Oral Presentations: Session 3

Session 3a

1 pm – 2.30 pm

Mathematics and Statistics, Physics and Astronomy

## 24 - Physics Toys and Puzzles

Makayla Zets<sup>1</sup>, Ethan Cochran<sup>1</sup>, Julie Centofanti<sup>1</sup>

<sup>1</sup>STEM, Physics and Astronomy

*Faculty Advisor: Snjezana Balaz*

STEM is the future. More and more people are discovering all the things you can do within science, technology, engineering, and mathematics. This project demonstrates physics concepts through 3D printed toys, like a tippe top and a harmonica. These are little toys that people of all ages are able to play with, but they are also a way to educate about engineering, physics, mathematics, 3D printing, and more. This is a perfect way to show that STEM can be fun!

## 58 - Fantasy in LED Light and Digital Sensation

Brooke Bocker<sup>1</sup>

<sup>1</sup>STEM, Physics and Astronomy

*Faculty Advisor: Michael Crescimanno*

As a way to make what I'm learning in PHYS 2611 real and practical, I set out to learn how to control LED lights and use electronics to sense light and sound. An arduino is a convenient digital controller for measuring the electronic light and sound sensations and then responding with an LED light sequence. To affix the arduino, LEDs and the sound and light sensors, I learned how to use tinkercad for design of a 3d printed mount for the project. In addition to describing the circuits used for the sensors, I'll describe the programming and the artistic vision for the mount and behavior of the device.

## 63 - Testing G-Band Calibrated Images for HETDEX

Alyssa Leone<sup>1</sup>

<sup>1</sup>STEM, Physics and Astronomy

*Faculty Advisor: John Feldmeier*

The Hobby-Eberly Telescope Dark Energy Experiment (HETDEX) is a study designed to help gain an understanding of dark energy, with over 100 collaborators worldwide. This portion of the project involves imaging data taken as part of the HETDEX project by testing the data quality of the first 376 imaging fields to ensure accurate measurements of the brightness of objects in each field. These imaging fields were taken with the Kitt Peak 4-meter Mayall telescope and the Mosaic camera. The stability of the color term of the Mosaic camera is investigated between observing seasons. Using astronomical data-mining techniques, we first visually inspect hundreds of stacked images and assign quality codes in order to train our automated classifiers. The data are then analyzed statistically using numerical separation with user inspection.

## 67 - Measuring the $^{83}\text{Kr}$ hyperfine interval with free-running laser diodes

Jonathon George<sup>1</sup>, Ian Jones<sup>1</sup>

<sup>1</sup>STEM, Physics and Astronomy

*Faculty Advisor: Michael Crescimanno*

Utilizing low-cost laser diodes and university-standard spectral tubes, we significantly simplify the process of measuring the  $^{83}\text{Kr}$  hyperfine interval. We explain the critical differences between this approach and historical methods, including the usage of highly accessible materials and 3D-printed optical assemblies. We then compare our measurement to an accepted value and briefly describe our plans moving forward.

## 47 - The Impact of Trust on Social Distancing

Luke Hetzel<sup>1</sup>

<sup>1</sup>STEM, Mathematics and Statistics

*Faculty Advisor: Ou Hu*

After the incredibly detrimental effects of the Covid-19 pandemic, much research on developing more robust systems to handle future pandemics appears necessary. One area in which the government requires cooperation from people is adherence to social distancing guidelines. Due to the scope of the problem, enforcement of social distancing is prohibitively difficult. Thus, it becomes important to understand which traits foster an increased cooperation and adherence to social distancing. This paper analyzes the effect of two different types of trust on the level of social distancing, using panel data across 39 different countries. It distinguishes between interpersonal trust, trust in people such as family, friends and strangers, and institutional trust, trust in organizations such as the government, the news, universities or the World Health Organization. The paper submits four possible models to explain levels of social distancing. It finds no significant relationship between interpersonal or institutional trust and social distancing.

## 89 - Counting Tiles

Hannah Roose<sup>1</sup>

<sup>1</sup>STEM, Mathematics and Statistics

*Faculty Advisor: Alexis Byers*

Starting with a rectangular region, how many different configurations will cover the region only using domino tiles? We investigated this classic enumeration question using graphs and matrices with a technique called the transfer matrix method. Then, we applied these same techniques to the rectangular region, but now with triominoes, triangles, and trapezoids as tiles.

## 4 - Crude Oil Plant Design

Bailey Hornberger<sup>1</sup>, Brittany Realty<sup>1</sup>, Kristen Szalay<sup>1</sup>, Jenna Dodson<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Douglas Price*

The capstone of the senior 2021 Chemical Engineering class will be comparing the plant design for two types of crude oil compounds. Students will be responsible for the complete design of the chemical reactors, separating components, additional unit operations, as well as a cost and safety analysis of the plant. The capstone will require a working knowledge of all core classes taken in their 4 years of education, making the project a true test of the student's capabilities. For this presentation, I will be showing my group's progress on the capstone and what we have learned so far.

## 22 - Hydraulic Design of Industrial Facility

Jacob Crawford<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Suresh Sharma*

Complete a meaningful design experience of an industrial facility with a focus on the hydraulics sub-discipline while working in a multidisciplinary team to plan, manage, and complete major design project. Design of a water supply system, roof drainage system, parking lot catch basins, and retention basins will be processed and explained.

## 28 - Alkali-silica reaction (ASR) and freezing and thawing deterioration in concrete

Jared Koenig<sup>1</sup>, Mohammed Khan<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Richard Deschenes*

Alkali-silica reaction (ASR) occurs in concrete due to a reaction between reactive aggregates and alkalis in the high-pH pore solution. The occurrence of ASR leads to an expansive alkali-silica gel followed by cracks in concrete, which if exposed to freeze-and-thawing (FT) cycles may exacerbate the deterioration of the concrete. The formation of ASR gel and transport of water during freezing may result in higher tensile stresses as compared to concrete with only one deterioration mechanism present. Although moderate to severe ASR rarely occurs in concretes with inert aggregates, lesser instances of gel formation are more common and may adversely affect FT performance. The present research is aimed to measure the deterioration of concrete exposed to ASR, FT, and a combination of both. The results will be used to develop concrete more resilient to ASR and FT deterioration. The research methodology included batching of concrete mixtures containing either moderately or highly reactive aggregates paired with non-reactive aggregates. Companion mixtures were produced with six percent air entrainment. In total, four mixtures were cast, which are being tested in different environments. The exposure environments simulate conditions to accelerate ASR, FT, and combined ASR and FT deterioration in concrete. The change

in mass and volume were measured periodically to quantify expansion caused by deterioration of the microstructure. The preliminary result indicates prisms with air-entraining admixtures expand less when compared to non-air entrained prisms. The results will be used to refine models of the coupling mechanism of ASR and FT deterioration in concrete.

## **30 - Liberty Park Little Squaw Creek Restoration Phase 1 and Storm Water Volume Analysis:**

Joseph Zielinski<sup>1</sup>, Stephen Darlington<sup>1</sup>, Kieran Burk<sup>1</sup>

<sup>1</sup>STEM, Engineering Technology

*Faculty Advisor: Robert Korenic*

Due to new development over the last decade in the drainage basin Little Squaw Creek in Liberty Park (Trumbull County) Ohio has begun to channelize. The channelization is due mostly to increased volumes of storm water runoff. To mitigate this problem, the stream will be reconfigured with pools and eddies to slow the speed of the water in the channel and allow sediment to redeposit. This research will detail the updated channel storm water volumes and velocities due to recent development and will make suggestions for channel/pool depth as well as overbank design and will make initial suggestions on engineering design best practices for the upcoming phases of the project.

## **73 - Geotechnical Design of an Industrial Facility**

Mohammed Khan<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Richard Deschenes*

The intent of the integrated project is to develop an Industrial Facility utilizing knowledge gained in the past and applying it to real-world problems. The proposed structure will be an industrial facility with 80640 sq. ft of area. With an office, loading dock, and water treatment plant. The proposed structure will be a single-story building with a steel truss, slab on grade with a footprint of 80700 sq. ft. The finished elevation of the building will be 1040 ft from sea level. Geotechnical engineering is concerned with the behavior of earth materials and the focus of this project is to provide geotechnical engineering services that will be performed for the proposed Industrial Facility on 20 acres of property located in Youngstown, Ohio. The purpose of these services is to provide information and geotechnical engineering recommendations relative to Foundation design and construction, Excavation considerations, Estimation of Cut and Fill, Boring log Analysis, Site preparation and earthwork, Construction drawings, Pavement design, and construction.

## **100 - Elastomer Lattices in Low Velocity Settings**

Elena Layton<sup>1</sup>, Kyle Preusser<sup>1</sup>, Nathanael Warren<sup>1</sup>, Charles Dwyer<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Pedro Cortes*

In professional football a helmet-to-helmet impact can produce more than 1600 pounds of force. 1600 pounds of force is more than enough force to cause a concussion and or fracture to the skull with or without a helmet. A helmet is designed to absorb the energy created when an impact occurs. Even with today's technology athletes at every level are suffering from serious head

injuries. This project takes into consideration research already used to develop different 3-D printed lattices. These lattices are either vertically, horizontally, or non-graded. The lattices are composed of materials provided by several different companies. The goal is to come up with a material that can provide a better cushion than the standard protection being used. After lining the helmet with an optimal makeup of three different lattices the helmet was dropped from 10, 15, 20, 30, and 40 centimeters. The tower apparatus used to drop the helmet took into consideration the NFL standard requirements of a helmet. One of these requirements was withstanding force from an impact caused by a 16-kilogram head. The overall project concluded the optimal material for absorbing the most force.

### 3 - Self-Driving Car

Sagar Pandey<sup>1</sup>, Kushal Waqle<sup>1</sup>, Ankit Vaidya<sup>1</sup>, Tek Chettri<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Robert Caven*

The vehicle industry has progressed drastically in the past decade. The different companies are focusing more on automated inputs to make driving safer, relaxing, and with numerous smart actions. So, we have decided to build a small prototype of the automotive car with limited smart functions like lane detection, steering control, and stop/ start control using artificial intelligence, OpenCV, Lidar.

#### DESCRIPTION OF PRODUCT

We will be working with the pi camera for Lane detection with the help of a Raspberry Pi camera. Image Processing will be done with the help of python run in raspberry pi 4. After the image is processed, open-source machine learning libraries will be used to provide an output of whether a right/left turn is ahead, or a slight lane adjustment is needed. The hardware control system will feature a proportional controller to smoothly execute the output from the image processing software. To kill the vehicle in case of an emergency a Bluetooth switch is also connected. This will combine the power of software and hardware and will give rise to endless possibilities to add a new feature to enhance the overall system. Some of the future possibilities are mentioned in the scope section.

#### SCOPE

After perfecting lane detection, steering, and stopping at required locations, our car can be upgraded with the ability to detect signs, traffic lights, and intersections. It can also be modified to detect other cars and objects and autonomously take actions accordingly. After being equipped with some of these basic features, our car can be used to deliver mails, documents, and other things around the university or can be equipped to find parking spots around the university and update via YSU application.

### 5 - MMA Smart Trainer

Vince Belica<sup>1</sup>, Mirella Boulos<sup>1</sup>, Andy Boyer<sup>1</sup>, James Shi<sup>1</sup>, Mark Zerefos<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Robert Caven*

Our product, the "MMA Smart Trainer," is intended to be worn by mixed martial arts fighters during training sessions. It will enhance the training by measuring and analyzing the punches and kicks received by the wearer's opponent: namely, the force of the blow and the location registered. The garment will be designed with various sensors combined with embedded microcontrollers to record data for later uploading. With proper interpretation of the data, the garment is intended to allow the wearers to more precisely hone their fighting skills.

## 15 - PLC Controlled Motor Operated De-energized Tap-changer

Jon Koutsourais<sup>1</sup>, Joseph Malvestuto<sup>1</sup>, Bartek Blaszczyk<sup>1</sup>, Evan Leek<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Frank Li*

Transformers and other industrial machines have traditionally had manual position switch mechanisms such as CAM shafts to adjust angular position. Our recent quest was to automate the position switch using a PLC to create a more efficient de-energized tap changer with more accurate angular positions. An ideal deliverable PLC will accommodate multiple positions such as eight, ten, and twelve rotary style positions while not exceeding the cost of a traditional CAM shaft. Additionally, durability and ease of use were among our top priorities. An HMI (Human Machine Interface) will allow positions to be controlled using touchscreen automation saving the user time and energy when adjusting positions. In our research, we were able to find a PLC and HMI that cut the cost of a traditional CAM shaft by as much as 74%, depending on the position count. Overall, our project will provide our partner company, Specialty Transformer Components, with an upgraded and easily implemented design. Furthermore, the PLC will improve the accuracy for the transformers resulting in greater customer satisfaction.

## 45 - Automated Solar Greenhouse

Doug D'Mello<sup>1</sup>, Nathaniel Morgret<sup>1</sup>, Cody Neighbor<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Faramarz Mossayebi*

As society grows, so must our power supply. With solar power being an option that many homeowners and business owners choose for power systems, each system must be designed to meet the proper demands. One such system that demonstrates this is the Youngstown State University, Ward Beecher Greenhouse. This system design takes solar panel energy and stores it in batteries to power the greenhouse lights at night, as well as other various automated functions. To convert from DC to AC power, an Inverter circuit is used. This takes the DC voltage and flips it between positive and negative values at very high speeds. In this system the AC power from the inverter is then stepped down to usable levels using a transformer, and then converted back into DC for storage.

## 66 - Ethanol Sensor System for a BMW 335i

Cole Smith<sup>1</sup>, Nick Penza<sup>1</sup>, Yousef Sassya<sup>1</sup>, Jon Patterson<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Frank Li*

Our senior design project involves designing and implementing an ethanol sensor system into a BMW 335xi that will increase performance and efficiency of the vehicle. Our design includes the use of an ethanol sensor, Arduino nano, and a piggyback engine control unit (ECU) to determine the quality and type of fuel put into the cars system and will be able to communicate with the car's engine ECU to determine the parameter changes that must occur in the engine. Our design is focused on the niche market of car tuners and car enthusiasts that want to have a standalone system to implement into their respective car for use of ethanol fuel. This design will be targeted towards car owners with similar specifications to that of our car that we are using in regard to engine specifications. We have determined a select range of parameters that we will compare before and after system installation to verify performance and efficiency: 0-60 mph times, oil temperature, engine temperature, intake air temperature, air fuel ratios (AFR's) in 3rd gear from

2,000 rpms to 6,000 rpms, AFR's in 6th gear at 2,000 rpms for 1 minute, and environmental factors such as air temperature, humidity and the type of weather. We are expecting to see an increase in engine efficiency parameters such as AFR's and engine performance parameters such as 0-60 mph times. This system will allow the user to make on the fly adjustments to ECU parameters and have more control of the car's internal workings after it is installed and should lead to a more efficient and refined experience.

## **98 - Exploration of Energy Harvesting Alternatives (Piezoelectric and/or Electromagnetic)**

Joao Garretto<sup>1</sup>, Marcus Kolade<sup>1</sup>, Hugo Mendel<sup>1</sup>, Khaled Kassem<sup>1</sup>, Bhawana Bhatta<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Robert Caven*

The concept of harvesting energy from alternative sources present in the environment has been increasingly important and popular to operate low power electronics. In this project, the concept of Energy Harvesting is explored with the motive of replacing a battery in a low-energy electronics device, with mechanically or electromagnetically generated power. A piezoelectric element is used to study, experiment and explore the mechanically generated power; and Faraday's law (using a magnet and a coil of wires to induce electromotive force) is used to electromagnetically harvest energy to operate a remote controller. The battery compartment of a GE Universal Remote Controller is substituted by the electromagnetically harvested energy generation and storage circuit, thereby powering this low-energy wireless electronic device. The device prototype fundamentally consists of a harvester, a low power management system and a low power storage system, and its functionality is applied in the TV remote controller. The power generated using the piezoelectric source was adequate but stabilizing and regulating it was a challenge. However, the use of the Electromagnetic source to generate power was more efficient, stable and easier to navigate; and therefore used in the prototype of the remote controller power source. A green circuit that applies energy harvesting and avoids the use of chemical batteries and conventional power source can be very useful for low power applications, and is specially helpful in the application of wireless devices, sensors, IoTs, etc.

## **109 - Smart Energy Monitor for Homes**

Faisal Albaty<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Robert Caven*

The project is to design and develop a Smart Energy Monitor (SEM) for small power residential and semi commercial applications. The SME will measure the real time current and computes the real time power consumption and power generation (in case of solar PV installed at home through an extra clamp). From the sensors data, active and reactive power along with its usage over a period of time for energy can be calculated. Current will be sensed using the current clamps and voltages will be sensed using the simple resistor divider network. The components will be connected to a microcontroller for the computations of power, energy, power factor. SEM will also be having an ability to connect to the internet through WIFI network or a LAN cable. Internet connectivity allows the SEM to send the data to a data base and then to the linked website or a mobile application. Simple and smart mobile application will show the real time data access. Apart from this real time visualization of consumption and generation, stored data in excel format so it can be accessed through the web portal link or mobile application.

## 19 - Observation of COVID-19 Prevention Techniques Among Individuals on a College Campus

Courtney Yesko<sup>1</sup>, Perry Brush<sup>1</sup>, Mariah Wilson<sup>1</sup>

<sup>1</sup>BCHHS, Health Professions

*Faculty Advisor: Jennifer Pieren*

The coronavirus is a highly contagious respiratory disease. Universities in the United States have had to implement campus wide procedures to reduce the spread of infection. A review of the literature found that observational research of prevention measures on campuses during a pandemic have not been studied. The purpose of this study was to assess and compare to public health guidelines the level of mask wearing, face touching, social distancing, and use of Youngstown State University's (YSU) hand hygiene stations by observing student's actions. This study used a convenience sample and data collection methods included a standardized instrument used by researchers while observing participants to measure behaviors. Seventy-four participants were observed on the YSU campus in five different locations; 60.8% wore masks properly, 55.40% did not participate in face touching, and 82.4% adhered to social distancing guidelines. Hand washing stations in two locations were only used twice during a three-hour observation period. Areas where students could eat or drink became congregation zones where students assembled without eating, drinking or wearing masks and therefore did not comply with campus or public health guidelines. Observing recommended policies to prevent infectious disease transmission is critical to prevent further quarantine and shutdowns of campuses and healthcare facilities.

## 34 - The Impact of the COVID-19 Pandemic on the Dental Hygiene Profession: Personal Protective Equipment and Infection Control Changes

Anna Derloni<sup>1</sup>, Katie Clement<sup>1</sup>, Darcie Bush<sup>1</sup>

<sup>1</sup>BCHHS, Health Professions

*Faculty Advisor: Jennifer Pieren*

The coronavirus pandemic is a public health threat causing concerns about personal protective equipment (PPE) and infection control in dental settings. The purpose of this study was to understand the impact of COVID-19 on PPE and infection control in the dental hygiene profession. Dental hygienists were asked to participate in a 15-question survey regarding PPE concerns and protocols used in their workplace. A link to the survey and the informed consent were posted on various dental hygiene Facebook group pages in November 2020. There were 227 respondents. The majority of the respondents (81.5%) worked in a private office. The most reported worn PPE were gloves (100%), eye protection (83.3%), face shields (88.1%), and surgical masks (78.9%). While 94.3% reported having face shields always available, 15.4% never had N95 respirators available. Private offices reported the greatest supply of N95 respirators, with 36.2% responding having more than a two-week supply. In contrast, 20.8% of corporate offices did not have any N95 masks in reserve. Hygienists are implementing a wide variety of new infection control and PPE changes since the pandemic began. The results suggest the availability of PPE vary considerably by practice setting. Concerns persist among the dental hygiene profession including access to PPE and risk of infection. Additional research needs to be conducted regarding PPE and infection control implementation and availability as the pandemic progresses.

## 46 - UV Light Disinfection

Sieyribeth Montaz<sup>1</sup>, Serena Stout<sup>1</sup>

<sup>1</sup>BCHHS, Health Professions

*Faculty Advisor: Diane Kandray*

Ultraviolet light (UV) is widely advertised to the public as a viable sterilization method for items used daily such as cell phones, eyeglasses, toys, toothbrushes and other items that may harbor harmful microorganisms. Toothbrushes are especially prone to high amounts of bacteria because of daily use and improper storage. Toothbrushes that remain moist between uses may accelerate the growth of harmful bacteria. The purpose of this study was to test the efficacy of home ultraviolet light toothbrush sterilization kits. Three toothbrush UV light units were purchased online and tested for sterilization effectiveness. Three participants brushed their teeth with a brand new, non-contaminated toothbrush. After brushing, saliva from the toothbrushes was swabbed on blood agar plates and incubated to show bacterial growth. The toothbrushes were then placed in each of three UV sterilization units for the length of time suggested by the manufacturer, swabbed on blood agar plates and incubated for 24 hours. The results concluded that the UV light kits when used according to manufacturer's instructions did not result in complete destruction of bacteria from the three toothbrushes. Consumers should be wary of UV light sterilization units and look for evidence in the literature or independent research before purchasing.

## 49 - Health Literacy

Amanda Leist<sup>1</sup>, Ashtyn Rogers<sup>1</sup>, Claire Brown<sup>1</sup>

<sup>1</sup>BCHHS, Health Professions

*Faculty Advisor: Jennifer Pieren*

Oral health literacy is the degree to which individuals have the capacity to obtain, process and understand basic health related information. Reading materials for the public should be developed at the 6th grade reading level due to the average reading level in the United States being that of a 13- or 14-year-old. The purpose of this study was to evaluate the readability of select Covid-19 prevention education resources to determine if these materials are at an appropriate reading level to serve the general population during the Coronavirus pandemic. Five materials obtained from various sources were evaluated for their readability level using the Flesch Reading Ease (FRE) readability formula. Mathematical calculations were performed individually for each material by following the FRE formula. Each item was assigned a score which fell into one of seven categories ranging from "very easy" to "very confusing". The results of the readability evaluation on five different items revealed that none of the materials were considered "very easy". Only one item was scored "easy", three were "fairly easy" and one was scored as "very confusing". Informational prevention materials related to Covid-19 may have been developed hastily to inform the public on ways to prevent the spread of Covid-19 infections, however, readability levels should be considered to ensure the greatest number of people are able to comprehend the information.

# 10 - Reverse Researching a Novel Training Methodology: An Argumentative Review

Kenny Walters<sup>1</sup>

<sup>1</sup>BCHHS, Physical Therapy

*Faculty Advisor: Frank Bosso*

## Purpose

This paper seeks to provide a hypothetical “why” for the multitude of success stories and documented improvements in athleticism from people who have gone through the Athletic Truth Group system.

Centering around the "Titin Theory" of muscle contraction, this argumentative review discusses the potential adaptive consequences at the biological level for one training themselves in this manner. This new theory of muscle contraction states that, as a muscle actively lengthens (eccentrically contracts), the levels of stiffness in the titin filament (and thus the sarcomere) directly increase in proportion to the stretch. I postulate that higher levels of stiffness developed in each joint of the body through a joint by joint "strength thru length" training approach such as the Athletic Truth Group will yield adaptations in the surrounding microbiological environment of the joints being worked that will allow for greater resiliency for a subsequent bout of activity based off of the SAID principle.

## 2 - Human Resources Capstone Project

Carlee Gaca<sup>1</sup>, Bailey Perkins<sup>1</sup>, Travis Tikkanen<sup>1</sup>, Ashlea Hawyluk<sup>1</sup>, Savanna Wade<sup>1</sup>, Andrew Welch<sup>1</sup>

<sup>1</sup>WCBA, Management and Marketing

*Faculty Advisor: Helen Han-Haas*

Our team will be presenting our HR Capstone Team Project. Our project consists of a real company and analyzing their Business strategy and HR Strategy. Our company is located in Middlefield, Ohio, and is named Mercury Plastics LLC. Mercury Plastics LLC has operated for over 50 years by specializing in plastic manufacturing in the tubing and plumbing industry. The purpose of this paper is to analyze this company. It is imperative to look at the background of the company and the competition they face in the growing market today. It is also important to look at a company's mission statement and see if their business strategy aligns. This is important because it will give the reader a better understanding of Mercury's business purpose and strategies. Having an efficient business strategy enables Mercury to operate at their best.

## 8 - AVI Foodsystems Business/HR Strategies

Nichole Noday<sup>1</sup>, Timothy Joyce<sup>1</sup>, Reagan Meusborn<sup>1</sup>, James DeMuccio<sup>1</sup>

<sup>1</sup>WCBA, Management and Marketing

*Faculty Advisor: Helen Han-Haas*

### Major Objectives

This report provides an analysis and evaluation of AVI Foodsystems. The company is a food and hospitality provider to various industries all over the country. It's culture, competitive environment, mission statement, and business strategy were researched in-depth to determine their alignment with one another. Observing how AVI Foodsystems operates provided justification as to whether its current practices displayed characteristics of a prospector, defender, analyzer, or reactor business strategy. Specific examples from company documents as well as insight from a personal representative, Joy Whyde, within its human resource department were utilized throughout this report.

### Key Decisions

The information gathered found that AVI Foodsystems is transitioning from a reactionary to an analyzer business strategy. New opportunities, stricter guidelines, and changes in the approaches for its divisions to ensure the transition of strategies goes smoothly will be discussed.

### Conclusions

This report highlighted AVI Foodsystems specific business strategy and explained its nature using details from its culture, competitive environment, mission statement, operations, and experience from a current employee. It was determined that adopting an analyzer strategy is what is best for the company and its goals. Next, AVI Foodsystems' human resource system will be analyzed to determine its strategic alignment with its business objectives.

## **90 - Red Ochre: How a mineral shapes our understanding of early human culture**

Samuel Witham<sup>1</sup>

<sup>1</sup>BCLASSE, Sociology and Anthropology

*Faculty Advisor: Loren Lease*

Red ochre is a mineral used by humans beginning 300 thousand years ago. It is found at archaeological sites in the form of rocks, pebbles, pigment, powder, and is found on beads, shells, and the walls of caves in the form of art. Red ochre is found throughout the world, from Africa to Argentina, but the material was treated as a novelty item by researchers, not an item that may hold the secrets of human culture. This changed at the end of the 20th Century, and many theories were proposed to explain why and how red ochre was used by these early humans. The two main theories are utilitarian use, that humans use red ochre because it benefitted them in some way, or symbolic use, that red ochre was connected to rituals, religion, or culture. There is a problem when trying to study red ochre, and it is that there are so many sites that have reported finding red ochre, that trying to determine when and where it was used is difficult. For this project I created an interactive map, with the goal of creating a database that provides and depicts information on red ochre sites, which is a resource that has not been created before. This map will show how red ochre use has spread across the world throughout time, and also show how past anthropological biases have affected the understanding of human culture.

## **96 - Vinyl Records: The Resurgence of a Materialistic Culture**

Nathan Clapp<sup>1</sup>

<sup>1</sup>BCLASSE Sociology and Anthropology

*Faculty Advisor: Paul Gordiejew*

Within the last decade, the collection and exchange of vinyl records have gained increasing popularity. The revitalization of these practices has given rise to a new demographic, which does not rely on the format, unlike prior demographics. This study examines the motivations of record collectors and exchangers and how the value of vinyl records is determined. There is the investigation of shared identity during social gatherings, holidays, and record store activities. Data gathered were from Three informants, two of which are sole proprietor record store owners in the rust belt of Ohio. The utilization of Auto-ethnographic techniques allowed me to be an informant. Remote fieldwork was employed due to the pandemic and consisted of a questionnaire, open-ended interviews, and auto-ethnographic experience. Classic anthropological texts will inform the analysis of data. Conclusions are preliminary and still emerging due to ongoing analysis of data.

## **72 - Education and Domestic Violence Against Women**

Hannah Heavener<sup>1</sup>

<sup>1</sup>BCHHS, Criminal Justice

*Faculty Advisor: Richard Rogers*

This research seeks to identify whether the level of education has an effect on the level of domestic violence against women. Using SPSS on the dataset 5-ncvs\_2015-2019\_five-year\_file (2).sav, the descriptive statistics are compared in order to determine the effect that the level of education has on the presence of domestic violence. As of the time of submission of this abstract, final results have not yet been calculated, but descriptive statistics for the variables have.

## **93 - Measuring Change: Statistical Techniques Used in Prestigious Criminal Justice Journals**

Allison Bator<sup>1</sup>

<sup>1</sup>BCHHS, Criminal Justice

*Faculty Advisor: Richard Rogers*

Statistical techniques used in prestigious journals have evolved over the years. Statistical analytical methods, which began with basic descriptive analyses have advanced into higher order statistical techniques. This research study intends to explore the changes in the statistical techniques used over a period of five years. This study will utilize articles ranging from 2016 - 2021, from three prestigious Criminal Justice Journals: *Justice Quarterly*, *Journal of Criminal Justice Education*, and *Criminology*. It is expected that the statistical techniques used will become more advanced as the years progress.

## 12 - Biomedical Investigation of Achilles Tendon Repairs in a Rat Model

Nancy Boulos<sup>1</sup>, Jane Casto<sup>1</sup>, Megan McCloskey<sup>1</sup>, Jack Farrell<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Hazel Marie*

The Achilles tendon is the strongest tendon in the human part and essential for basic leg movements. Each year, 18 out of 100,000 people will suffer from an Achilles tendon rupture and the current treatment may lead to the tendon rupturing again in the future. The goal of this project is to continue and validate previous research on possible healing treatments that will speed up recovery and lessen the chance of future ruptures.

To validate the previous research, a new procedure for testing was created. This new design was compared to the original to determine if the method of testing was consistent and accurate. The revised testing procedure involved inserting the tendon into a 3D printed box with epoxy to help the tendon adhere to the box. The box was then placed into the grips to limit the compression of the sample. The design was tested on inorganic phantom samples and tendon samples before being used on the control group of tendons from a previous study.

Early findings suggest that the previous testing procedure resulted in slippage of tendons that could have altered results. For two randomly selected tendons, the previous testing design produced a max load of 10.44 N, while the new method produced a max load of 28.72 N. Further testing is being completed and more conclusions will be made once testing is fully finished.

## 27 - NASA Lunabotics Competition Rover Mechanical Design

Mark DeAngelis<sup>1</sup>, Tim Chamberlain<sup>1</sup>, Dominic Pecchia<sup>1</sup>, Joe Pfeffer<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Hazel Marie*

The NASA Lunabotics Competition tasks collegiate teams with designing, building, and programming a rover that must traverse a simulated lunar surface as autonomously as possible to mine icy regolith (gravel) at a secondary ground layer 30 cm below the surface. This rover must meet specified design constraints, including an initial volume of 1 m long, 0.5 m wide, and 0.5 m tall, and a maximum mass of 60 kg. Additionally, the rover must be capable of avoiding or crossing boulders and craters upwards of 50 cm in diameter and depth. Teams are incentivized to optimize the rover's mass, energy usage, communication bandwidth, and dust tolerance to accurately mimic the requirements for a real lunar rover. While this is a multidisciplinary project, including seniors from both the mechanical and electrical engineering programs, the mechanical engineering seniors were responsible for the design and verification of all hardware components. In general, the rover was divided into four primary subsystems: the frame, drive train, digging system, and dumping system. The design specifically consists of an 8020 frame, completely in-hub wheels, a kinematically actuated augur to dig for icy regolith, and a pivoting bucket dumping system to deposit the obtained regolith into a collection bin. Although the augur design collects less regolith than other competitors in the NASA Lunabotics competition, it spreads substantially less dust – a judging metric that can award the team more points during the competition – and has been the design style for the YSU team for the past two years.

## 20 - NASA Lunabotics Mining Rover - Electrical Engineering

David Morvay<sup>1</sup>, Quentin Stokes<sup>1</sup>, David Neiheisel<sup>1</sup>, RJ Yarwoord<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Robert Caven*

The NASA Lunabotics Competition tasks collegiate teams with designing, building, and programming a rover that must traverse a simulated lunar surface as autonomously as possible to mine icy regolith at a secondary ground layer 30 cm below the surface. This rover must meet specified design constraints, including an initial volume of 1 m long, 0.5 m wide, and 0.5 m tall, and a maximum mass of 60 kg. Additionally, the rover must be capable of avoiding or crossing boulders and craters upwards of 50 cm in diameter and depth. Teams are incentivized to optimize the rover's mass, energy usage, communication bandwidth, and dust tolerance to accurately mimic the requirements for a real lunar rover.

While this is a multidisciplinary project, including seniors from the computer science, mechanical, and electrical engineering programs, the electrical engineers were responsible for the design, programming, and implementation of all electrical components on the rover. In general, the rover was divided into several electrical subsystems: controls, power management, data communication, networking, GUI software, physical wiring, and autonomy. The electromechanical design consists of six high-performance brushless motors, two linear actuators, and one stepper motor. For control systems, the rover features a master-slave configuration, using a Jetson Nano microcontroller and Basys 3 FPGA board. All autonomous or manual controls are transmitted from the Jetson Nano to the FPGA for distribution to the electromechanical systems. Furthermore, all sensory data captured by the FPGA is sent back to the Jetson Nano for display on the GUI software. Finally, the rover has the ability to be drive autonomously using an IR beacon transmitter and receiver. The rover will follow an IR signal as it moves through obstacles and terrain in the competition arena.

## 56 - Powertrain Baja SAE YSU

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<sup>1</sup>STEM, Engineering

*Faculty Advisor: Anthony Viviano*

Our team is a sub-team of the SAE Baja competition team here at Youngstown State University. As a whole the three sub-teams, Frame, Suspension, and Powertrain, work together to design, manufacture, and build a UTV to compete at a national competition against over 100 other teams. In previous years Penguin Baja Racing has finished in the top 20 overall, and we are looking to continue to improve upon our ranking. This year the team will be competing with the first ever 4-wheel-drive vehicle made here at YSU.

The scope of the Powertrain team is to successfully design and manufacture the first 4-wheel-drive drivetrain system at Youngstown State University. The design process included optimizing and testing the 2019 car to modify the axles, the hubs and acquire boundary conditions to implement the changes required onto a new vehicle. Moreover, theoretical, and analytical analysis was carried out to ensure a working mechanical component throughout the design process. The new drivetrain designs consists of a redesigned rear gearbox, a front open differential, a driveshaft to transfer torque and power from the rear gearbox to the front differential, and new front and rear wheel hubs.

## 62 - 2021 YSU Baja SAE Frame

Dakota Griffin<sup>1</sup>, Steven Wethli<sup>1</sup>, Austin Watson<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Anthony Viviano*

Baja SAE is an international organization that hosts an annual competition for collegiate student teams to design, build and test a single-seat all-terrain vehicle. This competition is open to many international teams that compete in various static and dynamic events including cost reports, design briefings, acceleration tests, and maneuverability courses. Youngstown State University's 2021 Baja team will be implementing a four-wheel drive powertrain compared to a two-wheel drive powertrain from previous years. This has presented many challenges for the team, including a redesign of most of the components to accommodate the new drivetrain.

This specific sub team of students focused on the design and fabrication of the frame of the Baja car and the mounts supporting all the components. The design process began with a comparative study between previous frames and different frame types while looking to optimize the previous year's design to accommodate the four-wheel drive system. Finite element analysis (FEA) methods were used to optimize and analyze the frame components, as well as utilizing torsion testing to validate the FEA results.

## 71 - YSU Baja Suspension Team

Cody Joseph<sup>1</sup>, Leah Sardich<sup>1</sup>, Lynea Rivera<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Kelsey Lyda*

The purpose of the YSU Baja Suspension Team's Quest presentation is to outline the closed loop engineering design process of an off road vehicle's suspension and steering components. The Baja team at YSU participates in the annual Society of Automotive Engineers (SAE) Baja racing competition against teams from all around the world. These vehicles are both designed and built by a group of Mechanical Engineering students to eventually be raced in a series of courses that challenge each of the vehicle's components of Powertrain, Frame and Suspension. The suspension team's design process was split into three main categories: front suspension, rear suspension, and steering. The front suspension was designed using the Performance Trends software that simulates the most optimal mounting and assembly positions. The finished design for the front suspension was a double wishbone dual A-arm design made out of the lightweight material of 6061-T6. The rear suspension adapted to an H-arm as opposed to previous designs of a trailing arm. The H-arm suspension system was chosen for its lightweight characteristics and high resistance to lateral loads. This design process was also heavily motivated by weight savings prompting the use of 6061 T6 aluminum as well. In addition, the steering system of the vehicle was mostly custom and utilized materials such as titanium and aluminum. Equipped with a custom housing, rack and pinion, steering column, and 3D printed Carbon fiber steering wheel, the team had all the pieces of the puzzle to create the ultimate off-road suspension system.

## **6 - Selection of phage clones specific for cortisol**

Leo Puhalla<sup>1</sup>, Celeste Snyder<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences

*Faculty Advisors: Diana Fagan, Pedro Cortes*

Cortisol is an important steroid hormone secreted by the adrenal cortex in times of stress. It is the main glucocorticoid hormone in the human body and prolonged exposure to cortisol can have serious health implications. Thus, the quantification of cortisol concentration in the bloodstream is clinically relevant to the assessment of chronic stress and consequently, the prevention of several medical conditions. In previous studies, a phage library containing viruses displaying random peptides on their surface was tested to select phage clones that bound to cortisol. This study involved the amplification of cortisol-specific phage clones. A phage titer followed the amplification of each phage clone to determine the number of viable phages. The phage that is found to bind best to cortisol will be determined by conducting enzyme-linked immunosorbent assays (ELISAs).

## **16 - Investigation of Alternative Splicing in Potato [*Solanum tuberosum*] and *Phytophthora infestans* Interactions**

Jessica Lee<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences

*Faculty Advisor: Jack Min*

*Solanum tuberosum*, commonly known as the potato, is a staple crop in many areas around the world. *Phytophthora infestans*, a water mold, causes one of the most damaging of potato diseases known as late blight. In this project, RNA sequence data was collected from the SRA database in the National Center for Biotechnology Information (NCBI) that includes 36 RNA samples of *S. tuberosum* under different conditions: water-inoculated or *P. infestans*-inoculated, WT or +RB samples, and at 3 different time periods. WT samples represented non-transformed potatoes, while +RB samples contained the RB transgene, a disease resistance gene found to resist late blight disease development. The RNA-sequences gathered from this paper are then analyzed and mapped to the potato reference genome using software packages including Bowtie, Tophat, and Cufflinks. This allows for the identification of alternative splicing (AS), a process that produces variably spliced mature mRNAs from a single pre-mRNA sequence. These mature mRNAs go on to encode different proteins, and thus AS is necessary in increasing the transcriptome and proteome diversity in different organisms. The final AS genes identified in this project allow for a better understanding of *P. infestans* and *S. tuberosum* interactions and how the organism's tissues react to the pathogen.

## 18 - Project HOPE

Hunter Flati<sup>1</sup>, Dustin Moffett<sup>1</sup>, Julianna Sandine<sup>1</sup>, Emily Vo<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences

*Advisors: Frank Beck, Kathy LaMarco*

The Health and Opioid-Abuse Prevention Education, or HOPE, curriculum was developed for schools to present to students in grades K-12 in the form of lesson plans, worksheets, assessments, materials and resources, and ways to reach out for help. Our null hypothesis was that the pre-test administered before the curriculum and the post-test administered after the curriculum would show no change in knowledge. We chose a Random Sample of 9 classes from kindergarten homerooms, 16 classes from first-grade homerooms, 16 classes from second-grade homerooms, 16 classes from third-grade homerooms, 14 classes from fourth-grade homerooms, and 14 classes from fifth-grade homerooms; one of which being special education, to conduct our research. This data allows us to determine the effectiveness of implementing Project HOPE into other schools.

## 23 - Promoting Oligosaccharide Synthesis Using Enzymes Immobilized on a Chitosan-Silica Support

Brea Tinsley<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences

*Faculty Advisor: Nina Stourman*

Oligosaccharides are sugars composed of two or more monosaccharide subunits. Recently, they have become an interest in the pharmaceutical industry due to their prebiotic properties and ability to maintain a healthy gut balance in humans. Oligosaccharides can be synthesized using enzymes called glycosidases. Glycosidases are primarily responsible for the cleavage of glycosidic bonds via hydrolysis. However, they also simultaneously catalyze a process called transglycosylation – the transfer of monosaccharide moieties from one sugar to another – resulting in oligosaccharide formation. Transglycosylation activity is most favored at higher temperatures and pH; though free enzymes are less stable under these conditions. In this study, a chitosan-silica support is used to increase the stability of the enzyme during oligosaccharide synthesis. Using lactase as an enzyme, conditions which support transglycosylation are explored through variation of pH and temperature, the addition of solvents, and the incorporation of lactase in a two-component enzyme system. Results show that pH 8 and 50 °C enhance transglycosylation activity. Contrarily, in the presence of solvents, transglycosylation activity is inhibited and alkylglycosides are formed instead. Lastly, in a two-component enzyme system, oligosaccharide yields improve as lactase-glucose oxidase ratios increase.

## 36 - Evaluation of Conservation versus Conventional Tillage Methods in Trumbull County

Robert Perrotta<sup>1</sup>

<sup>1</sup>STEM, Geology and Environmental Sciences

*Faculty Advisor: Felicia Armstrong*

The environment supplies various ecosystem services, many that are provided by soil such as nutrient cycling, plant growth/food supply, water purification and carbon capturing. Soil supports a wide variety of organisms that, although we do not see it, have a great influence within our everyday lives. To maintain healthy soils and high crop yields, various agricultural processes and

techniques can be used. Two different techniques commonly used are conventional tillage of fields, and on the opposite end, conservation tillage or no-tillage fields. Reducing tillage along with other conservation methods such as cover-crops and crop-rotation, preserves soil's structure, increases organic matter, and increases nutrient and water holding capacity. It is hypothesized that agricultural fields that incorporate more conservation methods will result in different soil properties. Furthermore, the relationship between soil properties or soil health and the related benefits for agricultural and ecosystem services can have a monetary value. Soil samples were gathered from various farms in Trumbull County, Ohio, and then tested for organic matter, soil texture, bulk density, nutrients, pH and other properties using standard methods to gain an understanding of the characteristics of each soil. These characteristics were compared with the agriculture method used on the farm. Preliminary results indicate that soil salinity is lower in the conservational samples tested vs the conventional samples tested, lower salinity suggests less productivity restrictions to various crops. Understanding the value of healthy soil and taking the corresponding ecosystem services into account could provide a better understanding of soil's place within society.

## **41 - Investigation of muscle fiber architecture in burrowing desert rodents through the use of Dice-CT methods**

Lydia Johnson<sup>1</sup>, Branson Brownfield<sup>1</sup>, Claire Wycoff<sup>1</sup>, Amelia Sprague<sup>1</sup>, Jordan Fain<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences

*Faculty Advisor: Michael Butcher*

Pocket gophers, pocket mice, and kangaroo rats all dig burrow systems in similar desert ecosystems, yet only gophers demonstrate musculoskeletal modifications that are typical for digging mammals. It was hypothesized that pocket mice and k-rats have long muscle fibers and short in-levers, thus enabling them to cycle their limbs quickly. Using DICE-CT methods, fixed specimens of each animal were incubated in iodine and the forelimb musculature was imaged with CT technology. Muscle architectural properties such as muscle volume, area, and fiber length were measured digitally using Amira/Avizo software, and these metrics were compared to values determined from gross dissection. Precision is expected between the two techniques. The variation in muscle structure observed supports the biomechanical ability of mice and k-rats to use frequent yet efficient digging strokes.

## **51 - Optimization of Juggerbot 3D ME12c BETA**

Joshua Entrikin<sup>1</sup>, Jarod Zillinger<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Advisor: Zac Divincenzo*

The goal of this project is to analyze the Juggerbot 3D ME12c BETA to find deficiencies, comparing it to newer and similar machines, and seeing what can be implemented to make the machine run more efficiently. Part of this process will be disassembling the machine and then reassembling it to learn how each part functions. 2-3 different work plans will be written with varying levels of improvement in order to allow for different pricings for different plans.

## 52 - Distribution of Invasive Diatom *Discostella Asterocostata* in Mahoning and Shenango River Watersheds

Justine Wylie<sup>1</sup>

<sup>1</sup>STEM, Geology and Environmental Sciences

*Faculty Advisor: Colleen McLean*

Diatoms are unicellular microalgae that have cell walls made of silica that are easily identified to species level. Diatoms are found in aquatic (or moist) environments such as freshwater, saltwater, and soils. This research explores the distribution of an invasive freshwater planktonic diatom *Discostella Asterocostata* (D. A.) which was first observed in 2016 in Meander Creek Reservoir (MCR). Additional recent observations of this species have been reported in other North American lakes, specifically in Arkansas and Indiana. This species of diatom is native to regions of Asia, such as Japan, South Korea, Eastern China, and Southern Russia. For this study, 16 samples from 10 surface water bodies in Mahoning and Trumbull County Ohio and Mercer County, Pennsylvania were analyzed for the presence and relative abundance of *Discostella Asterocostata*. The results showed that this invasive diatom was not only in MCR, but also present in Berlin Lake, Mosquito Lake, Shenango River Lake, and West Branch Lake. Samples from Mahoning River are currently being analyzed as well. This expands D.A. sightings to include Ohio and Pennsylvania. Future sampling of other surface water bodies in this region would be beneficial to understanding the biogeographic spread of this diatom

## 53 - Health Literacy

Prabhleen Multani<sup>1</sup>, Mackenzie Lewis<sup>1</sup>, Jason Ngo<sup>1</sup>, Caitlynn Shaffer<sup>1</sup>

<sup>1</sup>STEM, Health Professions

*Advisor: Anthony Brine*

The motivation behind this literature review was to examine the effectiveness of communication between patients and physicians and to explore ways that physicians and patients can communicate more effectively. This study is comprised of case study reviews. The literature review helped to determine that the most effective form of communication between physicians and patients is the teach back method. This literature review suggests a need for different communication strategies between patients and physicians to enhance the quality of care.

## 55 - 2020-2021 AIChE Student Design Competition

Emily Cieslinski<sup>1</sup>, Brendan Swanson<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Douglas Price*

This project is assigned as the senior chemical engineering student capstone for spring of 2021. The problem statement is from the American Institute of Chemical Engineers (AIChE) Student Design Competition, however this specific project will not be submitted to the competition. The goal is to build and simulate a naphtha processing plant in Iraq, following all of the procedures as necessary and evaluating the economic and safety impact of this plant. Naphtha can be obtained from crude oil and processed into gasoline, benzene, toluene, and xylene, all of which can be sold for profit. The local and regional taxes will be taken into account when determining the financial aspect of this project. Safety for workers, the community, and the environment is another large focus, and the goal is to find an inherently safer design for the entire process. With all of these factors, the plant must run as optimally as possible, and will be built and simulated in the ChemCAD 7 program.

## 59 - Influence of Residential Land Use on Mahoning River Water Quality Near Levittsburg, Ohio

Stephen Premec<sup>1</sup>

<sup>1</sup>STEM, Geology and Environmental Sciences

*Faculty Advisor: Felicia Armstrong*

The introduction of anthropogenic pollutants throughout the Mahoning River system has impacted water quality conditions for nearly a century. Whether they come from industrial, rural, or urban sources, pollutants incorporate their way into the water column with potentially devastating effects. The loss of Youngstown's steel industry and increased water regulations have formed new concerns for pollutants such as bacteria, phosphorus, and solid content. Water samples were taken from 13 locations on the Mahoning River along the Meadowbrook Drive region. It is hypothesized that this region will have higher levels of solids, phosphate and E. coli due to the high number of aged septic systems in the area. Analysis for soluble phosphate, total Coliform, E. coli and solids was carried out according to standard procedures outline by *Standard Methods for the Examination of Waste and Wastewater* (20th ed). Findings from these analyses are compared to reference surface water conditions established by the Ohio Environmental Protection Agency (OHEPA) and similar significant literature. Concentrations for orthophosphate were found to be lower than predicted, with most averages well below regulative concerns for Harmful Algal Bloom (HAB) production or aesthetical degradation (between 0.01 – 0.04 mg/L as Total Phosphorus normally). Most Probable Number (MPN) averages for total Coliforms were found to be extremely high - as expected with a large natural surface water system. MPN averages for E. Coli were found to approach cautionary levels for primary contact situations (<126 CFU/100 mL) in 14 of the 26 samples taken. Additionally, 3 of the 26 samples taken were found to approach cautionary levels for secondary contact situations (<576 CFU/100 mL). Finally, solid concentration averages were found to be within acceptable range limits for surface waters, not causing high concern for turbidity issues that could potentially impact aesthetical conditions (<500 mg/L average) and biological development (<1,500 mg/L).

## 64 - Preparation of Chitosan Composite Films with Antibacterial Properties

Cailey Tingle<sup>1</sup>, Candis Booker<sup>1</sup>, Daniella Hosack<sup>1</sup>, Korey Kihm<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences

*Faculty Advisor: Nina Stourman*

Iodine is a potent antibacterial agent that does not cause microbial resistance. Application of iodine may be assisted by its incorporation within a membrane for slow release. Membranes made from biopolymer chitosan are proved to be safe and are widely studied for practical applications. Three types of chitosan composite films were created and tested against two types of bacteria, *E. coli* and *B. subtilis*. The disks of chitosan-starch film did not inhibit bacterial growth. The films prepared when iodine was added to the mixture before drying caused slight effect on bacterial growth. The greatest inhibitory effect on both types of bacteria was caused when pre-made films were soaked in iodine solution and then dried. Our research demonstrated that there is some potential to using chitosan composites in preventing bacterial growth. Of the chitosan composite mixtures tested, we found that the chitosan films with embedded cloth and soaked in iodine worked the best against both *B. subtilis* and *E. coli*.

## 65 - Monitoring Water Quality During Lowellville Dam Removal

Alyssa Armstrong<sup>1</sup>

<sup>1</sup>STEM, Geology and Environmental Sciences

*Faculty Advisor: Felicia Armstrong*

The Mahoning River is located in Northeast Ohio and extends into Pennsylvania before joining with the Shenango River. For most of the twentieth century the lower reach of the Mahoning River supported steel and coke industries as well as received untreated domestic sewage. Heavy metals, PCBs and PAHs were all deposited in the Mahoning River during that time. There are 15 dams along the Mahoning River that were once used to pool water for cooling industrial processes. Currently there are plans to remove nine of the low head dams to promote ecological restoration and provide better access to recreational activities. The legacy contaminated sediments have accumulated behind the dams which could be released during dam removal. Therefore, dredging is needed prior to dam removal to prevent the contaminants from being released and spreading downstream. The Lowellville dam is located close to the Pennsylvania border and is the first dam removed on the Mahoning River. Prior to removal, 10,000 cubic yards of sediment were dredged covering 1.2 miles upstream of the dam. Water was sampled prior to dam removal and during deconstruction of the dam. Analysis of the water focused on heavy metals, suspended sediment, and phosphorus to determine how dredging and dam removal effects transport. Results showed that only when there was a precipitation event did sediments increase downstream of the dam. Furthermore, other water parameters did not seem to be significantly affected by dam removal. Overall the dredging and the systematic removal of the dam did not adversely effect water quality downstream.

## 68 - QA-ROV (Quality Assurance-Remotely Operated Vehicle)

Cameron Pribulsky<sup>1</sup>, Jordan Brown<sup>1</sup>, Daniel Cash<sup>1</sup>, Joey Pezzano<sup>1</sup>, Drew Sevek<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Robert Caven*

Steel/stainless steel tubing manufacturing is a difficult process which means that imperfections are likely to occur. The QA-ROV's purpose is to allow quality assurance personnel the chance to fix any defects in the tube before the product gets sent out to the customer. The QA-ROV will allow inspectors to see inside the tube through a live video feed on a computer or android device from the vehicle. The vehicle will ride on 4 rubber wheels with two rear drive motors mounted to a 3D printed cylindrical chassis. A camera will be mounted at the front of the vehicle with LEDs to illuminate the interior of the tube. The design also uses a servo to raise and lower an arm that provides pressure to the drive wheels which will allow the vehicle to theoretically drive in any orientation. The QA-ROV will give the manufacturer a cost effective and relatively easy process to ensure that their customers will receive a quality product every time.

## 69 - Applications of Hydrophobic Metal-Organic Frameworks

Dale McGoogan<sup>1</sup>, Kaylee Ray<sup>1</sup>, Dane Abraham<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences

*Faculty Advisor: Doug Genna*

Numerous metal-organic frameworks (MOFs) have been developed to have a wide variety of potential applications, however, in the presence of water, the instability of MOFs limits their performance. This issue can be overcome by the development of stable, hydrophobic metal-organic frameworks. These hydrophobic MOFs have a low affinity for water, which makes them significantly more promising for diverse applications, some of which include: separating oil spills from water, the

separation of mixtures of naphtha/water, gasoline/water, and diesel/water, and humid CO<sub>2</sub> capture.

## **70 - Generation of Novel Training Materials for the Software OpenFOAM**

Sahaj Thapa<sup>1</sup>, Nathan Lin<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Kevin Disotell*

In the present work, a knowledge base was created with the purpose of teaching junior Mechanical Engineering students the open-source computational fluid dynamics (CFD) software OpenFOAM. OpenFOAM is a command-line based software, meaning it has no graphical user interface (GUI). This leads to a sharp learning curve when students unfamiliar with Unix-based operating systems want to learn how to run CFD cases in OpenFOAM. The goal of the present work is to flatten the learning curve by generating novel educational materials designed for students who understand the fundamentals of fluid dynamics but have no previous experience working with Unix-based operating systems or command-line interaction (CLI). The primary teaching material for this work consists of a series of six PowerPoint modules. Each module introduces new concepts to the student regarding OpenFOAM settings and usage, CLI, and CFD principles. The slides can be navigated independently or in a classroom setting by Mechanical Engineering students who have taken fluid dynamics (MECH 3720), as shown by trial runs of the modules with peers. CLI and command-line CFD solvers are commonplace tools both in academia and industry. By working with students to develop their knowledge on the basics of CLI and OpenFOAM, YSU will better prepare aspiring researchers and industry professionals for their career goals.

## **74 - Modulating the Mechanical Properties of pi-Conjugated Polymers With Hydrogen-Bonding Dopant Units**

Cole Sexton<sup>1</sup>, Anthony Romeo<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Christopher Arntsen*

Conducting polymers are usually comprised of highly crystalline, pi-conjugated materials that show extensive pi-stacking. This architecture is essential to the function of the material as an electron conductor: electrons are able to move along the backbone of the chain as well as hop between chains. However, the crystalline nature of these systems means that they are mechanically stiff. Wearable electronics, as those in implanted medical devices, require both efficient conductivity as well as mechanical flexibility. It has been shown that flexibility and elasticity in pi-conjugated polymers can be increased with the inclusion of H-bonding dopant units without destroying the favorable electronic properties. We therefore use molecular dynamics to model pi-conjugated polymers with variable amounts of the dopant units, studying the effect on the mechanical properties of such systems.

## 76 - Exploring the role of dopamine in biparental care in the burying beetles

Isabella Futchi<sup>1</sup>, Bailey Brocker<sup>1</sup>, Ali Haupt<sup>1</sup>, Carmen Panaitof<sup>1</sup>

<sup>1</sup>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 and even in many vertebrates. 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, the biogenic amines octopamine (OA), dopamine (DA) and serotonin (5-HT) are the most likely candidates to be involved in the neuromodulatory control of burying beetle reproductive and parental behavior. We previously measured brain levels of these monoamine in breeding (parental) and nonbreeding burying beetles and showed that after 24 hours of care, when parental feeding rates peak, DA (but not 5-HT or OA) levels increase significantly in parental beetles compared to nonbreeding, unmated controls. To further investigate the role of DA signaling in burying beetle reproduction and parental behavior we are currently investigating the tissue-specific distribution of dopamine receptors types. Our preliminary work indicates that dopamine receptor 2 (dopR2) can be detected in the beetle brain, as well as the fat body and female ovary. Ongoing work will use gene quantification experiments to detect changes in the dopR transcript levels during a breeding bout and correlate the levels of gene expression with the stages of parental care. Moreover, in related studies we will use a pharmacological approach to block DA signaling via a specific dopamine receptor antagonist, fluphenazine, and investigate any subsequent changes in parental behavior. Together, these findings will provide the first evidence for a potential role of DA in the modulation of biparental behavior in an invertebrate model.

## 77 - Integrated Design Project: Geotechnical

Jacob Stellers<sup>1</sup>

<sup>1</sup>STEM, Engineering

*Faculty Advisor: Richard Deschenes*

In this project, I designed the geotechnical aspects of an industrial plant. The topography of the site had to be altered to accommodate the design requirement of the building being at an elevation of 1040 ft. above sea level. Work was done alongside the hydrology and transportation engineers to determine the grade of the parking lots and surrounding land to account for water drainage. An analysis of the provided boring logs was performed in order to determine the bearing capacity using Terzaghi's equation and the general bearing capacity equation at the depth of the bottom of the footings which is 3.5 ft. below 1040 ft. Collaboration was done with the structural engineer on the project to find preliminary loads on the footing. Square and strip footings were designed based off of the bearing capacity of the boring log closest to the location of the footing.

## 80 - Plant Growth in Simulated Mars Soil using Different Amendments

Scott Erb<sup>1</sup>

<sup>1</sup>STEM, Geology and Environmental Sciences

*Faculty Advisor: Felicia Armstrong*

If humans ever plan to colonize Mars, many factors have to be considered. One of those is how to reuse materials from recycling water to making use of the waste in a beneficial way. Biosolids are produced from the treatment of waste water whereas drinking water residuals are from drinking water treatment. These two materials, in addition to commercial fertilizer and an untreated control were used in simulated Mars soil to grow radish and kale. Another requirement for colonizing Mars is maintaining a food supply and plant growth. The simulated Mars soil is composed of crushed and sieved iron-rich basalt developed in 2007 by NASA and JPL Scientist (Mojave Mars simulant). The biosolids-soil has high amounts of nutrients and is hypothesized will have the most plant growth. Each treated soil and control were tested for pH, conductivity, organic matter, phosphorous, and ammonia, these different soil parameters indicate an overall fertility of the soils. The plants were grown to maturity, harvested, and weighed as a measure of plant success. A high percentage of seed germination was seen in the soils with added drinking water residuals and commercial fertilizer while the biosolids had fewer germinated seeds. This could be due to the biosolid soil's high pH which prevents seeds from germinating and plants from absorbing key nutrients from the soil. The treatment that had the highest plant growth was the commercial fertilizer. The results suggest that the Mars soil simulant would require several seasons to develop a more diverse environment including introduction of a microbial community to help cycle nutrients.

## 92 - Effectiveness of Various Materials used for Phosphate Removal

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*Faculty Advisor: Felicia Armstrong*

Phosphate water pollution is a concern in many regions of Ohio. Sources of phosphate include agricultural runoff, animal runoff, sewer runoff and other sources. When the phosphate gets into waterways it can cause algal blooms which can be detrimental to aquatic life. If the phosphate can be removed in tributaries before reaching major waterways, it can prevent these adverse effects. Our goal is to identify readily available low-cost materials that are efficient phosphate removers. Three materials were evaluated using phosphate adsorption isotherm. Drinking water residuals (DWR) were found to have the highest adsorption capability and removal efficiency. We will be evaluating them further for in-stream removal of phosphates. DWR form when coagulants composed of aluminum- or iron-based chemicals react with suspended solids during drinking water treatment process. The resulting residuals have the ability to bind with phosphate thereby removing phosphorus from runoff waters reducing adverse effects.

## 94 - The Rate Effects of Crosslinking Species and Degree on Antibiotic Delivery via Chitosan Scaffold

Thomas Drabison<sup>1</sup>

<sup>1</sup>STEM, Chemical and Biological Sciences

*Faculty Advisor: Nina Stourman*

Chitosan is a derivative of the structural biopolymer Chitin, which is naturally occurring in the exoskeleton arthropods and cell walls of fungi. Its chemical properties can be exploited to develop structural support systems for enzyme immobilization, protection against harsh environments, and drug delivery. Previous work has established that chitosan thin films may be created for the purpose of antibiotic loading and delivery, but it does not examine the rate at which this process happens. Chitosan thin films were developed using three different type of crosslinker (glutaraldehyde, tannic acid, and vanillin) at varying degrees of crosslinking. These films were then exposed to a saturated solution of chloramphenicol to determine loading capacity. Elution rates were determined in a similar fashion by exposing the loaded film to DI H<sub>2</sub>O. By gravimetric determinations, the amount of chloramphenicol loaded and subsequently eluted was found. These results were then able to be related to Newton's Law of Cooling to develop rate relationships amongst these variables. It was found that the degree of crosslinking has little effect on loading capabilities but has an inverse relationship to elution capabilities of the thin films. Further study may be carried out to explore the effects of pH, concentration of chloramphenicol solution, and structure of antibiotic on loading and elution capabilities.

## 104 - Cell Proliferation Studies of CC2C12 Cell Cultures

Balakrishna Brahmandam<sup>1</sup>, Melody Castner<sup>1</sup>, Madison Barton<sup>1</sup>, Harmeet Kaur<sup>1</sup>, Dominic Schroeder<sup>1</sup>, Marina Merlo<sup>1</sup>

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*Faculty Advisor: Gary Walker*

Rate of cell proliferation helps determine percentage of cells that grow as one layer on the surface of culture plates at any point in time. It acts as a guide as to when cells must be moved to ensure continuous growth. Each cell line has a unique proliferation rate.

The purpose of this project is to determine the rate of proliferation in myogenic stem cells, C2C12 cells, and the time to reach confluence. Myogenic stem cells were grown and cultivated in six well plates with a defined complete medium. Using the Cytation® cell imaging system, daily micrographic images were taken in three spots of each well to provide a holistic view of how long the cells took to reach confluence and the number of cells that grew in each well.

The results display the rate of confluence of myogenic stem cells, the time it takes to reach confluence, and the number of cells that grow in that time.

## 106 - Effect of Mesenchymal Stromal Cells (MSC) and Platelet Rich Plasma (PRP) on Rat Achilles Tendon Repair

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The calcaneal (Achilles) tendon is the largest and strongest tendon in the human body. Composed of primarily type I collagen, it is capable of handling tremendous loads during locomotion. However, with increased cases of Achilles tendon ruptures in recent years, coupled with long recovery periods and high incidence of re-rupture, there exists a need for new treatment methods aimed to improve and accelerate tendon healing. We have investigated the effect of collagen, platelet-rich plasma (PRP), and mesenchymal stromal cell (MSC), used in combination, on healing a complete Achilles tendon rupture using a Lewis rat model. The PRP was prepared using blood collected during exsanguination. The MSCs were obtained from the long bones of the rats, cultured under standard culturing conditions, and passaged three times. A differentiation assay on the MSCs has shown that they were capable of differentiating to muscle, fat, and cartilage cell lineages. Rupture was simulated by surgically transecting the tendon 6mm proximal to the calcaneus insertion, followed by surgical repair. All treatment receiving rats had a 20x30 mm piece of CollaTapetm wrapped around the repaired tendon before closing the incision. A single 100µL injection of MSCs, PRP, or a combination of both were administered subcutaneously adjacent to the incision. The rats were assigned 1- or 2-week recovery periods before harvesting both the operated and unoperated rat tendons. The biomechanical properties of the tendons were determined using standard force-extension analysis, and a subset of 2-week recovery tendons were used for collagen RNA analysis. When normalized as a percent of the control tendon, a significant improvement was seen in the ultimate tensile strength and the strain at failure after one week of recovery in the rats who received treatment using all three biologics in combination.

## 108 - Characterization of a New Open-Jet Wind Tunnel

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A boundary-layer wind tunnel has been converted to an open-jet facility at Youngstown State University. The open-jet facility is capable of achieving velocities of up to 35 m/s. This research consisted of assembling and installing a two-axis system in the open-jet test cell and utilized a Pitot-static tube, hot-wire anemometer, and a 3-D sonic anemometer, to measure the modified test cell flow quality in support of future air mobility systems testing.

## 110 - Soil Health and its Relation to Agricultural Practices

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*Faculty Advisor: Felicia Armstrong*

Maintaining soil health is an increasingly important factor for agriculture. Soil health is the ability of the soil to function with respect to the soil ecosystem that supports plants, animals, and humans. Part of healthy soil is having an active, diverse microbial community. The soil microbial community is responsible for processes like water cycling, nutrient cycling, nutrient availability, and decomposition of plant litter and residues into soil organic material (SOM). One method to measure soil microbial activity is through respiration and the release of carbon dioxide (CO<sub>2</sub>). The level of microbial activity is directly related to the stability of the soil system, and the physical and chemical environment of the soil. It is hypothesized that conservation agricultural methods will result in higher soil microbial activity due to the higher organic matter, less tillage, and more plant diversity as compared to conventional agricultural methods. Three fields in Trumbull County, Ohio were sampled in replicate, each with different agricultural practices. The fields included a sweet corn field

that utilized cover crops, a fallow field of daikon radishes, and a cornfield in a crop rotation that just began using cover crops. Water was added to the dried soil and placed in a mini-isolation chamber and allowed to equilibrate. A Vernier Labquest with a CO<sub>2</sub> sensor was used to measure soil respiration over a 6-8 hour time frame. Once the CO<sub>2</sub> levels stabilized, readings were averaged over the stable period. The second round of tests included the addition of nitrogen fertilizer to amplify the microbial activity in the soil. Additional soils from other farm fields will be tested to further expand on the understanding of how agricultural methods influence soil microbial activity.

## 111 - Measurement of Mitochondrial DNA for the Observance of Inheritance

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*Saccharomyces cerevisiae* is a facultative anaerobe. Wild type cells with a normal mitochondrial genome ( $\rho^+$ ) can aerobically respire or ferment. Cells with truncated mitochondrial genomes ( $\rho^-$ ), with a mtDNA mass equivalent to  $\rho^+$ , and cells lacking mtDNA ( $\rho^0$ ) can only ferment.  $\rho^-$  cells may contain unique conserved rep sequences. When a  $\rho^+$  is mated with a neutral  $\rho^-$ , the offspring is respiring  $\rho^+$ . Hypersuppressive  $\rho^-$  (HS  $\rho^-$ ) has the opposite effect when mated with  $\rho^+$ , resulting in all  $\rho^-$  offspring. Hypersuppressive strains contain rep sequences opposed to neutral  $\rho^-$  strains which lack it. MGT1 (CCE1) cruciform cutting endonuclease is involved in the resolution of Holliday junctions during recombination and may contribute to hypersuppressiveness. When MGT1 function is disrupted (knocked out -  $\Delta$ mg1), hypersuppressiveness is lost. The loss of hypersuppressivity may be due to a complication in replication or segregation. To test this aspect, wild type will be mated to neutral  $\rho^-$  and HS  $\rho^-$ . Two strains SSHS3324 (HS  $\rho^-$ ) and BS127 23-3 (neutral  $\rho^-$ ) are evaluated for MGT1 inheritance using  $\Delta$ mg1 variants. Additionally, some  $\rho^-$  cells lose their mtDNA when MGT1 is knocked out. Cells must contain significant amounts of mtDNA for mating experiments. Previously DAPI staining was used to measure mtDNA in SSHS3324 and BS127 23-3. A more quantitative approach to measuring mtDNA is qPCR. These results may be compared to the DAPI stain to verify the accuracy of visual results.

## 112 - The Effect of Land Use on Yellow Creek Ecosystem

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The Yellow Creek watershed begins in northeast Columbiana County and expands north into eastern Mahoning County then flows into the Mahoning River near Struthers, Ohio. Through the two counties and many townships where the watershed is located, many different land uses occur from urban to rural each impacting the Yellow Creek ecosystem. Water and macroinvertebrate samples were gathered at four locations, each with different land uses. It was hypothesized that the agricultural area would have the greatest negative impact on the creek with higher pollutants (phosphorus, bacteria) and lower amount of macroinvertebrate diversity. Macroinvertebrates are commonly used as an indicator of the biological condition of waterbodies. Water analysis included temperature, pH, conductivity, phosphorus levels, biochemical oxygen demand, dissolved oxygen and bacteria (Total Coliform and Fecal Coliform). These parameters give important information on the environmental conditions for aquatic life as well as an indicator for potential sources of

pollutants (agricultural runoff from nearby farms, industrial runoff, erosion and sediment). Two macroinvertebrate samples at each location were gathered, identified, and counted using the kick net method. The species collected and a biotic index was used to determine which site and land use had a greater effect on the watershed. Both water analysis and macroinvertebrate indexes indicated the agricultural site were lower than either the forested, industrial or residential sites.

## 114 - Crab Creek Water Quality Analytics

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Water quality is an important part of the overall health of an ecosystem. Not only do all organisms on land need access to clean water but all aquatic life requires a strict set of parameters to survive, any shift in these can lead to the die off of different species. Crab Creek is a small tributary of the Mahoning River running adjacent to several industrial areas. This tributary is important to study as the pollution of the tributary directly affects the overall health of the Mahoning River. Given Youngstown's industrial past, Crab Creek's water quality was tested and a determination as to the health of the tributary was made. To test the water, eleven parameters were decided upon to monitor. These parameters were: coliform and E. coli, phosphorus, biological oxygen demand, solids, ammonia, nitrate, temperature, pH, and conductivity. Samples were then taken at multiple sites and analyzed in the laboratory to determine whether they were above or below the normal threshold. In addition to sampling, an EXO Sonde Water Monitoring device was deployed in the field to continuously monitor additional information. It was hypothesized that areas with concentrated industrial activity would have lower overall water quality as determined by Ohio EPA warmwater habitat standards as compared to those upstream away from the industrial activity. With this in mind, the information gathered through this research can be indicative of the water quality of other tributaries near industrial sites running into the Mahoning River.