

11th Annual

RESEARCH SYMPOSIUM

2024



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| **ENGINEERING ABSTRACT** |
| **1** |

**OPTIMIZING BUILDING OCCUPANCY PREDICTIONS THROUGH COMPARATIVE TIME-SERIES ANALYSIS AND MACHINE LEARNING INTEGRATION**

Bassam Abdelghani, Ahlam Al Mohammad, Shadi Banitaan\*, and Mina Maleki\*

Department of Electrical and Computer Engineering, University of Detroit Mercy

Accurately forecasting building occupancy is crucial for optimizing energy consumption, enhancing occupant comfort, and improving space utilization in smart buildings. This study presents a comprehensive approach to predicting building occupancy using a nine-month Wi-Fi user count dataset comprising 6,600 data points. We employed advanced time-series forecasting techniques, specifically hyperparameter-tuned LightGBM models with exogenous variables, to capture long-term trends and short-term fluctuations in occupancy patterns.

Rigorous data preprocessing—including handling missing data and addressing non-stationarity—and extensive feature engineering were conducted to extract key temporal features such as time-of-day, day-of-week, and cyclical calendar variables. Several models, including LightGBM, SARIMAX, and LSTM, were evaluated across various optimization techniques, data frequencies, locations, window sizes, and time frames. Hyperparameter tuning via Bayesian optimization further improved model performance.

The hyperparameter-tuned LightGBM Regressor with exogenous variables emerged as the top performer, showcasing its efficiency by achieving a mean absolute error (MAE) of 0.37, mean squared error (MSE) of 0.65, and root mean squared error (RMSE) of 0.80. This represents a significant 75\% reduction in MAE compared to the baseline model. The SARIMAX model also significantly improved, reducing errors by 23\% and effectively capturing seasonal patterns. These results underscore the effectiveness of integrating detailed temporal features and optimized model parameters in enhancing occupancy predictions, demonstrating the research's practical impact.

Our findings contribute to the theoretical understanding of building occupancy forecasting and provide a scalable solution for building management systems. This research offers tangible tools for professionals in smart buildings and energy efficiency, emphasizing the importance of model selection, hyperparameter tuning, and exogenous features in time-series forecasting.

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| **ENGINEERING ABSTRACT** |
| **2** |

**REPLICATION AND VALIDATION OF KKT OPTIMIZATION FOR COUPLED PHASE-SHIFT STAR-RIS**

Bassam Abdelghani, Muhammad Muzammil Ijaz, and Mariam Faied\*

Department of Electrical and Computer Engineering, University of Detroit Mercy

This study presents a detailed replication and validation of a KKT-based optimization framework applied to Simultaneously Transmit and Reflecting Reconfigurable Intelligent Surfaces (STAR-RISs). Originally proposed as a novel approach to enhance wireless communication by simultaneously transmitting and reflecting signals, STAR-RIS introduces complex optimization challenges due to the coupling of phase shifts for transmission and reflection. The original work developed a Penalty Dual Decomposition (PDD) framework to solve this non-convex problem, guaranteeing the Karush-Kuhn-Tucker (KKT) optimal solution under specific conditions. The proposed methodology was reimplemented using MATLAB in this project, and the results were validated against the original findings. Our replication confirmed the algorithm's convergence, achieving the same optimal throughput and phase-shift differences as in the original study. This work demonstrates the effectiveness of KKT conditions in optimizing non-convex problems and underscores the importance of reproducibility in advanced optimization techniques for modern wireless systems.

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| **ENGINEERING ABSTRACT** |
| **3** |

**DEVELOPING AN AUTOMATED DIAGNOSTIC TOOL FOR EARLY DIABETES DETECTION USING MACHINE LEARNING TECHNIQUES**

Alka, Clem Fortemps, Mina Maleki\*

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Diabetes remains a rapidly growing global health concern, posing serious risks if not managed effectively. Accurate prediction and early diagnosis are critical for effective disease management and prevention. This capstone project aims to develop a predictive model for diabetes diagnosis by leveraging data mining and machine learning techniques to analyze risk factors and identify key indicators of the disease. Additionally, it contributes to the creation of a robust, automated diagnostic tool to support healthcare professionals in early disease detection, ultimately helping to reduce the prevalence and impact of diabetes through timely intervention. The study investigates the application of various machine learning algorithms, including K-Nearest Neighbors (KNN), Decision Trees (DT), and Deep Learning (DL), to enhance prediction accuracy. The performance of these classifiers is evaluated based on key metrics, including precision, recall, and overall accuracy. Initial findings on a commonly used diabetes dataset indicate that DL models consistently achieve the highest accuracy, underscoring their effectiveness in predicting the onset of diabetes. Furthermore, this research emphasizes the importance of feature selection approaches in improving machine learning performance, ensuring that only the most relevant indicators are utilized in the predictive model.

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| **ENGINEERING ABSTRACT** |
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**OCCUPANCY PREDICTION: A COMPARATIVE STUDY OF STATIC AND MOTIF TIME SERIES FEATURES USING WIFI SYSLOG DATA**

Bassam Abdelghani, Ahlam Almohammad, Mina Maleki\*

Electrical & Computer Engineering and Computer Science Department, University of Detroit Mercy

Occupancy prediction has been the subject of ongoing research, employing various methods and data sources to improve occupancy prediction accuracy and energy efficiency in buildings. Precise occupancy prediction is crucial for optimizing energy usage, ensuring occupant comfort, and enhancing building management. With the increasing demand for intelligent building management systems, robust and accurate occupancy prediction models are becoming more critical. This study aims to predict building occupancy using WiFi Syslog files from three different datasets: an open-source dataset from the University of Massachusetts Dartmouth, a new locally collected dataset from the dental school at the University of Detroit Mercy, and finally, a dataset from an office building in Berkeley, California. Two types of features, static features, and MOTIF time series features, were extracted from the datasets to process and compare their performance in occupancy prediction.

The first step of the proposed framework consisted of selecting the most suitable time range to compare occupancy prediction models between different datasets. It was concluded that this analysis was best conducted semester by semester. Multiple regression algorithms, such as random forest and LightGBM, were applied in the following step, along with advanced ensemble techniques, including stacking and blending, to assess the model. The stacking regression showed the best results for static features across all datasets. It achieved a Coefficient of Determination ($R^2$) of 0.9540 in the first dataset, 0.9482 in the second, and 0.9977 in the third. For MOTIF features, however, the best algorithm depended on the dataset. All algorithms performed similarly in the first dataset, with $R^2$ of 0.956. In contrast, LightGBM and the Stacking Regressor had better results than the others in the second dataset, with a low $R^2$ of 0.531 due to dataset-specific differences. The stacking regression once again delivered the best results in the last dataset with an $R^2$ of 0.9967.

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| **ENGINEERING ABSTRACT** |
| **5** |

**NON-INTRUSIVE OCCUPANCY DETECTION USING WI-FI SIGNALS FOR ENERGY EFFICIENCY**

Swetha Gracy Felix Martin, Kavin Selvaraj, Sujithra Sundaran, Balamurali Muthuraj, and Mina Maleki\*

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Buildings account for a significant portion of total energy consumption, with HVAC systems responsible for more than half of this usage. Traditional HVAC systems operate on fixed schedules, leading to wasted energy when occupancy levels fluctuate. Current Smart Building Energy Management Systems (BEMS) often require privacy-intrusive sensors, limiting adoption. This project explores a non-intrusive, low-cost alternative using Wi-Fi-based occupancy detection by leveraging existing Wi-Fi infrastructure. Occupancy is estimated by analyzing the presence of electronic devices through their connection to the Wi-Fi network, using fluctuations in Wi-Fi signal strength and device logs to detect real-time occupancy. This enables more efficient and responsive HVAC control without the need for intrusive sensors. Data mining techniques are applied to large Wi-Fi signal datasets to identify patterns that can optimize energy management. A notable component of the study involves testing these methods on datasets from the Mechanical Engineering Department at the University of Detroit Mercy to evaluate the system’s effectiveness in real-world settings. This research offers a scalable, privacy-friendly solution for reducing energy consumption in buildings while maintaining occupant comfort.

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| **ENGINEERING ABSTRACT** |
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**LUNG CANCER PREDICTION USING MACHINE LEARNING MODEL**

Baskaran Palanisamy, Ashok Kumar Parihar and Manav Shah, and Mina Maleki\*

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Lung cancer is among the deadliest cancers and increasing survival rates require early detection. Our goal is to develop a machine learning model to assess an individual’s risk of developing lung cancer by analyzing factors such as age, gender, smoking history, and exposure to the environment. Identifying high-risk individuals will enable medical practitioners to prioritize them for early diagnostic tests and treatment.  We utilized a lung cancer dataset containing 1,000 samples and 26 attributes. During the data preprocessing phase, we focused on cleaning and preparing the data by addressing missing values and transforming categorical variables such as smoking status and gender into a suitable format for model interpretation. Furthermore, we scaled numerical data, including weight, smoking history, and age, to ensure optimal model performance. Next, several classification algorithms were employed, including Random Forest, Support Vector Machine (SVM), and Logistic Regression, to predict lung cancer. These models were compared and evaluated based on metrics such as accuracy, recall, precision, and Area Under the Curve (AUC) to assess their predictive performance, which could provide valuable insights into lung cancer risk. Moreover, we analyzed the key features influencing the predictions, as they may offer crucial information regarding lung cancer risk and contribute to early identification, ultimately saving lives and reducing medical costs.

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| **ENGINEERING ABSTRACT** |
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**ENHANCING THE UNIVERSITY OF DETROIT MERCY FACULTY REIMBURSEMENT MANAGEMENT SYSTEM**

Ethan Scheys, Eyiara Oladipo, Andre Price, and Mina Maleki\*

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The reimbursement management system project at Detroit Mercy’s College of Engineering and Science aims to streamline faculty expense submissions. Current reimbursement procedures require faculty to manually record expenses in Excel, export as PDFs, and route them through designated channels, creating inefficiencies and risk of error. This platform allows faculty to efficiently create, manage, and submit reimbursement requests while tracking academic expenses. An integrated Optical Character Recognition (OCR) feature automatically extracts data from receipts, minimizing manual input and reducing submission errors. Additionally, a centralized administrative portal enables oversight and tracking, ensuring smooth, real-time communication and streamlined workflows. Built on Vue.js, Node.js, and MongoDB, this system offers a secure, responsive solution that optimizes the reimbursement process and enhances user experience across the college

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| **ENGINEERING ABSTRACT** |
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**ENHANCING MULTI-FLOOR INDOOR LOCALIZATION ACCURACY USING FINGERPRINT-BASED DYNAMIC K-NN APPROACH**

Benyamain Yacoob, Daniel Marku, and Mina Maleki\*

Electrical & Computer Engineering and Computer Science Department, University of Detroit Mercy

Accurate indoor positioning is essential for a variety of applications, including navigation, asset tracking, and enhancing user experiences in smart environments. This research contributes to the advancement of reliable indoor positioning systems using Wi-Fi received signal strength (RSS) fingerprinting approach for multi-floor environments, effectively addressing challenges related to access point (AP) placement, signal variability, and diverse spatial contexts. Our primary contributions include a voting scheme for floor differentiation and a dynamic neighbor selection technique for user localization, both integrated within a k-nearest neighbors (k-NN) framework. The method employs floor-specific filtering and normalization to address RSS distribution variations across different floors. We tested our approach on a dense and a sparse dataset collected from three floors of an engineering building, featuring diverse room sizes and layouts. By enhancing our voting scheme with additional components, we achieved robust performance improvements, increasing floor differentiation accuracy from 99.82% to perfect accuracy in the dense dataset, and from 94.93% to 97.46% in the sparse dataset. Furthermore, our localization accuracy improved, yielding a mean distance error of 1.53 meters, with 42 out of 85 (52%) test samples falling within this average.

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| **ENGINEERING ABSTRACT** |
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**IMPLEMENTATION OF AN INTERPOLATOR ON AN OPEN-ARCHITECTURE CONTROLLER OF CNC MACHINES**

Jesus J. Isias and Mostafa Mehrabi\*

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The feeddrive system is an important component of CNC machines and its performance plays a key role in the accuracy and precision of the entire machining system. This research work reports on progress made on development of an open architecture control system that will be used to control the machine. The advantage of the design is on its open architecture that allows any new software or hardware to be integrated into this existing platform. Currently, the hardware and software structure are designed and developed. This poster presents some preliminary results obtained when a circular interpolator is designed and implemented on this platform. The experimental results obtained are reported.

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| **ENGINEERING ABSTRACT** |
| **10** |

**DEVELOPING AN OPEN-SOURCE AUTONOMOUS DRIVING PLATFORM THROUGH THE INTEGRATION OF A ROS2 INTERFACE INTO A WOODPECKER ELECTRIC VEHICLE**

Oriekaose Agholor, Andrew Pries, Brandon Smith, Edrees Ahmed,and Utayba Mohammad\*

Electrical & Computer Engineering and Computer Science Department, University of Detroit Mercy

In the past decade, many efforts have been directed at developing autonomous vehicles, with the Robot Operating System (ROS) being a cornerstone in the development process. However, ROS, being an open-source platform, and the vehicle’s architecture, being a proprietary system, resulted in proprietary autonomous solutions that can’t be used for public domain research. In this project, a basic fully open-source research platform for autonomous vehicles is integrated. The Woodpecker is an open-source Electric Vehicle (EV) platform with full access to all its Electronic Control Units (ECUs). However, it has no interface to ROS or any other autonomous operating systems, as it uses the industry standard communication bus, Controller Area Network (CAN) for communication and control processes. This research integrates the woodpecker vehicle with the most up-to-date version of ROS - ROS2. A Raspberry Pi along with CAN-HAT modules are connected to the vehicle’s CAN bus and connects to a ROS2 system over WiFi. ROS2 is used to capture driving commands from an Xbox joystick and deliver proper CAN messages through the Raspberry Pi module. The setup demonstrates full control over the vehicle’s steering, braking and acceleration through the ROS2 open communication model.

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| **ENGINEERING ABSTRACT** |
| **11** |

**OPTIMIZED ROAD IMAGE PRE-PROCESSING FOR THRESHOLDING AND SEGMENTATION USING GENETIC ALGORITHMS**

Abdulaziz Allahdan, and Mark Paulik\*

Department of Electrical and Computer Engineering, University of Detroit Mercy

This project delves into the development of a new image preprocessing method designed specifically for improving lane detection in autonomous driving systems. The goal is to optimize key parameters of the preprocessing pipeline using a Genetic Algorithm (GA) to enhance road image clarity and make them more suitable for the advanced algorithms that help self-driving cars interpret their surroundings. The approach combines bilateral and homomorphic filtering to address the problem of inconsistent lighting, which can obscure vital lane lines. By leveraging GA, the project aims to fine-tune the filtering parameters to maximize edge sharpness and contrast, ultimately improving the accuracy and robustness of lane detection. The success of this method could significantly boost the performance of lane detection technologies, which are essential for the safe and efficient operation of autonomous vehicles.

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| **ENGINEERING ABSTRACT** |
| **12** |

**A FINITE STATE MACHINE FRAMEWORK FOR REAL-TIME GAMEPLAY: AN FPGA IMPLEMENTATION INSPIRED BY RED DEAD REDEMPTION 2**

Ricardo Tapia Vargas, Joseph Messina, and Mark Paulik\*

Department of Electrical and Computer Engineering, University of Detroit Mercy

With video games becoming more advanced every day, high frame rates and realistic graphics have become the new standard for gaming. But one question remained: Would a modern video game still be exciting if it were made using the mechanism of the first games from the 1970s? To achieve this, we created our own finite-state machine game in hardware using a Field Programmable Gate Array (FPGA) board. Our game was based on the Western hit Red Dead Redemption 2 created by Rockstar Games. Players navigate as an outlaw and can travel through multiple cities, all through the use of carefully set up and designed state machines in the code. Along the way, the player can acquire items- moonshine, a repeater, a revolver, and cash- while evading multiple threats. As the player progresses, they can fully interact with each city through dialogue and certain button presses on the FPGA board. Additionally, the FPGA board supplies real-time feedback and displays everything the player needs to know about their on-hand items and their location. All of this encompasses our true goal, to take the new-age video game excitement from a beloved game and recreate that same exciting feeling in the format that was used by the first digital game players. The final game was coded in the SystemVerilog hardware description language, simulated and downloaded to the target hardware board.  As part of our mission to create an exciting game, we spent countless hours playing RDR2 to ensure that we got our details correct and created a breathtaking storyline. The last part of our research encompassed training AI (ChatGPT) to talk like a cowboy, using data from characters from RDR2 especially Arthur Morgan, to help us write a more immersive and accurate storyline.

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| **ENGINEERING ABSTRACT** |
| **13** |

**DEVELOPMENT OF AN IMPEDANCE TUBE FOR MESASURING THE ACOUSTIC PROPERTIES OF MATERIALS**

Lias Rayess1, Christian Yalda2, and Nassif Rayess2\*

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2Department of Mechanical Engineering, University of Detroit Mercy

Measuring the acoustic properties of materials is essential for effective noise control, particularly in creating comfortable and functional living spaces. Sound, as acoustic energy, needs to be absorbed to reduce echo and ensure clear speech communication. In a typical room, materials like carpets, furniture, and drop ceilings help absorb sound. Without this energy absorption, rooms can become acoustically uncomfortable, making it difficult to hear clearly and causing an unpleasant auditory experience.

Effective acoustic design relies on quantifying the absorption coefficients of all surfaces in a space. The absorption coefficient is a measure of how much sound energy is absorbed by a surface compared to how much is reflected back. If a surface reflects all the sound energy, its absorption coefficient is zero, indicating no absorption.

Conversely, if all the sound is absorbed and none is reflected, the absorption coefficient is one, meaning total absorption. Most materials fall somewhere in between, with their absorption coefficients varying based on their ability to absorb and dampen sound.

The absorption coefficient of materials is measured using an impedance tube, a device equipped with a speaker at one end and a material sample at the other. The sound intensity inside the tube is captured by two microphones placed flush along the tube’s interior, allowing for precise measurement of how much sound energy is absorbed by the material. A key feature of this design is its use of readily available, off-the-shelf schedule 80 PVC tubing and accessories, making the impedance tube both cost-effective and modular.

This poster outlines the design of the impedance tube, which is currently under construction and will undergo testing in Winter 2025 to ensure it meets the relevant standards. The goal is to provide a practical, low-cost solution for accurately measuring the acoustic properties of materials, contributing to improved noise control and acoustic design in a variety of applications.

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| **ENGINEERING ABSTRACT** |
| **14** |

**ENERGY MODELING – COMBATING CLIMATE CHANGE ONE BUILDING AT A TIME**

Firas Safar, James Kamau, and Nassif Rayess\*

Department of Mechanical Engineering, University of Detroit Mercy

Energy efficiency in buildings plays a significant role in reducing greenhouse gas emissions, but while personal actions like turning off lights, adjusting thermostats, and managing natural light can help, they only have a limited impact in inefficient buildings. Major sources of energy consumption, such as lighting, heating, cooling, and equipment, are responsible for a substantial portion of greenhouse gas emissions. For example, in Michigan, one kilowatt-hour of electricity results in 0.86 pounds of CO2 emissions and burning 100 cubic feet of natural gas releases 5.5 pounds of CO2. In a typical 10,000-square-foot office building, this can amount to over 100,000 pounds of greenhouse gases annually. Upgrading major energy consuming systems often requires significant capital investment, making it critical to evaluate the potential energy savings and environmental benefits before committing to improvements. With support from the U.S. Department of Energy's Renew America’s Nonprofit grant, the authors have developed a protocol using OpenStudio building energy modeling software to assess the impact of energy upgrades. This approach, demonstrated on a nonprofit building in Detroit, highlights the potential for substantial reductions in both energy costs and greenhouse gas emissions. By modeling energy use, decision-makers can ensure that investments in energy efficiency not only reduce operational costs but also contribute to significant decreases in greenhouse gas emissions, making buildings more sustainable and environmentally responsible.

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| **ENGINEERING ABSTRACT** |
| **15** |

**DEVELOPMENT OF TWO-DEGREE-OF-FREEDOM VIBRATION SYSTEM TO DIGITAL TWINNING TECHNIQUES AT FREQUENCIES ABOVE 20 HZ**

Shangran Xu and Nassif Rayess\*

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Digital twins for vibration systems create a dynamic, real-time model of physical systems affected by vibrations, like machinery, buildings, and vehicles. Using sensor data from these systems, a digital twin replicates behavior, and vibration response under changing conditions. Essential for predictive maintenance and structural health monitoring, digital twins help in anticipating wear, preventing failures, and ensuring system integrity.

Digital twinning techniques primarily involve solving constitutive equations in real time to replicate system behavior. For systems with non-linearities, these equations must be solved numerically. Although computational speed has greatly improved, solving these equations in real time at higher frequencies remains challenging, generally limiting solutions to frequencies below five cycles per second which is adequate for applications like vehicle dynamics and bridge monitoring. The new technique under development aims to extend digital twin simulations to higher frequency vibrations, broadening its applicability across more dynamic systems.

The initial development and validation of this digital twinning technique center on a two-degree-of-freedom system featuring two masses supported by rubber metal laminate springs, which offer both stiffness and damping with slight nonlinear behavior. Loaded in shear, these springs allow moderate horizontal stiffness and high vertical stiffness, an unconventional but effective setup. The system is driven by a horizontal dynamic force from an electrodynamic shaker, with LabView software capturing the force signal and predicting the system’s response. By comparing expected and measured displacements and velocities, any discrepancies are used to refine system parameters. Tracking these parameters over time will provide valuable insights into the system’s condition and health.

This poster presents the digital twinning methodology along with simulated results. It also details the design and development of the two-degree-of-freedom system, now in the manufacturing phase, with testing set to begin shortly.

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| **ENGINEERING ABSTRACT** |
| **16** |

**ECE SENIOR DESIGN I – SIMULATION OF AN INTELLIGENT GROUND VEHICLE AND ITS INTEGRAL PROCESSES**

Oriekaose Agholor, Edrees Ahmed,and Michael Santora\*

Electrical & Computer Engineering and Computer Science Department, University of Detroit Mercy

The highest form of autonomy that is legally allowed and commercially available for vehicles is level 2. This design project pushes the barrier of what is currently available by developing an intelligent ground vehicle using simulation meeting the requirements of the self-drive Intelligent Ground Vehicle Competition (IGVC). The customer needs are organized using a need matrix and analyzed to identify engineering requirements. Through designing learning and the knowledge, experience and skills gained from coursework design and development have begun. These entail simulating various environmental and real-world elements for the Husky robot using MATLAB and ROS2 on a Linux Ubuntu operating system. These elements include road signs, obstacles, and persons. Currently, simulations for road sign detection and obstacle avoidance using sensor data from LiDAR and algorithms have been developed in MATLAB. The next steps include creating and testing path planning and object detection algorithms to enable the robot to navigate and make decisions autonomously. A Gantt chart has been made to provide the expected timeline for project completion, outlining future steps in refining simulations, testing in real-world environments, and integrating more advanced algorithms to improve the Husky robot’s performance.

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| **ENGINEERING ABSTRACT** |
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**ECE SENIOR DESIGN I – HARDWARE RESEARCH AND IMPLEMENTATION**

Oriekaose Agholor, Edrees Ahmed, John Gazdecki, Dalton Kanerva, and Michael Santora\*

Electrical & Computer Engineering and Computer Science Department, University of Detroit Mercy

This project involves the development of an autonomous vehicle for the Intelligent Ground Vehicle Competition (IGVC). The development has been broken into several subgroups according to the needs of the project. This poster discusses the development of the needs/metrics matrix, identification of engineering requirements, and design learning for the hardware portion of this project. Included are the goals and future steps that outline the vehicle design and development. Research and testing are underway to adjust the vehicle to meet IGVC requirements for speed, payload, safety, and vehicle measurements. This will be accomplished using the Husky A300 unmanned ground vehicle along with mechanical and software limiters. The process is underway to acquire and implement a wireless e-stop, which will allow for the vehicle to be disabled remotely. The equipment and vehicle will be IPX4+ rated in case of rain. Additionally, the external power distribution and vehicle surfaces will be safe for user interaction. Finally, a Gantt chart has been developed to provide the expected timeline for project completion.

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| **ENGINEERING ABSTRACT** |
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**ECE SENIOR DESIGN I – SYSTEM INTEGRATION**

Oriekaose Agholor, Dalton Kanerva, Brandon Smith, Evan Varga, and Michael Santora\*

Electrical & Computer Engineering and Computer Science Department, University of Detroit Mercy

This project focuses on the development of an autonomous vehicle for the Intelligent Ground Vehicle Competition (IGVC), with the System Integration Group playing a crucial role in ensuring all components of the vehicle work together seamlessly. The team has developed a needs-metrics matrix to identify engineering requirements that guide the design process. The end goal is the integration of various subsystems to accomplish tasks such as lane following, turning, and obstacle avoidance. By maintaining consistent communication networks, mounting profiles, and power usage, the group has already addressed key issues of network mitigation to ensure reliable performance across the entire system. The development of integration algorithms is ongoing to create a cohesive system that will allow the vehicle to efficiently and autonomously navigate the IGVC course. Furthermore, the team has mapped out future steps, potential challenges, and methods to improve vehicle performance. Lastly, a Gantt chart has been developed to track the timeline and deadlines, which will help the team stay on course for successful project completion.

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| **ENGINEERING ABSTRACT** |
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**ECE SENIOR DESIGN I – LOCALIZATION AND NAVIGATION**

Edrees Ahmed, Sumaia Alghaiti, Andres Diaz Navas, John Gazdecki, Linu Hanna, Brandon Smith, Simon Yeldo, and Michael Santora\*

Electrical & Computer Engineering and Computer Science Department, University of Detroit Mercy

This project involves the development of an autonomous vehicle for the Intelligent Ground Vehicle Competition (IGVC). The development has been broken into several subgroups according to the needs of the project. This poster discusses the development of the needs-metrics matrix, identification of engineering requirements, and design learning associated with Navigation systems. Included are the future steps and algorithms that outline the design development of this vehicle. Two of the most important tasks for autonomous mobile vehicles are localization and navigation. The knowledge of where the vehicle is located is called localization. The planning of a path to a destination is called navigation. The process of estimating position from changes in sensor data is called odometry. To achieve proper localization, odometry-based localization and Simultaneous Localization and Mapping (SLAM) are taken into consideration. Technologies such as Global Navigation Satellite System (GNSS) and Inertial Measurement Unit (IMU) are under consideration for tracking Global Positioning System (GPS) data, angular and linear velocity of the vehicle in Robot Operating System 2 (ROS2). For navigation ROS2 offers the Nav2 package, which allows the storage of maps provided by SLAM and path planning. Finally, a Gantt chart has been developed to provide the expected timeline for project completion.

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| **ENGINEERING ABSTRACT** |
| **20** |

**ROBOTICS AND MECHATRONIC SYSTEMS ENGINEERING DESIGN I** –   
**AUTOMATIC NAVIGATION CAR GPS FUNCTION**

Haokang Jin, Wenqing Zhang,andMichael Santora\*

Electrical & Computer Engineering and Computer Science Department, University of Detroit Mercy

This project focuses on integrating the GPS module with other sensors for autonomous vehicle localization and control. The autonomous vehicle is being developed to compete in the Auto-Navigation competition at IGVC. This poster presents the needs of metric matrix for localization. The engineering requirements are also supplied. For fusion of data it will use ROS2, sensor data is subscribed and preprocessed through steps such as filtering, noise reduction, correction, and time alignment. The preprocessed GPS data is then fused with data from IMUs and other sensors. Potential fusion algorithms include Extended Kalman Filter (EKF), Unscented Kalman Filter (UKF), Particle Filter (PF), and both tight and loose coupling techniques. The final choice of algorithm will depend on the specific requirements of future applications. The fused sensor data will be applied in vehicle speed control, attitude adjustment, and directional control. Also a Gantt chart of the future development of the project is included.

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| **ENGINEERING ABSTRACT** |
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**ECE SENIOR DESIGN I – USER ACCESS**

Andres Diaz Navas, Brandon Smith, Simon Yeldo, and Michael Santora\*

Electrical & Computer Engineering and Computer Science Department, University of Detroit Mercy

This project involves the development of an autonomous vehicle for the Intelligent Ground Vehicle Competition (IGVC). The development has been broken out into several subgroups according to the needs of the project. This document is for the user access subgroup. This poster discusses the development of the needs metrics matrix, engineering requirements, and design learnings for this portion of this vehicle. The user access group defines and integrates all means to control the vehicle, most notably the GUI (graphical user interface). The goal of the user access group is to make vehicle control as easy, safe, and convenient as possible for control and development.  To align with our goal of coordinating vehicle control within MATLAB, the current plan for the vehicle's Graphical User Interface (GUI) involves using MATLAB's app designer feature. Key features include buttons for specific vehicle modes—such as remote control, lane following, and parallel parking—along with a complete autonomy mode.  The rules for IGVC require lane line identification to be displayed during operation, and so processed images will be shown on the GUI. Additionally, an E-stop will be included in the GUI, along with important sensor readings for development and troubleshooting. The vehicle will also be able to be controlled with a remote control for easy transport, which also includes an E-stop feature. A Gantt chart has been developed to provide the expected timeline for project completion.

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| **ENGINEERING ABSTRACT** |
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**ROBOTICS AND MECHATRONIC SYSTEMS ENGINEERING DESIGN I – AUTOMATIC NAVIGATION CAR LIDAR FUNCTION**

Zhang Wenzhang, Yan Han, and Michael Santora\*

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The goal of this project is to achieve obstacle recognition and avoidance for uses with route planning. The obstacle recognition is for an autonomous vehicle that competes in the Auto-Navigation Competition at IGVC. The requirements are recorded in a Needs Metric Matrix regarding detecting obstacles, bypassing obstacles, finding paths, and identifying gaps between obstacles. A presented are the Engineering Requirements. To date the Light Detection and Ranging (LiDAR) is acquiring data. This LiDAR data can be used in algorithms such as: learning algorithms, Convolutional Neural Networks (CNN) and Random Sample Consensus (RANSAC) algorithm. The most likely algorithm will be RANSAC algorithm. The future development of this project is supplied in a Gantt chart.

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| **ENGINEERING ABSTRACT** |
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**ECE SENIOR DESIGN I – VISION AND SENSING RESEARCH AND IMPLEMENTATION**

Evan Varga, John Gazdecki, Brandon Smith, Simon Yeldo, Sumaia Alghaiti, Linu Hanna, Andres Diaz Navas, and Michael Santora\*

Electrical & Computer Engineering and Computer Science Department, University of Detroit Mercy

This project involves the development of an autonomous vehicle for the Intelligent Ground Vehicle Competition (IGVC). The development has been broken out into several subgroups according to the needs of the project. This poster discusses the development of the needs metrics matrix, identification of engineering requirements, and design learnings associated with vision and sensing. Included are the future steps and algorithms that outline the vehicle design and development. For vision and sensing, it is required to see lane lines, pedestrians, street signs, potholes, tires, barrels. Currently, Statistical Convoluted Neural Network (SCNN), or image processing are to be used to identify lane lines. The pedestrians and potholes (painted white) are to be identified through blob detection. The street signs can be read through a mix of LiDAR identifying the stop sign, and the camera dynamically cropping the image around the identified sign. A Tesseract AI then reads the text to determine the sign’s content. The Ouster LiDAR can be used for additional obstacle detection, like barrels and tires on the road. To date, a 2D camera and the Ouster LiDAR are gathering data on a ROS2 node. The images have been localized to a static camera position, with the image to world coordinate conversion being accurate to a few inches of tolerance. The lane lines have been overlayed onto images taken from the 2D camera using SCNN. Finally, a Gantt chart has been provided for the expected timeline.

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| **ENGINEERING ABSTRACT** |
| **24** |

**ROBOTICS AND MECHATRONIC SYSTEMS ENGINEERING DESING I: AUTOMATIC NAVIGATION CAR CAMERA FUNCTION**

Ren Yicong, Zerui Li, and Michael Santora\*

Electrical & Computer Engineering and Computer Science Department, University of Detroit Mercy

This project aims to achieve image recognition and obstacle detection in autonomous navigation using cameras and LiDARs. The goal is to implement the detection into an autonomous vehicle for the Auto-NAV IGVC competition. The needs metrics matrix for this process are discussed. The engineering requirements are also presented. Some possible algorithms include using Point clouds for obstacle detection and mapping (such as SLAM), grayscale images can help recognize obstacles or lines, while color images identify objects or obstacles of different colors. Depth images can be utilized for object detection and distance measurement. The primary methods include data fusion between the camera and LiDAR, ROS2 communication, and image processing techniques to enhance the accuracy and stability of the autonomous navigation system. These environmental perceptions can be integrated into mapping, such as SLAM. Additionally, a Gannt chart is supplied to show the future work of the project.

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| **SCIENCE ABSTRACT** |
| **25** |

**SYNTHESIS AND CHARACTERIZATION OF FERROCENE AMIDES USING COUPLING AGENTS**

Allyson Doslak, Maya Saeed, and Marwa Abdel Latif\*

Department of Chemistry and Biochemistry, University of Detroit Mercy

Ferrocene amides are crucial organic molecules in the biochemical field due to their versatile applications as anti-cancer, anti-malarial, and anti-fungal drugs. The ferrocene moiety is reported to have high stability due to metal binding, and low toxicity, low cost, reversible redox and catalytic abilities. Additionally, ferrocene amides are efficient in selective structural modification and interactions with other biological molecules.6 Conventional synthetic methods of ferrocene amides requires the use of ferrocenoyl chlorides, which are expensive, unstable in open atmosphere with associated health hazards. This work investigates alternative syntheses and associated purification and characterization for a range of amides including ferrocene amides. Our aim is to use a more stable starting reagent, ferrocene carboxylic acid, in combination with well-known coupling agents for more efficient synthetic methodologies for ferrocene amide syntheses.

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| **SCIENCE ABSTRACT** |
| **26B** |

**COMPARATIVE ANALYSIS OF STOMATAL TRAITS IN PEPPER PLANTS ADJACENT TO CHIVES AND TOMATOES**

Amira Abuhmoud, Batoul Ajrouche, Isabella Kritzman, Islam Nasser, and Stokes Baker\*

Department of Biology, University of Detroit Mercy

Interactions between plants, particularly in intercropping, can influence physiological traits like stomatal traits which are vital for plant gas exchange. This study examines whether the stomatal density of pepper plant leaves (*Capsicum annuum*) changes when planted near chives (*Allium schoenoprasum*) compared to tomatoes (*Solanum lycopersicum*). The hypothesis proposes that there will be a difference in stomatal density, stomata length and percentage of open stomata of a pepper plant leaf depending on the neighboring plants (tomatoes and chives).  The experiment took place at Cadillac Urban Gardens in Southwest Detroit. Ten pepper plant leaves were collected from a pepper plant located by chives and another ten from a pepper plant located by tomatoes. Stomatal impressions were made by applying a clear-coat nail polish to the leaves, transferring it onto clear tape once dried, and viewing the imprints under a microscope equipped with an ocular micrometer. The results showed there was some impact on stomatal response by intercropping. Stomatal density, (*t* = -2.02, *P* = 0.074) and stomatal length (*t* = -0.277, *P* = 0.788) were not affected by the species of companion plants. Notably, the percentage of open stomata was significantly higher in pepper plants grown near chives which was approximately 40.3% compared to those grown near tomatoes which was 15.6% (*t* = -4.37, *P* = 0.0018).  This result suggests that the intercropping system may significantly impact plant growth and crop yield because of the role of gas exchange in photosynthesis. Changes in the environment, such as altering CO2 levels or from chemical signals from the companion plants may be the cause of the observed stomatal response.

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| **SCIENCE ABSTRACT** |
| **27** |

**INVESTIGATING THE HABITAT PREFERENCE OF ALFALFA LEAFCUTTER BEES IN PALMER PARK**

Ali Alhamazah and Stokes Baker\*

Department of Biology, University of Detroit Mercy

Solitary bees play a crucial role in ecosystems because they are better pollinators than social bees (e.g., honeybees, bumble bees, *et cetera*), even in urban environments.  In 2020, the U.S. Fish and Wildlife Services (USFWS) established a 0.4 hectare forbs-dominated prairie in Palmer Park (Detroit, Michigan) to support bee biodiversity.  This study aimed to evaluate the effectiveness of the USFWS restoration efforts.  Alfalfa leafcutter bees (*Megachile rotundata*), a solitary bee species, were introduced in two locations in Palmer Park, the restored prairie and unimproved upland prairie.  Reeds in nesting boxes were collected.  Reeds from upland prairie contained leaf-covered cocoons.  Surprisingly, several reeds from the forbs dominated prairie contained larvae that were developing without leaf-covered cocoons, which hindered their development.  To improve the effectiveness of future prairie seed mixes, the leaf preferences of *M. rotundata* cocoon construction is being invested.  To identify leaf fragments used in cocoons, DNA barcoding will be used. DNA has been successfully isolated from leaf fragments.  Currently, polymerase chain reaction (PCR) with primers to chloroplast sequences (*rbc*L locus) is being attempted.

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| **SCIENCE ABSTRACT** |
| **28B** |

**STOMATAL DENSITY IN PEPPER PLANTS WHEN PLANTED ALONGSIDE MARIGOLD FLOWERS AT THE URBAN GARDENS IN DETROIT, MI**

Chloe Avis, Lydia Campbell, Yara Marouf, Mya Mascaro, Emma McKinley, and Stokes Baker\*

Department of Biology, University of Detroit Mercy

Pesticides are not used at the Cadillac Urban Gardens; thus, plants are more susceptible to pests. To find a solution, pepper plants (Capsicum) are grown with the companion plant, marigolds (Tagetes), a plant that produces terpenes, which are gaseous compounds that repel insects. Stomata, which are leaf pores that allow for gas exchange, may be affected by the terpenes. To investigate this, Nail polish stomata peels were used to analyze stomata response to growing next to marigolds. A microscope was used to measure stomata density, the percentage of opened stomata, and stomata length. Student t-tests did not detect any statistically significant differences indicating that planting marigolds with sweet peppers does not affect the stomata density of the pepper plants however, marigolds are beneficial for companion planting since marigolds deter insects and do not reduce the gas exchange needed for photosynthesis.

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| **SCIENCE ABSTRACT** |
| **29B** |

**THE EFFECT OF SUNLIGHT ON PEPPER PLANTS AND THE AMOUNT OF STOMATA PRESENT IN THE PEPPER LEAVES IN CADILLAC URBAN GARDENS DETROIT, MI**

Brooke Alred, Madeline Langenburg, Ashley Pelc, and Stokes Baker\*

Department of Biology, University of Detroit Mercy

The amount of sunlight that pepper plants receive has a significant impact on the growth and development of the pepper plants because light intensity influences stomata density of their leaves and the percentage of open stomata. The objective of the study was to determine the difference in stomatal densities based on the location of leaves within the red picnic pepper plants (*Capsicum annuum*). It was hypothesized that the upper leaves of the pepper plant would exhibit a higher density of stomata, and a greater percentage of open stomata compared to the lower leaves of the plant due to an increase in exposure to sunlight. Twenty pepper leaves were collected from Cadillac Urban Gardens in Detroit, Michigan. Ten leaves were collected from the bottom of the pepper plants and ten leaves were collected from the top of the plants. Stomatal peels were performed and examined under a microscope to determine and analyze stomatal indexes. The study showed that the leaves toward the top of the plant had a higher stomatal density and a greater percentage of stomata than the leaves found lower on the plant. This suggests that the increase in light intensity has a direct relationship with both stomatal density and percent of open stomata.

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| **SCIENCE ABSTRACT** |
| **30** |

**USING FLOW CYTOMETRY TO UNDERSTAND CELLULAR CHANGES FOLLOWING EXPOSURES TO ENVIRONMENTALLY RELEVANT TOXINS**

Antonillamarein E. Hanna, Mona Khalil, Luna L. Jacob, Hasan Alsharifi, Gacia M. Vosbigian, Sarah A. Magid, Miranda J. Jasinski, and Rachelle M. Belanger\*

Department of Biology, University of Detroit Mercy

Aquatic environments are frequently exposed to both natural and anthropogenic stressors. Stressors such as chemical pollutants have negative impacts on the environment in which they are present. Chemical pollutants are stressors which negatively impact the environment where they are present. We will examine the effects of the commonly used agrochemical Roundup® (active ingredient glyphosate) and algal toxins, such as microcystin-LR, on cells of the liver of crayfish using flow cytometry. Flow cytometry uses lasers to detect and analyze physical characteristics of single cells. This powerful quantification tool will allow us to analyze the cells from the hepatopancreas (liver) from several samples rapidly. Cellular markers will be employed including fluorescein diacetate, propidium iodide, and SYBR Green I to determine the effects of these toxins on cells of the hepatopancreas post-exposure to Roundup® and algal toxins. These data will be compared to tissue morphology using hematoxylin and eosin-stained hepatopancreas tissues. Using a combination of Roundup® and algal toxins will allow us to determine if these stressors have additive morphological effects. Based on previous research, it is expected that the combined effects of the toxins on the hepatopancreas will be greater than their individual effects. Preliminary data will be presented, examining the effects of these pollutants on hepatopancreas cells. Understanding the individual and combined effects of microcystin-LR and Roundup®, even at low concentrations, in the aquatic environment will provide valuable references for determination of safety thresholds of pollutants and protection of ecologically important and at-risk aquatic organisms.

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| **SCIENCE ABSTRACT** |
| **31** |

**DOES MICRO- AND NANOPLASTIC EXPOSURE ALTER OLFACTORY PHYSIOLOGY AND OLFACTORY-MEDIATED BEHAVIOR OF FATHEAD MINNOWS (PIMEPHALES PROMELAS)?**

Miranda J. Jasinski1, Sarah A. Magid1, Hasan Alsharifi1, Rachelle M. Belanger1\*, William A. Dew2\*, and Levi Storks1\*

1Biology Department, University of Detroit Mercy

2Department of Biology, Algoma University, Sault Ste. Marie, Ontario, Canada

The amount of micro- and nanoplastics found in the Great Lakes and freshwater ecosystems is rapidly increasing due to inadequate management of plastic waste. Microplastic (particles <5 mm) and nanoplastic (particles < 1 µm) enters the environment via numerous sources, including industrial activities, cosmetics, and the breakdown of plastic objects and wastes (e.g., tires, textiles, bottles). Micro- and nanoplastic exposure can negatively impact organisms with several negative toxicological endpoints observed. Current evidence suggests that exposure alters behavior, including olfactory-driven behavior, and exerts neurotoxic effects on tissue. This could be particularly important in the context of predator avoidance, which is mediated in part by olfaction in fish. In this study, we measured 1) behavioral avoidance of fathead minnows (Pimephales promelas) to a conspecific alarm cue and 2) electrophysiological responses to three odorants after exposure to environmentally relevant concentrations of polystyrene micro- and nanoplastics. Our data suggest that exposure influences avoidance of a conspecific alarm cue and reduces electrophysiological responses of the olfactory epithelium to a social and alarm odorant, but not a food odorant. Overall, preliminary data indicates that exposure to micro- and nanoplastics might reduce both physiological and behavioral responses to some environmental cues, but not others. Given that fish rely heavily on olfaction for several key behaviors (e.g., feeding, reproduction, migration, predator avoidance), micro- and nanoplastic exposure could severely impact fish ecology in natural systems.

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| **SCIENCE ABSTRACT** |
| **32** |

**ANALYZING THE INFLUENCE OF PHEROMONE CONCENTRATION ON THE DEVELOPMENT OF LARVAL SEA LAMPREY**

Xavier sterling1, Tyler Buchinger2\*, and Donna Kashian3\*

1Department of Biology, University of Detroit Mercy

2Department of Biology, Michigan State University

3Department of Biology, Wayne University

Sea lamprey are a significant hazard to the health and biodiversity of an ecosystem that it's not naturally from. The feeding strategies it employs, boring a hole into the host to feed on blood and bodily fluids, are too severe for the animals that haven’t coexisted with this specific species. A potential method is to target the larvae of sea lamprey if the adults are able to reach smaller streams. The focus of this study is to observe the effects of the pheromones produced by adults on the larvae. To observe this, larvae are placed in various concentrations of 3kPZs and measured each week. Based on the current results, there appears to be some influence on growth, with a higher concentration seeming to correlate with a lower growth percentage increase.   Further testing and analysis are needed to verify this correlation. Depending on the results of this research, more methods can be made to control the invasive species, specifically at the larval stage.

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| **SCIENCE ABSTRACT** |
| **33** |

**IDENTIFICATION AND CHARACTERIZATION OF BACTERIOPHAGE ISOLATED FROM SOIL SAMPLES THROUGH THE SEA-PHAGES PROGRAM IN BACTERIOPHAGE DISCOVERY AND GENOMIC RESEARCH**

Alexandria Jarbo and Stephanie Conant\*

Department of Biology, University of Detroit Mercy

Bacteriophages, which specifically infect bacteria, hold great promise as therapeutic agents against antibiotic-resistant infections. However, only 25% of sequenced phage genes have known functions, limiting the understanding and application of phage therapy. The challenge is to isolate and characterize new bacteriophages to expand the knowledge base and therapeutic potential in this field. In this study, the bacteriophage CocoaPuffs was isolated from a soil sample collected on September 5, 2023, from the McNichols Campus Library (GPS: 42.41443 N, 83.13907). An enrichment procedure was conducted to promote phage replication, followed by direct plating on Mycobacterium smegmatis. A spot test confirmed the presence of phage, resulting in 187 plaques. Individual plaques were selected for purification, with two rounds of purification performed to obtain a concentrated phage lysate. The final titer was calculated at 3.74 x 10^12 PFU/mL. Electron microscopy and gel electrophoresis were employed to analyze the phage structure and confirm its lytic nature. The successful isolation and characterization of CocoaPuffs provide valuable insights into the biology of phages and their potential therapeutic applications. The study confirms the effectiveness of the SEA-PHAGES program in enhancing undergraduate engagement in scientific research. By identifying and characterizing new phages, this work contributes to the broader goal of advancing phage therapy and addressing antibiotic resistance in bacterial infections.

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| **SCIENCE ABSTRACT** |
| **34** |

**UNDERSTANDING BEHAVIOR OF HARVESTERS THROUGH PHOTOPHOBIA AND SPATIAL LEARNING**

Gabrielle E. Makonnen and Preston Foerder\*

Department of Psychology, University of Detroit Mercy

Harvesters (also known as harvestmen or daddy long legs) were tested for evidence of negative phototaxis (photophobia, avoidance of light) and their spatial learning abilities. Phototaxis refers to the directional movement of an organism in response to a light source. This response varies from positive phototaxis, where an organism moves towards a light source, and negative phototaxis, where an organism moves away from a light source. There are about 6500 different species of harvesters, about 21 species are present in Michigan. We tested the species *Phalangium opilio*. There exists a range of research on spiders, who are mislabeled as harvesters, however, the research for harvesters is very limited. Their two eyes have been studied neurologically. Studies have shown that they can differentiate between light and dark, but the extent of their visual perception is still unknown. We used a T-maze with a bright light to encourage the *P. opilio* to enter a black goal box that was placed on either side. We will share our results and further discuss future research on their visual perception and spatial learning abilities.

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| **SCIENCE ABSTRACT** |
| **35** |

**MASS SPECTROMETRY-BASED METABOLOMICS STUDIES OF PDH1 DELETION MUTANT YEAST**

Andrew A. Bosah1, Evelyn M. Rihacek1, Suzanne M. Sareinil2, Shaza N. Ahmed1, Oswaldo Celestino Escobar1, Yara A. El-Sheikh1, Nicole A. Najor2\*, and Kendra R. Evans1\*

1Department of Chemistry and Biochemistry, University of Detroit Mercy

2Department of Biology, University of Detroit Mercy

Putative 2-methylcitrate dehydratase (PDH1) is a Saccharomyces cerevisiae mitochondrial protein that participates in propionate metabolism. The PDH1 gene in Saccharomyces cerevisiae is orthologous to the human gene aconitate decarboxylase 1 (ACOD1), which recent reports suggest is a regulator of immunometabolism in inflammation and infection. However, the metabolic consequences of PDH1 deletion have not yet been fully characterized. To further explore the molecular functions of PDH1, we performed liquid chromatography-mass spectrometry (LC-MS)-based metabolomics to compare PDH1 deletion mutant yeast to BY4741 wild-type yeast. Both intracellular and extracellular metabolite extractions were performed on yeast cultures harvested at mid-log growth phase. The yeast extracts were analyzed by reversed-phase chromatography coupled to a time-of-flight mass spectrometer operated in positive ionization mode. Following untargeted feature detection and alignment, univariate and multivariate statistical analysis was performed to detect differential features between the yeast strains. Putative compound identification was performed by matching accurate mass to literature databases. Preliminary results, which suggest the mutation has multiple potential metabolic effects, will be described.

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| **SCIENCE ABSTRACT** |
| **36** |

**LOWERING EUTECTIC POINTS IN THE SYNTHESIS OF LOW-MELTING ALLOYS**

Eliona Islami, Jewels Haisha, Hazel Song, Leza Jeki, Ullah Fargo, Roxana Nistor, Marcus Dally, Minerva Hanna, Mariam Sathi, Fadia Aldaroudi, Kelly Cho, Lia White, Hyo Young Chun, Minjae Choi, Marc Naddaf, Heewoong Kim, Hadeel Bazzi, Luna Sharak, Benny Tran, and Mark Benvenuto\*

Department of Chemistry and Biochemistry, University of Detroit Mercy

We have examined the idea of making metal alloys that specifically have low melting points – the 100ºC temperature being something of a benchmark, because this is the boiling point of water. Starting with tin and bismuth, a eutectic temperature can be found, which is lower than the melting point of either element. Adding controlled amounts of other metals, such as gallium, or of Wood’s metal fusible alloy, lowers the overall melting temperature further. Our attempts, and their resulting melting temperatures, will be discussed.

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| **SCIENCE ABSTRACT** |
| **37** |

**SYNTHESIS OF A SERIES OF ACTIVE, LONG-CHAIN MOLECULES VIA SCHIFF’S BASE CONDENSATIONS**

Avery Saunder, Joe Crandall, Jewels Haisha, Eliona Islami, Anaum Khan, Batoul Mortada, Thomas Mueller, Mustafa Shammar, Leandra Zoma, Holly Roberts, Marc Naddaf, Heewoong Kim, Luna Sharak, Benny Tran, and Mark Benvenuto\*

Department of Chemistry & Biochemistry, University of Detroit Mercy

A series of long-chain molecules has been synthesized utilizing a Schiff’s base condensation between aliphatic aldehydes and aliphatic amines. The target molecules are all long enough chains that they behave as syrupy liquids. The synthetic technique is environmentally very friendly, because it uses no solvent, simply the mixture of two neat liquids. These molecules appear to bind to metal ions such as silver (I). Results have been characterized by proton-NMR.

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| **SCIENCE ABSTRACT** |
| **38B** |

**AGE AFFECTS STOMATAL DENSITY IN LEMON GRASS AND BERRY BUSH PLANT IN URBAN GARDEN OF DETROIT, MI**

Crystal Nava-Ramirez, Camryn Pepper, Nermeen Saad, Patrick Schubert, and Mohamed Dabaja\*

Department of Biology, University of Detroit Mercy

When plants age, their cell division slows and eventually stops, resulting in a failure to regenerate plants’ death. This study is aimed to determine whether stomatal density is influenced by the age of the plant. Our hypothesis is older plants would exhibit lower stomatal density, suggesting a slower rate of cell division. In contrast, the study anticipated that younger plants would show higher stomatal density. Collected samples from 10 lemongrass plants represented younger plants and 10 berry bush plants for older plants from the urban garden in Detroit, MI were examined under the microscope. The stomatal density was measured for percentages of open and closed stomata. The results for younger lemongrass plants had a greater number of stomata, with an average of 53.6 open and 5.7 closed with older berry bush plants showing a lesser number of stomata, with an average of 4.7 open and 5.2 closed.

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| **SCIENCE ABSTRACT** |
| **39** |

**EXPLORING THE INTERACTIONS BETWEEN CANDIDA *ALBICANS* AND *STREPTOCOCCUS* MUTANS IN BIOFILM FORMATION**

Sarah K. Abraham, Nobel A. Makonnen, Reina B. Seklaoui, and Jonathan S. Finkel\*

Department of Biology, University of Detroit Mercy

Yearly, the CDC is aware of around 25,000 candidemia which is a fungal bloodstream infection *Candida albicans*. This fungus forms biofilms on microbial surfaces, which are crucial for its pathogenicity. Biofilms form when yeast cell attach to a surface and then later fungal cells spread beginning the change from yeast to a filament cell. After the final step of maturation any cell that is not attached to the matrix or then released into the surrounding environment. This is precisely what causes the infections we see. This summer’s research focused on understanding the attachment process of *Candida albicans* biofilms and exploring potential drug target to inhibit this process. We particularly looked at biofilms formed by *Candida albicans* and *Streptococcus mutants,* using strains from the mutant library. What was found particularly interesting was that the loss of biofilm in the BCR1 mutant can be restored *by S. mutants*, proposing a complex interaction between these two organisms.

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| **SCIENCE ABSTRACT** |
| **40** |

**IDENTIFYING CELL WALL GENES IN CANDIDA *ALBICANS* AND *STREPTOCOCCUS* MUTANS THAT FORM CARIOUS BIOFILMS**

Nobel A. Makonnen, Ji X. Luth, and Jonathan S. Finkel\*

Department of Biology, University of Detroit Mercy

The human mouth is filled with bacteria, fungi, and viruses that typically live at equilibrium to maintain a healthy environment.  An imbalance of these microorganisms in their environment is responsible for some of the most common diseases in the human mouth including cavities (caries) and periodontal disease.  *Candida albicans* and *Streptococcus mutans* are among some of the microorganisms that have long been associated with dental caries. One of the major mechanisms that microorganisms use to cause caries, which can lead to infection, is multi-organismal biofilms, which can be defined as microbial communities that bind to a substrate and are encased by an extracellular matrix.  This research aims to identify which cell wall genes are required for the *C. albicans* and *S. mutans* biofilm formation with the goal that these genes could be targeted with new drugs to decrease the adherence frequency.  This research was conducted through plating of the mutant yeast strains and a control strain, inoculation, and spectrophotometer analysis.

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| **SCIENCE ABSTRACT** |
| **41** |

**IDENTIFICATION OF GENE FUNCTION IN THE MYCOBACTERIA PHAGE XENO**

Fatimah Rezk, Elissa Slim, and Jonathan S. Finkel\*

Department of Biology, University of Detroit Mercy

Bacteriophages are viruses that target bacteria. The demand for studying bacteriophages has increased due to its importance within the field of therapeutic phages. Because of the bacteriophages’ high specificity in aiming for their target bacteria, this process can help us develop more effective treatments for bacterial infections. One limiting factor to understanding and developing better phage therapy is that only 25 % of sequenced genes have a known or even hypothetical function. The research will consist of molecular cloning, phenotypic assay, and interaction assay. So far, our group has built the foundation of identifying the functionality of these genes within the phage Xeno through processes such as polymerase chain reaction, gel electrophoresis, chemical transformations, and isothermal assembly. Xeno is a siphovirdae bacteriophage that targets Mycobacterium smegmatis. Its genome is 42395 nucleotides long and was calculated to contain 69 different genes. We have tested 30 out of the 69 genes, with 18 out of the 30 tested being functional. The purpose of this research in identifying the functionality of the gene, is to proceed in completing the cytotoxicity, as well as the defense assays to begin the cloning required for the hybrid experiments.

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| **SCIENCE ABSTRACT** |
| **42** |

**EXPLORING THE INTERACTIONS BETWEEN CANDIDA *ALBICANS* AND *STREPTOCOCCUS* MUTANS IN BIOFILM FORMATION**

Reina B. Seklaoui, Nobel A. Makonnen, Sarah K. Abraham, and Jonathan S. Finkel\*

Department of Biology, University of Detroit Mercy

Candida albicans are fungi that have the ability to form biofilms on microbial surfaces, which allows the organism to cause infection and harm to the human body. Every year, the CDC reports approximately 25,000 cases of candidemia, a bloodstream infection caused by Candida albicans. The formation of biofilms begins with the attachment of yeast cells to a surface, allowing them to spread later, creating a matrix. After maturation, detachment of cells begins, which allows for the cell to repeat. This fall focused on understanding the attachment process of Candida albicans biofilms and exploring potential drug targets to inhibit this process. we looked at various Candida albicans mutants and Streptococcus mutants and how their biofilm formation. Notably, we discovered that Streptococcus mutants can restore biofilm formation in the BCR1 mutant strain without this ability. This suggests a complex interaction between these two organisms.

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| **SCIENCE ABSTRACT** |
| **43** |

**HEXOSE PLATINUM CONJUGATES AS CANCER DRUGS**

Diego Galarza Ramirez1, Naya Kheirbek2, Gabriella Greenlaw2, and Klaus Friedrich2\*

1Chemistry and Biochemistry Department, University of Detroit Mercy

2Biology Department, University of Detroit Mercy

When cancer cells undergo rapid growth, their energy requirements increase significantly compared to normal cells. As a result, many cancer cells show overexpression of hexose transporters, which are integral membrane proteins responsible for facilitating the transport of hexoses across cellular membranes. This research initiative aims to create cancer drugs specifically tailored to enhance drug uptake in fast-growing cells, while minimizing side effects. Cisplatin is an essential compound when it comes to the treatment of cancer through chemotherapy. The metallo drug crosslinks DNA, which initiates apoptotic pathways in cancer cells but is shown to have several side effects. To focus the uptake of platinum drugs on fast-growing cells and by that to reduce deleterious side effects due to the interaction of the drugs with biomolecules other than DNA in cancer cells, hexose platinum conjugates that are potential substrates of hexose transporters are being synthesized in this project. The conjugates consist of three domains, a transporter substrate, a spacer, and a chelant for platinum (Type of bonding of ions and their molecules to metal ions). A series of synthetic steps makes it possible to independently manipulate these domains and to systematically study substrate-transporter and drug-DNA interactions. Several sugar-based drug candidates have been synthesized, characterized, and tested. In this study, we explore protecting group strategies to obtain drug candidates that are easily accessible through a limited number of synthetic steps. The goal is to identify sugar derivative that are shown to be efficacious with respect to transporter recognition, possess a favorable pharmacological profile, and demonstrate efficacy in combating cancer.

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| **SCIENCE ABSTRACT** |
| **44** |

**LANTHANIDE TERPYRIDINE COMPLEXES AS VITAMIN C TRANSPORTERS TAGS**

Samantha Mena, Sydney Moorer, Nichol Grafton, and Klaus Friedrich\*

Department of Chemistry and Biochemistry, University of Detroit Mercy

In recent years, research focused on the role of sodium-dependent vitamin C transporters (SVCTs) has increased dramatically. Vitamin C is suspected to have a regulatory function in the hypoxic pathway of glioblastoma cells, it contributes to immune responses, and is studied for its potential role in the prevention and treatment of gynecological cancers, among many other fields.

This project strives to develop small, molecular fluorescent tags designed to identify SVCTs by covalently binding fluorescent moieties based on lanthanide chelation to highly specific SVCT substrates. By using moderately lipophilic vitamin C derivatives, we expect to obtain molecular tags that have the potential to traverse the blood-brain-barrier. Suitable chelants for La3+, Eu3+, and Ce3+ are *e*. *g*. terpyridines. A convergent synthetic pathway leading to terpyridine chelants has been devised to obtain products that in one domain bind lanthanide ions and harvest and transmit energy, in a second domain act as SVCT substrates. The goal is to develop bio-compatible probes to metabolically tag SVCTs to enable their study *in vitro* and *in vivo*.

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| **SCIENCE ABSTRACT** |
| **45** |

**LOCALIZATION OF POSSIBLE PARACRINE CONTROLLING PH BLANACE IN MADAGASCAR ROACHES: GROMPHADORHINA PORTENTOSA**

Cornelius Harris, Tearea Boggan, Kennedy Dunlap, Erika Gordy, Jolani Perez, and Gregory Grabowski\*

Department of Biology, University of Detroit Mercy

This study uses Hansson’s technique to identify carbonic anhydrase (CAH) activity and the possible paracrine regulatory relationships between the Malpighian tubules, tracheal airways, and ceca in Madagascar roaches. Carbonic anhydrase (CAH) supports the conversion of carbon dioxide into bicarbonate and protons, CO2 + H2O ⇌ H2CO3 ⇌ H+ + HCO3- . Ceca are blind-ended finger-like projections that have acidic secretions (pH of 4.98). Tracheal airways are used for gas exchange and are closely associated with cecal surfaces. Malpighian tubules were intertwined with the surface tracheal airways. Larger airways within the cecal wall branch into smaller airways found within the mucosal cecal folds. Using Hansson’s technique, CAH activity was found only in the smaller airways and not in the larger airways. CAH activity was also found in the Malpighian tubules surrounding the ceca. Acetazolamide (CAH inhibitor) was used as a control. Orange-G was used to find acidophilic granules indicating possible paracrine control. Orange-G staining cells were located adjacent to larger airways within the cecal wall, as well as within the apical region of Malpighian tubules. Because no CAH activity was found in cecal folds it is assumed that the airways are the source of protons. Future research will involve using proton pump and bicarbonate/chloride exchange inhibitors to define the role of airways in cecal acid secretion.

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| **SCIENCE ABSTRACT** |
| **46** |

**DEVELOPMENT OF ANTIBIOTIC RESISTANCE IN *MORAXELLA CATARRHALIS* BACTERIA**

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*Moraxella catarrhalis* is a bacterium that resides in the upper respiratory tract and can be associated with bronchitis, bronchopneumonia, sinusitis and otitis. Itis linked with bronchopneumonia in chronic obstructive pulmonary disease (COPD) patients. The purpose of this work was to investigate the development of antibiotic resistance in *M. catarrhalis*.Fastidious *M. catarrhalis* was routinely cultured on Brain Heart Infusion (BHI) agar. The organism grew less well on standard nutrient agar medium. It could grow at body temperature or room temperature. Susceptibility to several antibiotics that use different modes of action was determined by the disk diffusion method. Inhibition zone diameters ranged from 23 to 45 mm at body temperature. For comparison, *Escherichia coli* showed zone diameters of 0 to 17 mm for the same antibiotics. Interestingly, zone diameters were considerably larger when the tests were incubated at room temperature. There did not appear to be any spontaneous antibiotic resistant mutant colonies that had arisen in the inhibition zones for *M. catarrhalis*. This may have been partly due to the low inoculum used on the agar surface in the disk test. Subsequently, an attempt was made to select resistant mutants for the antibiotic known as rifampicin directly on agar containing the antibiotic. The mechanism of action for rifampicin is to block synthesis of RNA by binding to RNA polymerase. The antibiotic had exhibited a discrete border to the inhibition zone in the disk assay. One use of the antibiotic is to prevent infection by *Neisseria meningitidis.* On agar containing rifampicin, with a large inoculum, spontaneous mutant colonies of *M. catarrhalis* would appear in a few days at body temperature or several days at room temperature. The mutants could be useful for study of antibiotic resistance and genetics in *M. catarrhalis.*

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| **SCIENCE ABSTRACT** |
| **47** |

**TESTING THE VIABILITY OF FRONTAL ALPHA ASYMMETRY FOR MEASURING EMOTIONAL RESPONSE**

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In previous experimentation, frontal alpha asymmetry (FAA) was used as a metric to measure a subject’s emotional motivations—approach or withdrawal. Asymmetrical pre-frontal cortex activity in response to external stimuli is reported to reflect an approach or withdrawal response in some studies. To further evaluate the accuracy of these reports, six participants observed images of children and violence while their FAA data was measured via EEG equipment. Participants were also asked to rate each set of images’ level of pleasantness. The data collected showed no clear evidence that FAA data reflected a subject’s emotional reaction; hence, we conclude that to date, FAA is inconclusive as a means of measuring emotional response. While we conclude that FAA is inconclusive as a metric for emotions, some limitations of our study are discussed.

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| **SCIENCE ABSTRACT** |
| **48** |

**ELECTROPHYSIOLOGICAL MARKERS OF VERTICAL SACCADE PROGRAMS**

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2Department of Psychology, University of Detroit Mercy

3Department of Biology, University of Detroit Mercy

Based on saccade reaction times, our theory is that greater cortical activity is required to program down- than up-directed saccades. We rationalized that the high temporal resolution of event-related potentials (ERPs) will allow us to quantify cortical programming of saccades. Participants were fitted for electrophysiology data collection (IX-EEG amplifier, Labscribe software, 19 electrode cap with Ag/AgCl electrodes; EOG electrodes above and below the right eyelids to detect vertical saccades; a Miami J neck brace to minimize head movement artifacts). Participants completed the saccade task while sitting within a Faraday chamber. Our concern was whether more cortical effort is associated with the releasing of down-directed saccades near the Frontal (electrodes F3 and F4) and Parietal (P3 and P4) Eye Fields.  For analysis, we integrated voltages between -200ms and -4ms of saccade onset.  This area under the voltage curve quantifies cortical activity relative to the average reference, and we interpreted larger areas as reflective of greater recruitment of cortical resources. A 2 Lobe (Frontal vs Parietal) X 2 Hemisphere (Left vs Right) X 2 Saccade Direction (Down vs Up) repeated measures ANOVA was conducted on the integrated voltage values.  The primary finding was a 3-way interaction effect that was close to being statistically significant (p= .08; partial eta squared= .30).  Down-directed pre-saccadic activity was greater for all electrode sites, but was especially greater in the left frontal lobe. The findings are congruent with the prediction of our theory, indicating a need to pursue our electrophysiology project, with higher statistical power.

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| **SCIENCE ABSTRACT** |
| **49** |

**THE ROLE OF CidI.3.2 IN EYE AND WING DEVELOPMENT IN *DROSOPHILA MELANOGASTER***

Gabrielle Makonnen and Maryam Qoda, and Jacob Kagey\*

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Previously, the CidI.3.2 allele was isolated and mapped from a genetic screen in Drosophila melanogaster. This allele was identified in a screen for genes that regulate development cell growth and division in the developing eye. Of note, CidI.3.2 resulted in a complete loss of the organismal head and pupal lethality. Our goal was to understand the molecular and genetic mechanisms that lead to this phenotype and better understand the role of Cid in organismal development.  
To study this mutation, we are utilizing the RNAi system, that allows for tissue specific down regulation of Cid. In particular, we are focusing on the developing eye and wing, since these are well-established developmental systems in fruit flies. We found that introduction of the RNAi system in the eye and found no dramatic phenotype changes. Additionally, we used the same system and introduced it in the wings, with no major significant difference of wing size or shape, compared to head. Some of the methods used in the lab were larvae and pupae dissection using microscopes and staining with antibodies so we could use the fluorescent microscope. The exact reason why the CID gene is affecting the growth of a head is not yet known, however, our RNAi data suggests that while necessary, there may only be a need for a small amount of Cid protein for the fly to successfully navigate eye and wing development Once we understand what exactly is causing the lack of head or irregular wing size, we can figure out how it is happening, and possibly compare it to human cancers by using the same mechanisms to try and cure them. In the future, we are going to be setting up new crosses to see if there is any new data available.

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| **SCIENCE ABSTRACT** |
| **50** |

**SPECTROPHOTOMETRIC EVALUATION OF MYROSINASE ACTIVITY IN MASTICATED BROCCOLI LINKED TO AGE**

Amanda Carswell, George Brown, Helen Guirgis, Manpaul Pannu, and Anne-Marie Kosi-Kupe\*

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The health benefits of sulforaphane in cancer prevention have been widely studied. The enzyme myrosinase is essential in the breakdown of broccoli glucosinolates into sulforaphane. This study undertakes a time-related spectrophotometric evaluation of broccoli samples chewed by individuals of ages ranging from thirteen to sixty-seven. This project elucidates to what extent age impacts the mastication process, the myrosinase activity, and the overall mechano-chemical digestion.

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| **SCIENCE ABSTRACT** |
| **51** |

**HOW THE PLAGUE BACTERIUM *YERSINIA PESTIS* AVOIDS KILLING BY HUMAN NEUTROPHILS**

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2Division of Integrated Biomedical Sciences, University of Detroit Mercy School of Dentistry

*Yersinia pestis*, the causative agent of plague, delivers cytotoxic Yop proteins to host cells, thus preventing phagocytosis and clearance by innate immune cells like neutrophils. Neutrophils are known to be a prime target for Yop delivery during *in vivo* infections.

Given the critical nature of this host-pathogen interaction for Yop delivery, the goal of our work is to understand the role of different bacterial and host proteins in this process. Three surface adhesins of *Y. pestis* can contribute to Yop delivery, Ail, Pla (plasminogen activator) and Psa (pH 6 antigen). Using a fluorescent reagent to detect Yop delivery, we find Ail, Pla and PsaA can all contribute to Yop delivery to HL-60 cells in the presence of human serum, a component added to mimic *Y. pestis* infections in host tissues.

Infection of the phagocytic neutrophil-like cells line HL-60 in the absence of serum, with a strain lacking Ail (Δ*ail*), had no impact on cell binding, but 10-fold more bacteria were phagocytosed by HL-60s in the absence of Ail based on a gentamycin protection assay measuring intracellular bacteria. Precoating bacteria with human serum results in very low levels of phagocytosis for a D*ail* mutant. This suggests that serum coating leads to reduced phagocytosis when Ail is not present to cleave serum complement proteins like C3b to iC3b and further degradation products. Additional experiments are underway to visualize intracellular and extracellular bacteria using differential labeling of bacteria with an anti-*Y. pestis* capsule antibody that is inaccessible to intracellular bacteria.

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| **SCIENCE ABSTRACT** |
| **52** |

**TOXR AND TCPP COMBINE TO ACTIVATE THE TOXT PROMOTER IN VIBRIO CHOLERAE BY DIRECTLY CONTACTING RNA POLYMERASE: A CRYOEM STRUCTURE/FUNCTION STUDY**

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1Division of Integrated Biomedical Sciences, University of Detroit Mercy School of Dentistry

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*Vibrio cholerae*, the causative agent of the diarrheal disease cholera responds to environmental conditions in series of transcription activation steps that results in co-activation of the *toxT* promoter by two membrane-anchored transcription factors, ToxR and TcpP. Once *toxT* is activated, the ToxT protein activates several virulence genes including cholera toxin and the toxin co-regulated pilus. TcpP serves as the direct activator of *toxT* and ToxR is a co-activator. Using Cryo-EM, we solved the structure of a *toxT* transcription complex including ToxR, TcpP, RNA polymerase (RNAP) and the *toxT* promoter. Using site-directed mutagenesis of TcpP, we confirmed TcpP-Q80 as a key DNA binding residue in the DNA-recognition helix, required for *toxT* activation. In addition, TcpP-K101 is a critical residue in the wing domain that engages the minor grove in winged-helix-turn-helix transcription factors. Perhaps the most revealing finding was that TcpP-F72 makes critical contacts with the a-CTD of RNAP to initiate transcription. Mutation of TcpP-F72 to alanine or serine resulted in an 85% or 95% reduction in *toxT* activation, respectively. Finally, alteration of residues in an N-terminal hydrophobic patch predicted to affect TcpP/ToxR interactions, reduced *toxT* activation by 40-90% depending on the substitution. Thus, we have demonstrated the promoter architecture of the active *toxT* promoter complex at the atomic levels and verified predicted critical molecular interactions for initiating *toxT* activation required for the disease cholera. Future studies aim to disrupt these critical interactions in a search for effective therapeutics for a disease with millions of cases each year worldwide.

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| **SCIENCE ABSTRACT** |
| **53** |

**A CHARACTERIZATION OF NEURONS IN THE *DROSOPHILA* NOCICEPTIVE NETWORK**

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2Life Sciences Institute and Department of Cell and Developmental Biology, University of Michigan

The nociceptive network is involved in sensing noxious stimuli in the environment. Nociceptors are receptors known to sense mechanical injury, such as extreme temperatures, harmful chemicals, and pH levels. In *Drosophila melanogaster* larvae, avoidance behavior is facilitated by abdominal leucokin (ABLK) neurons. ABLK neurons create an excitatory network with second-order neurons (SONs) and nociceptors. The Ye Lab found second-order neuron communication with ABLK neurons to be muffled, leading to an understanding of an additional group of inhibitory neurons synapsing with anterior ABLK neurons. An uncharacterized group, known as midline projection (MIP) neurons, was predicted to synapse above the ABLK neuronal group, making them a potential candidate for inhibition. Through immunostaining, MIP neurons were tested using a bipartite system to identify if they functioned as GABAergic or serotonergic inhibitory neurons. Preliminary data suggested MIP neurons function as serotonergic inhibitory neurons with quantitative analysis of ABLK neurons with inhibitory neurons. The establishment of the inhibitory neurons in the *Drosophila* larvae nociceptive network helps to continue to build the scaffold of the neural network and its plasticity.

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| **SCIENCE ABSTRACT** |
| **54** |

**FERROCENE AND DERIVATIVES EFFECT ON CACO-2 CANCER CELLS**

Kailah C. Collins, and Mara R. Livezey\*

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Ferrocene is an iron-based metallorganic compound and studies of ferrocene along with complex derivatives have shown that these molecules work as antiproliferative agents and can lead to cell death. Our research investigates the effects of ferrocene and its derivatives on Caco-2 colon cancer cells. We applied ferrocene, ferrocene carboxaldehyde, and ferrocene methanol at µM concentrations to determine their effectiveness against cancer cells. To conduct our experiments, we employed the Alamar Blue Assay and Trypan Blue Assay methods. This enabled us to identify ferrocene drugs that exhibit antiproliferative activity and lead to modest cell death. We are keen to further study the mechanism by which ferrocene kills Caco-2 cells, with particular focus on ferroptosis. This would be a significant development in the search for effective cancer-fighting agents and furthering the understanding of the drug ferrocene.

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| **SCIENCE ABSTRACT** |
| **55** |

**INVESTIGATING THE STRUCTURE OF *STAPHYLOCOCCUS AUREUS* PROTEINS GloB AND FrmB TO DESIGN IMPROVED PRODRUG ANTIBIOTICS**

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The esterases GloB and FrmB from Staphylococcus aureus are pivotal in activating carboxy ester prodrugs. This study aims to elucidate the structures of GloB and FrmB while bound to specific ligands to enhance our understanding of their enzymatic mechanisms and potential therapeutic applications. The primary objective was to determine the crystal structures of GloB and FrmB in complex with ligands using X-ray crystallography. We expressed, purified, and crystallized GloB and FrmB, in preparation for X-ray crystallography to resolve their structures. Various crystallization conditions were tested to optimize crystal formation. Successful crystal formation was achieved primarily under conditions with PEG 3350 compared to Tris pH 7.5 buffer, which provided clusters of needles. Crystals were harvested and high-resolution structures will be obtained at the AMX beam line at the NSLS2 synchrotron, which will reveal detailed interactions between the esterase and their bound ligands.

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| **SCIENCE ABSTRACT** |
| **56** |

**ALEXITHYMIA PREDICTS FACE EMOTION PRECEPTION AFTER ACQUIRED BRAIN INJURY**

Rebecca De La Garza1, Robiann R. Broomfield2, Emily Flores2, Robin A. Hanks3, & Lauren J. Radigan4, and Lisa J. Rapport2\*

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This study investigated the presence and level of alexithymia and examined the relationship between alexithymia and affect recognition abilities after acquired brain injury (ABI), accounting separately for etiology due to stroke or traumatic brain injury (TBI).  Neurologically-healthy adults (NHA; *n* = 99) and adults with moderate to severe ABI (TBI; *n* = 63; stroke *n* = 56) participated. Main measures included the Toronto Alexithymia Scale-20 (TAS-20) and Multicultural Facial Emotion Perception Test (MFEPT).  ABI groups endorsed greater alexithymia than NHA, but TBI and stroke subgroups did not significantly differ. Hierarchical multiple regression indicated that TAS-20 subscales Difficulty Identifying Feelings (DIF) and Externally-oriented Thinking (EOT), but not Difficulty Describing Feelings (DDF), added unique value to predicting objective affect recognition (MFEPT) after accounting for age, face recognition ability, and general cognitive function. Moreover, the relationship between alexithymia and affect recognition was moderated by group: DIF and DDF were inversely related to MFEPT only for adults with ABI. EOT was inversely related to affect recognition for all three groups. Adults with ABI experience alexithymia more frequently and intensely than neurologically-healthy adults, and this impairment may partly underlie struggles with affective processing frequently observed in these individuals on experimental tasks and in real-world interactions.

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| **SCIENCE ABSTRACT** |
| **57** |

**Reframing the Dental Experience: Stress Experiences of Patients and Dentists**

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The purpose of this research is to explore the dynamics of stress and fear in the dental context, including patients' odontophobia and anxiety and dentists' burnout and stress. The perspective of this research is what will help clients will help dentists. This study seeks to provide a foundation to explore strategies to enhance compliance and reduce patients’ anxiety. Important elements include dental professionals’ rates of stress and burnout, patients’ fear and low compliance, and the dynamics of how to improve patient outcomes and by association, dental professionals’ work experiences. Dentists are inclined to professional burnout, anxiety disorders, as well as depression. Sources of induced stress arise from work environments such as workplace, financial and practice management issues, and from personality types of individuals who choose the profession. Patients’ experiences can manifest as fear, anxiety, and odontophobia, at the extreme. This research analyzes Berggren's model of dental fear, and anxiety which predicts that dentally anxious individuals postpone treatment, leading to a deteriorating dental state and subsequently to fear of negative evaluations within relation to client’s oral conditions. This is a review of the literature with ideas for future research, directions to go, including qualitative work. Future research should explore antecedents of compliance, including anxiety, and the social and cognitive dynamics in which this will allow for improving both dentists and patient experiences.

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| **SCIENCE ABSTRACT** |
| **58** |

**PSYCHOLOGICAL SUPPORT FOR UNDERREPRESENTED STEM STUDENTS:** **A PILOT STUDY**

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The mental health and well-being of university students is a pressing global concern. Mental health distress and disorders are on the rise; some estimate that more than 1/3rd of students meet the criteria for at least one mental health disorder (e.g., depression, generalized anxiety, and suicidality). The mental health of undergraduate engineering students has consistently demonstrated higher rates of mental disorders and stress compared to other academic programs. To combat this issue, some researchers suggest integrating wellness activities tailored to engineering students within their coursework. The current pilot study seeks to address this problem by incorporating a social support group for first-year engineering students from underrepresented populations. The treatment group comprised of ten Science and Engineering Equity Development (SEED) Scholars. Seven STEM (Science, Technology, Engineering and Math) students, who did not undergo any treatment, were used as a comparison group. Assessments of happiness, psychological distress, stress, perceived social support, and resilience were taken in September 2022 and April 2023 of the student’s freshman year. As hypothesized, the results show an increase in happiness and resilience, with a decrease in stress for the treatment group. Social support and psychological distress did not show significant changes. In contrast, while not significant, the control group showed increased psychological distress and stress, and decreased resilience. The result of this study suggests that participation in a bi-monthly support group and the SEED program improved students’ psychological well-being.

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| **SCIENCE ABSTRACT** |
| **59** |

**REACTION OF S-PEEK WITH OH AND OOH RADICALS IN FUEL CELLS**

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Sulfonated polyether (ether) ketone (sPEEK) membranes are potential candidates for proton-transfer membranes in hydrogen fuel cells, but they degrade due to reactions with hydroxy radicals. This study uses M062X hybrid density functional calculations to explore the reactivity of sPEEK with OH radicals in a water environment. In fuel cells, OH, H, and OOH radicals are present, with OH radicals believed to particularly contribute to degradation of sPEEK. In this investigation, reactions of sPEEK with OH and OOH radicals were analyzed. One type of reaction was abstraction of hydrogen atoms from sPEEK by the radicals. Other reactions involving the reaction of OH with the SO3H group were also studied. Many of the reactions with OH were found to be spontaneous, but none of the reactions of the sPEEK molecule with OOH were found to be spontaneous.

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| **SCIENCE ABSTRACT** |
| **60** |

**ANTIBACTERIAL AND ANTIBIOFILM ACTIVITY OF THERABREATHTM ORAL RINSES AGAINST ORAL MICROBES**

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2University of Detroit Mercy, School of Dentistry, Division of Integrated Biomedical Sciences

*Streptococcus mutans* is a Gram-positive coccus that has the ability to metabolize dietary sugars and produce lactic acid as a byproduct. The acid in the local environment of a tooth surface can cause demineralization of tooth enamel leading to caries (tooth decay). *S. mutans* also encodes glucosyltransferase enzymes that convert sucrose into insoluble extracellular polysaccharides, which are a vital component for biofilm formation of *S. mutans* and provide binding sites for other oral microorganisms, ultimately aiding in the development of dental caries. Prevention of dental caries requires routine mechanical removal of plaque biofilm to reduce the number of acid-producing bacteria, including *S. mutans*, near tooth surfaces. Prevention may also include the use of antiseptic or therapeutic mouthrinses to kill or remove bacteria that are difficult to reach mechanically.  The goal of this study was to determine the antibacterial and antibiofilm activity of various TheraBreath™ oral rinses compared to other commercial mouthrinses, using *S. mutans* as a model oral pathogen. In vitro biofilms of a type-strain of *S. mutans* were grown for 24 hours in the presence of sucrose. Oral rinses were added to wells and rotated at 100 rpm for 15 minutes. Six separate experiments were conducted, each with duplicate treatment wells. Following treatment, biofilms were assessed using a Live/Dead vitality stain to assess antibacterial activity and crystal violet stain to measure total biofilm remaining after treatment. Additionally, liquid killing assays were performed to determine bactericidal activity against *S. mutans, Escherichia coli*, and saliva samples. Our findings suggest that TheraBreath™ Whitening Fresh Breath and TheraBreath™ Healthy Gums exhibit antibacterial properties against in vitro biofilms and planktonic *S. mutans* and other microbes from saliva. TheraBreath™ Healthy Gums was the only formulation tested that had comparable bactericidal activity to other commercial brands of oral rinses.

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| **SCIENCE ABSTRACT** |
| **61** |

**A MULTI-YEAR QUANTATIVE ANALYSIS OF DUODENAL PAPILLA RELATIONSHIPS**

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The duodenum, as the first part of the small intestine, is crucial in the complex process of digestion and nutritional absorption. This organ is vital in breaking down ingested food, which aids in the digestion of essential nutrients into the bloodstream. The duodenum is distinguished by its various morphological and physiological properties, including the duodenal papilla, which links to both the pancreas and the gallbladder, controlling the release of digestion enzymes and bile. Furthermore, the duodenum is distinguishable by its short length. The duodenum is in the abdominal cavity, specifically the upper abdomen, which lies distal to the stomach as the small intestine's first part. The pyloric sphincter, a muscle valve that functions as a critical step in the digestive process, separates the duodenum from the stomach. Over a seven-year study involving 89 cadavers, our research aimed to determine the measurements of the distance between the pylorus and the major papilla and the distance between the minor papilla and the major papilla. The study confirmed the anticipated 8 cm distance from the pylorus to the major duodenal papilla, consistent with prior observations. However, the 2 cm distance between the major and minor duodenal papilla is notably shorter than commonly documented in textbooks and journals. This research offers valuable insights into the precise measurements of duodenal structures. Grasping the measurements between the pylorus and the major papilla, as well as the distance between the minor papilla and the major papilla, is not only indispensable for precise medical practice but also for advancing our knowledge, improving patient care, and promoting early detection and prevention of gastrointestinal diseases.

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| **SCIENCE ABSTRACT** |
| **62B** |

**INDOOR VERSUS OUTDOOR ENVIRONMENTAL EXPOSURES ON STOMATAL FEATURES OF BASIL LEAVES**

Annabelle Elias, Candice Mansour, Laurence Karana and Hussein Koubeissi, Liam Biem, and Joel Bonney\*

Department of Biology, University of Detroit Mercy

Stomata are a key part of the plant’s process of exchanging resources. Understanding the relationship between stomata and plants can help us optimize the exchanges between plants and resources. This study explored the stomatal density, length, and percentage of open and closed stomata in basil, which are essential indicators of how the plant responds to environmental conditions. We gathered 20 basil leaves in two different environmental conditions (ten inside and ten outside), varying in sunlight and airflow. Our study aimed to determine how stomatal features differ between indoor and outdoor basil leaves. We hypothesized that differences in stomatal features would be apparent between the different environments, and that outdoor plants would have lower stomatal density and more open stomata than indoor plants. We collected from the MSU Garden in Detroit, MI, and then performed stomata peels. We found that the outdoor basil leaves had a longer stomatal length versus the indoor plants (*P* = 0.03). The other data collected, such as stomatal density and open-close percentage, showed a nonsignificant difference. Thus, according to our data, the 20 leaves collected from outdoor vs. indoor conditions showed no observable variation in stomatal density and open-close ratios. Our study highlighted the environmental factors that influence stomata features in basil. By understanding these relationships, we can optimize growing conditions for the basil and other plants.

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| **SCIENCE ABSTRACT** |
| **63B** |

**THE EFFECT OF PLANTING CHILI PEPPERS IN GREENHOUSES VERSUS RAISED BED GARDENS ON STOMATAL DENSITY AT THE URBAN GARDENS OF DETROIT, MI**

Zachary Bailey, Shahamat Chowdhury, Larry Beasley, Liam Bien, and Joel Bonney\*

Department of Biology, University of Detroit Mercy

Leaf stomata are essential for regulating carbon dioxide and water in plants. Plants must open their stomata to intake carbon dioxide to aid in the production of glucose. However, they risk losing water vapor in the process. To minimize water loss, plants will have fewer stomata in the presence of high concentrations of carbon dioxide. The objective of this experiment was to find the effect of location on stomatal density in chili peppers. Stomatal density was observed in the leaves of chili peppers that were grown inside of a greenhouse and compared to stomatal density in the leaves of chili peppers grown in the raised bed gardens outside of the greenhouse. We hypothesized that peppers grown in a greenhouse would have more stomata than peppers grown in the raised bed garden located outside the greenhouse because greenhouses have a lower concentration of carbon dioxide than the outdoor raised bed garden. Fewer stomata allow the plant to take in a sufficient amount of carbon dioxide while minimizing water loss. Ten leaves from the greenhouse and raised bed garden at MSU Garden in Detroit, Michigan were collected and their stomatal densities were observed. We found the stomatal densities in leaves from peppers grown in the greenhouse were significantly greater than the stomatal densities in leaves of peppers grown in the raised bed gardens outside (*P* = 0.003). These results demonstrate that plants grown outside will be able to intake a greater amount of carbon dioxide while minimizing water loss simultaneously. These results can be applied to innovate farming by growing more crops in raised bed gardens because they will have a higher rate of photosynthesis, allowing them to grow faster and produce a greater yield of crops in less time.

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| **SCIENCE ABSTRACT** |
| **64B** |

**THE ROLE OF LEAF SURFACE AREA IN STOMATAL DENSITY AND PERCENT OF OPEN STOMA IN CHESTNUT VERSUS HAZELNUT LEAVES**

Gianna Jadan, Samuel Padmanabhan, Sydney Upton, Liam Bien, and Joel Bonney\*

Department of Biology, University of Detroit Mercy

Stomata are crucial in the photosynthetic processes of plants, functioning in the mechanisms that allow for the uptake of carbon dioxide that will lead to the production of glucose that fuels the plant. The objective of our study was to analyze the differences between stomatal density and percentage of open stomata in plants with smaller leaves versus plants with larger leaves. We expect chestnut leaves, which are smaller, to have a higher stomatal density and more open stomata than hazelnut leaves. Our group collected ten chestnut leaves and ten hazelnut leaves from an urban garden in Detroit that were grown under the same lighting and soil conditions. We then produced stomatal peels, and calculated the stomatal length, density, and percent of open stoma for each leaf slide. After comparing the average calculations for each plant, our results demonstrated that chestnut leaves do have significantly more stomata than hazelnut leaves (*P* = 0.000018), and a higher percentage of open stomata (*P* = 0.03). This would allow for the chestnut leaves, though smaller, to still be able to achieve the proper amount of carbon dioxide uptake they would need for survival. Overall, concluding that smaller plant leaves increase the stomatal density and percent of open stomata found in a plant’s leaf, in order to allow for the proper uptake of carbon dioxide for photosynthesis. This study may be important for urban agriculture as it suggests that plants with smaller leaves may require more maintenance than larger ones, indicating the need for more selectivity in crop choices and prioritizing care based on available resources.

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| **SCIENCE ABSTRACT** |
| **65B** |

**THE INFLUENCE OF SUNLIGHT EXPOSURE ON STOMATAL DENSITY AND GROWTH IN BASIL PLANTS**

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Department of Biology, University of Detroit Mercy

Measuring stomata is crucial for understanding how plants regulate gas exchange and photosynthesis, directly impacting growth and overall plant health. The amount of sunlight basil plants are exposed to has a significant effect on the stomatal density of the basil leaves as well as a possible effect on growth. Previous research by Bashir (2022) indicated that increased light exposure leads to higher stomatal density in various plant species, suggesting a direct correlation with enhanced photosynthesis and growth. We conducted our research at an urban farm in Detroit, Michigan. The objective of our study was to determine if basil plants differ in stomatal density based on the amount of sunlight they’re exposed to. In the areas where there is more shade, we expect to show fewer stomata and a lower percentage of open stomata. In the areas of more sunlight exposure, we expect to see more stomata which would indicate more CO2 uptake, enhancing photosynthesis which is essential for plant growth. Our group did a stomata peel on 20 basil leaves that we collected from an urban garden. Next, we used a microscope to examine each of the 20 peels. We looked at the percentage of open stomata and the stomatal density. We found a nonsignificant difference in stomatal density with plants in the sunlight having a greater stomatal density). In this case, our p-value, 0.418 was greater than 0.05, our hypothesis was not supported, meaning the leaves would not grow more depending on the amount of sunlight it’s exposed to, but other factors could come into play in basil leaf growth. This approach could be implemented in other agricultural settings to enhance crop growth and yield by optimizing light exposure and strategically placing plants within greenhouses.

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| **SCIENCE** |
| **66B** |

**ENVIRONMENT AFFECTS THE AMOUNTS OF STOMATA FOUND WITHIN A CELL**

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The environment has a great effect on the amount of stomata found within a leaf. Things within the environment that can affect stomata are light quality and intensity, air humidity, atmospheric CO2 concentration, biotic and abiotic stresses. The effect of sunlight on stomata is that the stomata opens when hit with sunlight that allows carbon dioxide to enter the leaf for photosynthesis. We went to MSU gardens in Detroit and collected ten leaves from pepper leaves that were inside the greenhouse and ten from the planter that was outside. We then compared the greenhouse leaves to the planter leaves and found the stomata within them. It is hypothesized that there will be more open stomata in the sun. We found when comparing leaves from the sunlight vs the greenhouse that the greenhouse leaves had more stomata found within them (p=0.15). Our P Value was not significant; therefore, our hypothesis was not hypothesized. This is significant because it shows that the environment does have an effect on the stomata found within leaves. In conclusion, there were more open stomata in the leaves found in the greenhouse rather than outside in the sun. These results are important for urban farmers because they can give an insight on what to expect when planting greenhouse plants compared to planters outside.

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| **SCIENCE** |
| **67B** |

**THE EFFECTS ON STOMATAL DENSITY OF RED PEPPER LEAVES**

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Environmental factors affect stomatal density, a measurement of the number of stomata per unit area. Stomata, which are tiny openings in leaves that control water loss and gas exchange, are essential for plant adaptability. The stomatal density of red pepper leaves cultivated both indoors and outdoors was investigated in this study. Due to their popularity in urban gardening and their capacity to react differently to environmental changes, red pepper plants were chosen. We predicted that while leaves grown in a greenhouse would have a lower stomatal density because of the stable environment and greater CO₂ concentrations, leaves grown outdoors would have a higher stomatal density because they would be exposed to more changing CO₂ levels and environmental conditions. Twenty red pepper leaves were gathered from urban gardens in Detroit, ten of which came from an outdoor garden and ten from a greenhouse. A microscope was used to view and evaluate stomatal density on stomatal peels. In comparison to the outside leaves (262.89 stomata/mm²), the average stomatal density of the greenhouse-grown leaves was lower (218.24 stomata/mm²). Nevertheless, the difference (*P* = 0.1703) was not statistically significant. Since the p-value indicated that the observed variations in stomatal density might have happened by chance, these data disproved our original premise. This study provides information for urban farmers and greenhouse operators, despite the absence of statistical significance, by revealing that stomatal density may not be greatly changed by controlled conditions like greenhouses as previously believed. Understanding these processes is helpful in optimizing growing conditions for plants in urban agriculture.

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| **SCIENCE** |
| **68B** |

**THE ROLE OF STOMATA LENGTH IN A CAPSICUM ANNUUM PLANT AND THE STAGE OF MATURATION, FOR CAPSICUM ANNUUM LEAVES IN URBAN GARDENS OF DETROIT, MI**

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The objective of our study focused on analyzing stomata length in bell pepper plants. Stomata are the microscopic openings on the surface of plant leaves. These openings allow the exchange of oxygen and carbon dioxide between the plant and the environment while reducing water loss depending on environmental conditions. We investigated our hypothesis that the stomata of bell pepper leaves would exhibit differences in length and density depending on the plant's stage of maturation. We predicted that leaves from plants in later stages of development, with more mature and ripened peppers and leaves, would have smaller stomata, suggesting reduced nutrient exchange and increased water conservation. To test this hypothesis, we collected ten bell pepper leaves from Cadillac Urban Garden in Detroit, five mature and fully developed, along with five that were premature and underdeveloped. After gathering the leaves, stomata peels were performed in the lab, and the samples were analyzed under a microscope to examine stomatal density, length, and the percent of open stomata. We did our calculations by determining the standard deviation and p-values, and after analyzing that data, it was found that there was no significant difference in density or length, nor in stomata openness. Although our predictions suggested differences based on the plant's maturation stage, our findings came to contradict our hypothesis. To conclude, the experiment showed that the stomatal changes associated with maturation in bell pepper plants did not result in any significant difference in stomatal length, density, or the percentage of opened stomata.

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| **SCIENCE ABSTRACT** |
| **69B** |

**COMPARATIVE ANALYSIS OF STOMATA DYNAMICS IN ABELMOSCHUS ESCULENTUS IN RESPONSE TO GREENHOUSE CULTIVATION METHODS**

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Red-stemmed okra (*Abelmoschus esculentus*) has been shown to grow similarly between greenhouse and open-field cultivation methods. Greenhouse cultivation emphasizes optimized light exposure, temperature, water availability, and gas exchange. Leaf stomata are microscopic openings responsible for regulating said gas exchange on the underside of most leaves. When open, stomata allow the influx of carbon dioxide (CO2) and the release of oxygen (O2). Analysis of stomata dynamics (stomatal density, stomata size, and proportion of open stomata) between cultivation methods is an effective method of evaluating overall health of many plants, including red okra. Accordingly, we hypothesized that we would see a higher proportion of open stomata in open field cultivated red okra due to uncontrollable, potentially sub-optimal conditions that are simulated in greenhouse cultivation methods. We collected 20 total leaves (*n*= 10 per cultivation method) from red okra plants at Cadillac Urban Gardens in Detroit, MI. We created stomatal peels of each leaf then performed microscopic evaluation to determine the mean of each stomatal dynamic response. Our study found that the there was no statistical difference in stomatal density and size between groups (*P* > 0.05), while there was a significant difference in the proportion open stomata between the conditions (*P* < 0.05). Our study suggests that open field cultivation may be favorable as more open stomata are capable of gas exchange, thereby increasing the rate of biochemical processes such as photosynthesis. Our data on the stomata dynamics of okra leaves provide insight into the impacts of agricultural practices on the plants we eat.

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| **SCIENCE ABSTRACT** |
| **70B** |

**THE ROLE OF PERCENT OPEN AND CLOSED STOMATA IN ARROWWOOD VIBURNUM LEAVES AND THE EFFECTS OF INSECT DAMAGE FOR ARROWWOOD VIBURNUM PLANTS IN URBAN GARDENS OF DETROIT, MI**

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The effects of insect damage have prominent consequences on percent open and closed stomata in arrowwood viburnum leaves and can lead to problems with photosynthesis and plant development. The goal of our study was to find if arrowwood viburnum plants have more open or closed stomata based on insect damage. We predict that arrowwood viburnum plants with more insect damage will have more closed stomata then healthy plants. Our group gathered 5 healthy leaves and 5 insect damaged leaves from an urban garden. We then performed a stomatal peel and inspected it under a microscope. We counted the percent of open and closed stomata in each sample and recorded our data. Our data from the study shows that leaves with more insect damage will have more closed stomata then leaves without insect damage. These effects will lower the exchange of oxygen and carbon dioxide inside the leaf.

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| **SCIENCE ABSTRACT** |
| **71B** |

**STOMATA LENGTH, STOMATA DENSITY, AND PERCENTAGE OF OPEN STOMATA IN BRASSICA OLERACEA VAR. VIRDIS PLANTED IN THE GROUND AND RAISED PLANT BEDS IN DETROIT, MI**

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The objective of our study was to determine whether plant location plays a role in the differentiation of stomata length, stomata density, and percentage of open stomata in *brassica oleracea var. viridis* (collard greens). Plants grown in raised plant beds absorb water and natural nutrients from this enclosed area more quickly than plants grown in the ground, ultimately leading to plants in the bed being deprived of these. Because raised plant beds provide less water and natural nutrients to the plant, we expect to see a decrease in percentage of open stomata, a decrease in stomata density, and a decrease in stomata size for those located in raised beds. Plants grown in the ground should have a greater percentage of open stomata, a higher stomata density, and larger stomata. We collected 20 collard green leaves (10 from a raised plant bed and 10 from the ground), performed stomatal peels, and analyzed them under a microscope. We examined average stomata length, average stomata density, and average percentage of open stomata. Our study shows that in plant beds, *brassica oleracea var. viridis* has a significantly less percentage of open stomata and significantly smaller stomata length. Stomata density was not affected.

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| **SCIENCE ABSTRACT** |
| **72B** |

**EFFECT OF DIFFERENT ENVIRONMENTS ON PLANT STOMATAL DYNAMICS OF PEPPER PLANTS**

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The abundance of the stomata density, length, and percent open of pepper leaves is affected by the location it is grown in. The objective of our study was to determine if pepper plants had a variance in stomatal density based on area. We expected that pepper plants grown inside the greenhouse had greater stomatal density, stomata length, and percent open stomata compared to pepper plants grown outside Our group collected 10 pepper leaves that were grown in a greenhouse and 10 pepper leaves grown outside, we made leaf impressions and examined them under a microscope. Our results showed that the pepper leaves grown in the greenhouse had greater stomatal length and higher percentage of stomata open. Our study suggests that pepper plants grown in the greenhouse have higher stomatal dynamics because the temperature and water intake are regulated.

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| **SCIENCE ABSTRACT** |
| **73B** |

**EFFECT OF HERBIVORY ON STOMATAL DENSITY OF OKRA PLANTS IN A DETROIT URBAN GARDEN**

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Eva Nyutu\*

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Urban gardening is a significant alternative source of produce in Detroit, as exemplified by MSU’s Detroit Partnership for Food, Learning and Innovation (DPFLI) urban agriculture center. Okra, which is grown at DPFLI, is a particularly important crop due to its proposed therapeutic properties. The okra we examined at DPFLI exhibited signs of insect damage. Prior studies have found that insect herbivory can lead to stomatal opening and closure, which has effects on photosynthesis and the chemical makeup of leaves. These effects can result in further environmental consequences, such as the proliferation of agricultural pests such as aphids. Our objective was to find out how stomatal density, percent open stoma, and stoma length differ between insect damaged and undamaged okra leaves. We hypothesized that insect damaged leaves would exhibit a higher stomatal density than undamaged leaves. We collected ten insect damaged okra leaves and ten undamaged okra leaves from DPFLI, performed stomata peels to create microscope slides, and determined the stomatal density, percent open stoma percentage, and stoma length for the leaves. Our results suggest that leaves with lower stomatal densities and higher percent open stoma exhibited the most signs of insect damage. While many insect-leaf interactions lead to stomatal closure, there are some insects that can open stoma, which may account for our results.

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| **SCIENCE ABSTRACT** |
| **74B** |

**THE RELATIONSHIP BETWEEN STOMATAL DENSITY AND YIELD OF RED HABANERO PEPPERS**

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Stomata play a key role in plant development as it contributes to gas exchange and transpiration. Stomata density is also an indicator of adaptation to certain environments, therefore identifying factors that affect stomata density could change productivity and plant growth. The objective of our study was to examine whether the yield of habaneros affects the stomatal density, stomatal length, and open stoma. We hypothesized that leaf stomatal density, length of stomata, and proportion of open stoma on habanero plants would change with respect to the amount of yield. We performed the stomata peeling method with the use of a microscope to identify three variables, stomata density, stomatal length, and percentage of stomata open. We assessed how these variables are related to the yield. We detected that the mean stomatal density, stomatal length, and percent open stoma of habanero leaves did not differ significantly between the high and low yield. Proposing that in this garden their maybe other factors in play that may lead to excessive water loss, potentially hindering growth due to increasing temperatures and carbon dioxide levels.

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| **SCIENCE ABSTRACT** |
| **75B** |

**PRESENCE OF ENDOCRINE DISRUPTING COMPOUNDS UPSTREAM AND DOWNSTREAM OF AN URBAN WASTEWATER TREATEMNT PLANT**

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The quality of urban surface waters such as the Detroit River has become an emerging concern due to the increased detection of Endocrine Disrupting Chemicals. Although concentrations of these chemicals are typically reported at low levels ranging from ug/L (parts per billion) to ng/L (parts per trillion), concerns have been raised about the potential impact on humans and aquatic organisms from long-term exposure to these chemicals if they remain unregulated. Most of these chemicals are released from the effluent of municipal wastewater treatment plants, which are not optimized to remove these organic compounds resulting in their discharge to the surface water. Water samples were collected in the Summer from the upstream/influent and the downstream/effluent near the Detroit wastewater treatment plant to examine 17 Endocrine Disrupting Chemicals. Surface water was analysed for pharmaceuticals, personal care products and pesticides. Of the 17 target substances analysed 7 were not detected in any of the samples, while 10 were detected this included sucralose, iohexol, caffeine, acesulfame K, acetaminophen, sulfamethoxazole, Bisphenol A, carbamazepine, atenolol and gemfibrozil at concentrations ranging from 4.5 to 4000 ng/L. Measuring Endocrine Disrupting Chemical levels near the Detroit wastewater treatment plant effluent will help identify at-risk watersheds and serve as a benchmark for future contaminant reduction strategies and remediation efforts.

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| **SCIENCE** |
| **76** |

**META-ANALYSIS OF ERYTHROPOIETIN DOSAGE FOR NEONATAL HYPOXIA AND ENCEPHALOPATHY TREATMENT IN ANIMAL AND HUMAN EXPERIMENTAL STUDIES**

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Hypoxia-Ischemic Encephalopathy (HIE) is a leading illness for cause of neonatal death and infants who survive suffer from severe mental disabilities. Researchers and physicians have been investigating the effects of erythropoietin (EPO) as a potential treatment for neonatal HIE. Many animal and human studies have shown significant and non-significant improvements of sensorimotor function following EPO treatment of total dosages ranging up to 15000 U/kg. In 2022, a double-blind, randomized, placebo-controlled trial tested the efficacy of EPO combined with hypothermia on 500 infants who were born 36 weeks that suffered from hypoxia-ischemic encephalopathy (HIE). It was found that a total dosage of 5000 U/kg EPO combined with hypothermia did not lower risks of death and neurodevelopment disability where 52.5 % EPO group vs. 49.5 % saline group had death incidents or neurodevelopment impairment (relative risk, 1.03; 95% confidence interval [CI], 0.86 to 1.24; P=0.74). It is of great importance to acknowledge that animal clearance of EPO is approximately three times faster in rats specifically, suggesting that equivalent dosages in humans should be approximately one third that of the dose given to rodents, 3333-5000 U/kg. We hypothesize the cause for poor outcomes in previous clinical is using an EPO dosage that is too high. We conducted this meta-analysis project of previous animal and human trials emphasizing on sensorimotor developmental and histopathological outcomes to evaluate the dosage of EPO treatment and to find an appropriate EPO dosage in humans.