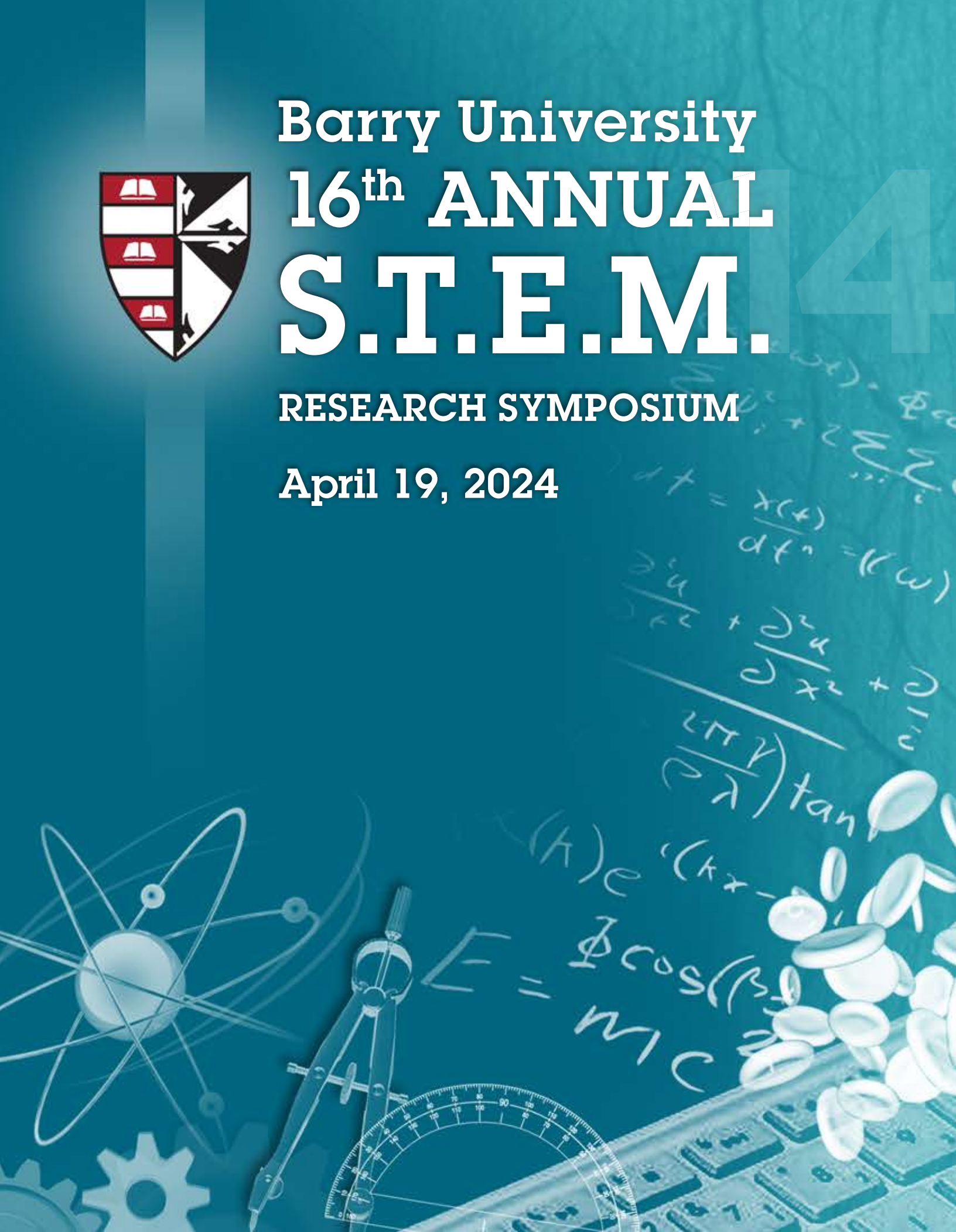
Barry University

16th ANNUAL S.T.E.M.

RESEARCH SYMPOSIUM

April 19, 2024



16th Annual S.T.E.M. Research Symposium

This research symposium is aimed at engaging the Barry community in learning about and sharing in the excitement of ongoing discoveries and research within the Science, Technology, Engineering, and Math disciplines (S.T.E.M.), Medicine, Humanities and Social Sciences. Undergraduate, graduate and high school students will present posters related to their past and current research in biology, chemistry, computer science, sports and exercise science, health science, humanities, mathematics, music, medicine, social sciences, psychology, and physics.

Friday, April 19, 2024

9-11:45 am *Poster Presentations*

10-10:30 am *Opening Ceremony*

noon-1 pm *Keynote seminar*

1-2 pm *Award Ceremony*

We gratefully acknowledge:

The dedication of research mentors, support staff, undergraduate, graduate and high school student researchers.

Sigma Xi, The Scientific Research Honor Society for sponsoring Dr. Teresa Petrino-Lin Memorial Award for Outstanding Student Presentation

Sponsors from Barry University: Department of Biology, Department of Math and Computer Sciences, Department of Chemistry and Physics, Department of Psychology, and College of Health and Wellness

Contributions from high schools: iTech @ Thomas A. Edison Educational Center and American Heritage School

Special thanks for assisting with the Symposium to:

Department of Marketing and Communications and Dr. Stephanie Bingham

Organized by Members of Barry University's STEM Committee:

Sabrina Des Rosiers PhD, Christoph Hengartner PhD, Ricardo Jimenez PhD, Zacharias Papadakis PhD, Michael Robinson PhD, Zuzana Zajickova PhD, and Anita Zavodska PhD

Keynote Seminar Abstract

Barry University STEM 2024

Title: Fighting Climate Change One Bite at a Time

Speaker: Elaine Franklin, Environmental Sustainability Coordinator for the City of Hollywood, Florida

Abstract

The City of Hollywood is dedicated to addressing the relationship between food and climate change. By reducing pollution from wasted food and making informed dietary choices, everyone has the power to contribute positively to sustainability. Food waste prevention and dietary choices play a pivotal role in combating climate change. Learn practical strategies to reduce food waste. Get tips to improve your health and the environment through dietary choices. By adopting these practices, each of us becomes an agent of positive change to shape a more sustainable world.

Keynote Speaker Bio – Elaine Franklin

Elaine has a master's degree in conservation biology from the University of Hawaii at Manoa. She brings years of diverse experience to the role of Environmental Sustainability Coordinator.

Prior to her life in Florida, Elaine developed and delivered an environmental sustainability curriculum to youths in Eswatini/Swaziland, Southern Africa, through her own company. She earned her Permaculture Design Certification in South Africa and guided low-income residents in establishing abundant, diverse and sustainable food gardens in their own yards. She has studied the impacts of human activities on birds throughout the world, most recently coauthoring a paper on the effects of a new transportation project on bird communities in Equatorial Guinea. Elaine is a CLEO Climate Speaker, a facilitator of the En-ROADS climate simulator, a Florida Master Gardener, and an avid cyclist.

DEPARTMENT OF BIOLOGY

1. **Growth and survival of turtlegrass (*Thalassia testudinum*) seedlings under hydroponic and planted laboratory conditions**

Ariel Alibocas, Ainsley Vanderhyde, and Silvia Macia (Department of Biology, Barry University, Miami Shores, FL)

Thalassia testudinum, turtlegrass, is a species of seagrass commonly found in shallow tropical seas. Turtlegrass is extremely important for the ecosystem, providing habitat to many organisms and sustaining water quality. Due to the rising water temperatures and ocean acidification, restoration of seagrasses is becoming increasingly important. The purpose of this study was to determine the optimal conditions for laboratory rearing of turtlegrass: hydroponically; planted singly; or planted in groups. Turtlegrass seeds were collected along the shoreline of Key Biscayne, Florida. Once the seeds germinated, the seedlings were split into 6 tanks: 3 hydroponic and 3 with sand. Each hydroponic tank had 133 seedlings. In the tanks with sand, 20 seedlings were planted singly, and 100 seedlings were planted in 20 groups of 5. The length of the longest leaf of 20 random hydroponic seedlings, the longest leaf in the groups of 5, and the longest leaf of the single seedlings were measured every 2 weeks for 16 weeks. Seedlings grown hydroponically had the best survival rates over the course of the experiment. Over the first 10 weeks, hydroponic seedlings also had the highest growth rate, although after 10 weeks their growth declined. Overall, our research suggests that hydroponic growing conditions are more effective than planting either singly or in groups, and are logistically easier to set up and maintain.

Funding provided by the Department of Biology at Barry University.

2. **Effects of limb loss on the obstacle negotiation in brittle stars**

Ariel Aribocas, and Janne Pfeiffenberger (Department of Biology, Barry University, Miami Shores, FL)

Limb loss is an effective defensive mechanism that is found in several phyla. Ophiuroidea, Brittle stars, can autotomize their limbs and regrow them. This is a costly event but enables animals to overcome a predation event. Costs associated with limb loss can be measured in the energy that is required to regrow the limb, but as well as the potential reduction in locomotor effectiveness and other organismal fitness metrics. Brittle stars, with their pentaradial body plan have redundant limbs that allow them to compensate for limb loss rather easily, and they have served as models for bio-inspired robots. Brittle stars live in complex environments, often navigating obstacles several times larger than themselves. In this study, we examined how limb loss affects the climbing and obstacle negotiating capacity in brittle stars. We examined brittle stars negotiating obstacles of varying heights with 1, 2, or 3 limbs missing. We found that obstacle negotiating ability was only affected when 3 limbs missing, suggesting that the redundancy of limb functions allows brittle stars to maintain effective obstacle negotiating capacities.

Funded by Departmental funds to the BIO 474 Marine Biology Seminar of Spring 2024

3. **The effects of beta-hydroxybutyrate on *Lactobacillus casei*'s antibiotic sensitivity**

Thurna Baronvil, Valentina Montagna, Ashley Torrentes Palacios, Arianna Fermin, Leticia R. Vega,

and Christoph J. Hengartner (Department of Biology, Barry University, Miami Shores, FL)

Lactobacillus casei is a lactic acid producing bacterium commonly found in human and animal gut. *L. casei* is widely studied given its ability to balance bacterial composition, absorb nutrients, and discourage harmful bacteria from disrupting a healthy ecosystem. Although naturally found in the gut, *L. casei* is also commonly found in dairy products and/or consumed in the form of probiotics. Given its prevalence in food products, scientists have aimed to study *L. casei*'s of antibiotic resistance (AR) genes. Antibiotics are naturally occurring or synthetically produced chemicals that target bacterial infections. In this study we characterized the antibiotic sensitivity exhibited by *L. casei* to commonly prescribed antibiotics. The sensitivity or resistance of *L. casei* to antibiotics (Erythromycin, Vancomycin, Streptomycin, and Gentamicin) was assayed using a disk diffusion method under aerobic and anaerobic conditions. Since ketogenic diets are known to increase the synthesis of beta-hydroxybutyrate (BHB) though ketogenesis, we sought to determine whether *L. casei'*s antibiotic sensitivity was altered in response to increasing BHB levels. Alterations in antibiotic sensitivity of gut microbiota in response to dietary changes may be important to understanding health and disease in humans and animals. *Authors contributed equally to this study

Funding provided by the Department of Biology at Barry University.

4. **Effect of PDGFand red-light on p27kip1 in NIHh 3t3 murine fibroblasts**

Chiara Brambilla, Virginia Rivas, Jared Ward, and Laura Mudd (Department of Biology, Barry University, Miami Shores, FL)

Wound healing is a complex process of regenerative events in which fibroblasts play an important role (Gonzalez, 2016). Platelet-derived growth factor (PDGF) increases proliferation in murine fibroblasts (Shrieber, 2001). Red light wavelengths (~640nm) appear to promote proliferation of fibroblasts during the wound healing process (Giannakopoulos, 2022). Proliferation is also affected by P27kip1 which slows or stops the growth phase of the cell cycle, allowing the organism to maintain homeostasis with regard to cell numbers (Zhu,2001). The purpose of this experiment is to observe whether PDGF with or without red light alters P27kip1, a protein implicated in cell proliferation. The ability to manipulate fibroblast proliferation can benefit those with chronic wounds, those recovering from surgery, or those with conditions resulting in abnormal proliferation of cells.

Funding provided by the Department of Biology at Barry University.

5. **Effect of oxidative stress on ERK expression in Hela cells**

Maximillian Buckelew, Lily Hernandez, Veronica Perez Taboada, and Pierre-Yves Jean-Charles (Department of Biology, Barry University, Miami Shores, FL)

Oxygen plays an important role in cell metabolism, being critical for efficient production of energy in the form of ATP through cellular respiration. Nevertheless, oxidative stress is known to negatively affect cells due to the generation of reactive oxygen species (ROS) that may cause damage to various cellular components, namely by inducing double-stranded breaks in DNA, provoking oxidation and misfolding of proteins, and causing peroxidation of lipids which compromises

membrane stability. Thus, we investigated the effects of oxidative stress on HeLa cells (cervical cancer cells) and extracellular signal-regulated kinase (ERK) expression using cell-based assays in tangent with time-course trials. Treatment of HeLa cells with hydrogen peroxide caused a decrease in ERK expression which is indicative of impaired signaling in the cell. Our study highlights the importance of appropriate oxygen levels in the cell for the maintenance of cellular integrity and activity.

Funding provided by the Department of Biology at Barry University.

6. **Understanding the effect of ethanol on behavioral characteristics in zebrafish**

Zaidon Cange and Stephanie Bingham (Department of Biology, Barry University, Miami Shores, FL)

Fetal alcohol spectrum disorders (FASDs) encompass a range of disorders attributed to ethanol exposure during embryonic development. These disorders produce various phenotypical characteristics, including cognitive impairments such as hyperactive behavior, diminished coordination, and poor memory. This study is focused on exploring the behavioral impacts of ethanol exposure in adult wild type zebrafish. Zebrafish exposed to varying ethanol concentrations (0%, 0.3%, and 0.5%) will subsequently undergo behavioral assessments to examine parameters such as latency to the upper zone, immobility time, and distance traveled. The goal is to determine whether our findings align with existing literature suggesting that even low doses of ethanol can alter locomotion, induce anxiety-like behavior, and exacerbate anxiogenic effects. This study contributes to the understanding of the behavioral implications of ethanol exposure, potentially shedding light on correlations to Fetal Alcohol Spectrum Disorders.

Funding provided by the Biology Department at Barry University.

7. **The effects of forever chemicals on zebrafish embryogenesis**

Zyhria Curry, Yasmin Marsh, and Stephanie Bingham (Department of Biology, Barry University, Miami Shores, FL)

Per- and poly-fluoroalkyl substances (PFAS), commonly known as forever chemicals,are synthetic chemicals that have very strong C-F bonds which make them resistant to degradation. PFAS is most commonly found in firefighting foam, food packaging, cooking utensils, in the foods we eat, and the water we drink. Two of the most common substances used are perfluorooctanoic acid (PFOA) and perfluorooctanoic sulfonic acid (PFOS). Recognizing the increasing exposure to these ubiquitous environmental contaminants led to interest in the potential and persistent health risks in both humans and the marine population. Therefore, *Danio rerio* (zebrafish) will be used to investigate potential negative health outcomes caused by this exposure. The purpose of this study is to examine how embryonic exposure to PFAS affects early developmental rates in zebrafish. Zebrafish is appropriate for this study as its embryos offer a valuable opportunity for studying development due to their transparency and genetic similarity to humans. The possible developmental effects induced by various PFAS compounds will be evaluated at 0, 0.5, 2, 4, 8 and 12 mg/L for 5 days (120 hours). Parameters to be studied include survival rates, progression through developmental stages by measurement of key structures such as the swim bladder, spine, and body length, as well as morphological abnormalities. Examining the effects of PFAS in zebrafish during embryogenesis provides an opportunity to gain insights into potential effects

during human embryogenesis.

Funding provided by the Department of Biology at Barry University.

8. **Eye color in marine fishes: implications for behavior and ecology**

Dicarlo Davis, Ernest Charles, and Michael Robinson (Department of Biology, Barry University, Miami Shores, FL)

Marine fishes are an incredibly diverse group with diverse and often striking patterns of coloration. The function of this coloration has been debated since at least the time of Darwin. Some known uses of coloration in marine fishes include inter- and intraspecific communication, mimicry, and camouflage. We use a comparative approach to examine one aspect of this coloration: eye color. The color of the eye itself and the area surrounding the eye are potentially important, because the eye itself is an important organ and it is located near the brain. Many predators direct attacks towards the head to improve success. Color in fishes can be used to obscure the eye reducing attacks to the head or in other cases obscuring the danger presented by a predator. In other cases color appears to accent the eye, possibly as a costly signal given the importance of the head. Finally, in some cases the color of the eye seems to be controlled by factors other than communication.

Funding provided by the Department of Biology at Barry University.

9. **Evaluating the effects of ethanol exposure on learning and memory in zebrafish**

Precious Ezeamama, Neissa Rousseau, and Stephanie Bingham (Department of Biology, Barry University, Miami Shores, FL)

Zebrafish is an important model system for the study of learning and memory. This study's objective is to implement a T-maze paradigm to examine passive avoidance as well as spatial memory of adult zebrafish conditioned with a food reward system. The latency period associated with finding the reward after conditioning is associated with cognitive function. We hope to determine whether there are differences in the learning and memory capacity as well as passive avoidance behaviors in control vs. ethanol-treated zebrafish which will provide insights into the effects of alcohol on cognition.

Funding provided by the Department of Biology at Barry University.

10. **The effects of beta-hydroxybutyrate on a gut microbiome resident *Lactobacillus casei***

Arianna Fermin, Valentina Montagna, Thurna Baronvil, Ashley Torrentes Palacios, Leticia R. Vega, and Christoph J. Hengartner (Department of Biology, Barry University, Miami Shores, FL)

Lactobacilli are rod shaped bacteria found in the gut, vagina, mouth, and certain dairy products that serve as protective agents against harmful microorganisms. Lactobacillus casei is a lactic acid producing bacteria that is commonly found in human and animal gut. Various studies have shown that *L. casei* is associated with promoting human health, mainly in the gastrointestinal tract (GIT). Alterations and dysfunctions in the gut have been shown to affect the bacterial composition of the

gut microbiota, ultimately influencing the host health. The adoption of different diets, such as the ketogenic diet, have been shown to alter the species composition of the human microbiome. The ketogenic diet, referred to as the "keto diet", is a low-carbohydrate, high-fat diet that aims to trigger the process of ketosis to enhance weight loss. Ketosis occurs when the body utilizes lipids (fats) in the absence of carbohydrates, producing molecules known as ketone bodies. As the body's energy pathway changes, excessive production of these molecules has the potential to affect the gut microbiome, possibly changing the proportional levels of *L. casei*. This study aims to investigate the possible influence of ketone bodies produced during a state of ketosis on *L. casei*. Potential effects on growth of *L. casei* were examined by manipulating the concentrations of key molecules: glucose, a non-keto sugar control; beta-hydroxybutyrate, a ketone body; and inulin, keto diet sugar replacement. Our finding suggest that all three carbon sources may be utilized for growth by *L. casei* under the conditions tested. This initial characterization was important to help us characterize the growth of *L. casei* under our assay conditions.

Funding provided by the Department of Biology at Barry University.

11. **The impact of color and pattern variation in soft plastic swim baits on largemouth bass(micropterussalmoides) fishing success**

Kyle Fowler, and Janne Pfeiffenberger (Department of Biology, Barry University, Miami Shores, FL)

Largemouth bass (Micropterussalmoides) fishing enthusiasts continually seek ways to optimize their angling success. Among the myriad factors influencing success rates, the selection of artificial lures, particularly soft plastic swim baits, stands out as a pivotal determinant. While anglers often rely on intuition or anecdotal evidence when choosing lure colors and patterns, empirical research on the effectiveness of different options remains scarce. This study focuses on examining the relationship between lure color and pattern visibility and the propensity of largemouth bass to strike. Our hypothesis posits that in clear water conditions, lures with more vibrant and conspicuous colors will elicit a higher frequency of strikes compared to those with subtler or more naturalistic hues. To test this hypothesis, we employed a multifaceted approach combining lab experiments, behavioral observations, and statistical analyses. By varying the colors and patterns of soft plastic swim baits and recording the corresponding strike rates under the same environmental conditions, we found that vibrant lures with high contrast colors elicited faster strikes compared to lures with less contrasting colors. More data is needed, but ultimately findings from this research will empower anglers with evidence-based insights, enabling them to make informed decisions when selecting artificial lures for largemouth bass fishing. By bridging the gap between theory and practice, we aspire to enhance the angling experience while advancing our understanding of the ecological dynamics of freshwater habitats.

Funded by departmental funds to BIO 474 Marine Biology Seminar Spring 2024

12. **Effect of α1-adrenergic receptors on ERK activation in Hela cells**

Giselle Garcia, Veronica Perez Taboada, Lily Hernandez, and Pierre-Yves Jean-Charles (Department of Biology, Barry University, Miami Shores, FL)

α_1-adrenergic receptors (α_1ARs) are G protein coupled receptors (GPCRs) that are involved in neurotransmission and regulation of the sympathetic nervous system upon binding of the

neurotransmitter, norepinephrine, and the neurohormone, epinephrine. The body naturally produces the catecholamine norepinephrine and epinephrine during states of stress and anxiety. Canonically, stimulated α_1AR couples the G protein Gαq resulting in activation of the second messengers diacylglycerol (DAG) and Ca^{2+}. GPCRs are also known to activate mitogen-activated protein kinases (MAPKs) such as extracellular signal-regulated kinase (ERK) through G protein- and β-arrestin-mediated mechanisms. Thus, we investigated the activation of ERK in HeLa cells stably expressing α_1AR and compared them to basal. We observed acute ERK activation in the cell expressing α_1AR confirming the functionality of the receptor and its ability to initiate MAPK cascades.

Funding provided by the Department of Biology at Barry University.

13. **β2AR mediated signaling in Hela cells**

Lily Hernandez, Veronica Perez Taboada, Maximillian Buckalew, and Pierre-Yves Jean-Charles (Department of Biology, Barry University, Miami Shores, FL)

Beta-2 Adrenergic receptor (β_2AR) is a prototypical G protein-coupled receptor (GPCR) that mediates signaling by coupling to Gαs subunit of heterotrimeric G protein. Once β_2AR is activated through an extracellular signal, Gαs exchanges GDP binding for GTP and activates adenylyl cyclase to produce the second messenger cAMP. cAMP generation leads to activation protein kinase A (PKA) which phosphorylates several cellular targets to mediate cell response. We investigated various signaling cascades mediated by β_2AR when stimulated by the synthetic agonist, isoproterenol. Interestingly, our time course experiment revealed that β_2AR failed to activate protein kinase B (AKT) and phosphoinositide 3-kinase (PI3K). On the other hand, mitogen-activated protein kinases extracellular signal-regulated kinase 1 and 2 (ERK1/2) were activated by the receptor. Our study highlights the selectivity of β_2AR for distinct intracellular signaling cascades which result in specific cell responses.

Funding provided by the Department of Biology at Barry University.

14. **In vitro growth of African violet (*Saintpaulia ionantha*) tissue explants.**

Lily Hernandez, Valentina Montagna, Veronica Perez Taboada, Elizabeth Sanchez, and Flona Redway (Department of Biology, Barry University, Miami Shores, FL)

Plant tissue culture refers to growing parts of the plant (explants) in culture media under aseptic and controlled conditions. Many advances have been made using plant tissue culture including the production of hybrid plants, virus-free plants, and the ability to save endangered species. Implementing this common technique, we treated different explants of *Saintpaulia ionantha* (African Violet), leaves and petioles (explants), to Murashige and Skoog (MS) agar basal medium, or MS medium containing different hormone treatments and/or plant preservative mixture (PPM). Explants were sterilized in 10% household bleach and Tween 20 and cultured in 16/8h photoperiod. After 17 days in culture, contamination ranged from 0-33%. Swelling of the petiole occurred after seven days in the MS only and MS with PPM treatments, and roots were observed after 17 days in the MS only treatment. Shoots developed after four weeks in the hormone treatment. The overall effects of the different hormone and PPM treatments on root and shoot formation and growth of the cultures will be presented and discussed.

Funding provided by the Department of Biology at Barry University.

15. **Adaptive climbing strategies after limb loss in the mangrove tree crab, aratus pisonii**

Yesiana Herrera, Sadana White, and Janne Pfeiffenberger (Department of Biology, Barry University, Miami Shores, FL)

Mangrove tree crabs are an arboreal species of Sesarmid decapods that live in the trunks and canopies of mangroves. They return to the water to feed and to reproduce, but otherwise live an entirely arboreal lifestyle. Being able to move efficiently in this environment is key to their organismal fitness, as foraging and prey evasion rely on successful and effective locomotor abilities. Limb loss however is a frequent occurrence and effective defensive strategy in this species. Multi-legged animals like crabs have redundant functionality in their limbs that can compensate for the events of limb loss, yet we know little about the roles and functional importance of their limbs, as well as their compensatory ability. This study seeks to answer two questions: 1) How do Mangrove tree crabs modulate limb kinematics to adjust for limb loss? 2) Does the loss of certain limbs affect locomotor ability more? We hypothesized that the effects of limb loss depend on the functional importance of the limbs that were lost. We found that loss of the 1st and 4th pair of limbs resulted in no change in limb movement patterns, whereas loss of the 2nd and 3rd pair of limbs resulted in switch limb alignments. In general, locomotor performance was not affected by the loss of a pair of limbs. The 4th pair of limbs seemed to have the least effect on locomotion and mostly serve a stabilizing and anti-toppling function.

Research supported by Departmental funds to J.A. Pfeiffenberger

16. **Effects of hypoxia on Hela cells**

Paige Leary, Anayeli Garcia, Veronica Perez Taboada, Lily Hernandez, Neeyah Hanley, and Pierre-Yves Jean-Charles (Department of Biology, Barry University, Miami Shores, FL)

Oxygen is an important requirement for many cells because it contributes to the generation of ATP through aerobic cellular respiration. Deficiency or absence of oxygen may lead cells to undergo lactic acid fermentation or programmed cell death depending on their oxygen metabolism and requirement. Using time-course experiments and cell-based assays, we investigated the effect of hypoxia on cervical cancer HeLa cells. Chemical hypoxia was induced using cobalt and its effect on cell morphology and survival monitored. We observed oxygen-dependent changes in the HeLa cells which highlight adaptation mechanisms in these cells during hypoxic conditions.

Funding provided by the Department of Biology at Barry University.

17. **Effects of habitat complexity on prey capture effectiveness in the red lionfish, pterois volitans**

Ashley Lopez, and Janne Pfeiffenberger (Department of Biology, Barry University, Miami Shores, FL)

Pterois volitans, commonly known as the red lionfish, have become a very successful invasive species of the Western Atlantic Ocean and the Gulf of Mexico in the past two to three decades. In

particular, the hunting strategy and ferocity of the lionfish are one of the many reasons of why it is such a successful invasive species. Lionfish have an extensive diet, consuming any prey that can fit inside their mouth. This immense dietary variation and the lack of predators have caused it to decimate native marine species in several habitat types in the Gulf of Mexico and the Atlantic Ocean. In our study, we examined the habitat preference of lionfish in terms of prey capturing effectiveness. In this experiment we simulated three different habitat types (sandy bottom, vegetation, rocky reef) that lionfish have been observed at in Florida and observed feeding events on live, bait fish. We recorded the time to prey capture, prey capture success ratios, and cataloged the prey capture strategies of the lionfish. We hypothesized that increased habitat complexity would have no effect on prey capture success, but that it would affect the time when the prey was captured, as well as the prey capture strategy. We found that lionfish were able to capture their prey most of the time, with increases in prey capture time being prominent in the vegetation and rocky reef habitat. Prey capture strategies were similar, however we noted that the corralling behavior of the lionfish was affected by increasing complexity of the habitats.

Funded by Biology Departmental funds to BIO 474 Marine Biology seminar Spring 2024

18. **The effects of beta-hydroxybutyrate on *Lactobacillus casei*'s antimicrobial activity.**

Valentina Montagna, Ashley Torrentes Palacios, Thurna Baronvil, Arianna Fermin, Christoph J. Hengartner, and Leticia R. Vega (Department of Biology, Barry University, Miami Shores, FL)

Biofilms are protective layers of biological polymers produced by bacteria that serve to help bacteria withstand harsh environments. In the gastrointestinal tract, the diverse gut microbiota is maintained through bacterially produced biofilm attached to the intestinal mucus rather than the epithelium. Pathogenic biofilm-forming bacteria can adhere and persist on biological or artificial surfaces, such as the intestinal wall or the side of a catheter, increasing their potential to cause infections. Many Staphylococcus bacteria species have the ability to produce biofilms. In this study we examined whether the cell free supernatant (CFS) of *Lactobacillus casei* inhibited the growth of bacteria that are known to produce biofilm such as *Staphylococcus epidermidis*. *L. casei* is a relatively non-pathogenic rod-shaped bacteria that can naturally be found on human tissues of the digestive, upper respiratory, or female reproductive tract, and in certain dairy products. *Lactobacillus casei* is a lactic acid producing bacterium known for balancing bacterial composition and discouraging harmful bacteria from disrupting a healthy ecosystem in the gut of humans and animals. Given its wide range of health benefits, scientists are interested in studying *L. casei*'s ability to produce antimicrobial substances that inhibit pathogenic and opportunistic bacteria such as Staphylococcus, including Staphylococcus' ability to form a biofilm. Because excessive use of ketogenic diets over prolonged periods of time increases the synthesis of beta-hydroxybutyrate (BHB), we tested the CFS of *L. casei* grown in the presence of varying concentrations of BHB for changes in antimicrobial or anti-biofilm properties. Our studies may help to inform how dietary alterations together with probiotics andor prebiotic foods may help to promote healthy gut flora.

Funding provided by the Department of Biology at Barry University.

19. **Aubergine regulates germ granule assembly and granular mrna translation in drosophila embryos.**

Veronica Perez Taboada[1], Roy Chen[2], and Ruth Lehmann[2] (Department of Biology, Barry University,

Miami Shores, FL; [2] Whitehead Institute, Cambridge, MA)

Germ granules have been long established as essential for the development of the germ line in the Drosophila Melanogaster (fruit fly) model. These Ribonucleic Nucleic Proteins (RNP) granules, when properly assembled, aggregate and translate maternally deposited mRNAs and proteins to produce primordial germ cells (PGCs), which will eventually become the germ line. Impaired functioning of the germ granules causes reproductive defects and sterility when absent. With the help of super-resolution microscopy, we decided to investigate granule assembly and translation patterns in the absence of Aubergine (Aub), an important germ granule protein. Translation was assessed by monitoring nanos mRNA, which is granule-dependent and exclusively active in the germplasm of embryos. Our results reveal that different germ granule components have different sensitivity to the loss of Aub. The granule scaffold protein Oskar and nanos mRNA are strongly depleted in homozygous aub mutants. However, Vasa, another functionally essential protein in germ granules, was significantly reduced even in heterozygous aub mutants, suggesting a strong dependency on Aub function. Using the SunTag system to quantify nanos mRNA translation, we found that the loss of translation in aub mutants was variable and showed an apparent correlation with the phenotypes of germ granules, suggesting that Aub regulates translation indirectly by controlling germ granule assembly. Together, these results feature Aubergine as an essential factor in germ granule assembly and translation of granular mRNAs.

Funding provided by the Lehmann Lab at the Whitehead Institute and the Bernard S. and Sophie G. Gould Fund

20. **Investigating α2AR mediated non-canonical signaling in Hela cells.**

Veronica Perez Taboada, Lily Hernandez, Anayeli Garcia, Nicole Rodriguez, and Pierre-Yves Jean-Charles (Department of Biology, Barry University, Miami Shores, FL)

G protein-coupled receptors (GPCRs) are seven transmembrane domain proteins responsible for cellular biochemical reactions and physiological responses. Upon binding of extracellular ligands, GPCRs undergo a conformational change that activates G proteins and triggers intracellular signaling. The α2 Adrenergic Receptor (α_2AR) is a GPCR found in various cell types, including blood vessels, intestinal lining, and uterine wall. Upon ligand binding, α_2AR couples Gαi, which inhibits Adenylyl Cyclase and results in decreased intracellular levels of cyclic Adenosine Monophosphate (cAMP). Using cell-based assays and western blotting technologies, we have assessed Mitogen-activated Protein Kinase (MAPK) and Akt/PI3K signaling after receptor stimulation to determine how α2AR differentially mediate signal transduction in Hela cells.

Funding provided by the Department of Biology at Barry University.

21. **Effect of adrenergic signaling receptor on hela cell morphology**

Nicole Rodriguez Hilario, Veronica Perez Taboada, Giselle Garcia, Paige Leary, and Pierre-Yves Jean-Charles (Department of Biology, Barry University, Miami Shores, FL)

G Protein-coupled receptors (GPCR) are transmembrane proteins that associate with heterotrimeric G proteins to elicit cellular responses from extracellular stimuli. Adrenergic receptors are GPCRs that respond to catecholamines such as epinephrine and norepinephrine to

mediate sympathetic signaling of the autonomic nervous system. We transfected α1, α2 and β1 adrenergic receptors to HeLa cells. We achieved stable expression of the receptors and analyzed their effects on cell morphology. Interestingly, the HeLa cells presented a distinctive morphological pattern based on receptor expression indicating receptor-based effects on cell response.

Funding provided by the Department of Biology at Barry University.

22. **Does coffee have an effect on plant growth?**

Nicole Rodriguez Hilario, Biancaliz Cruz Carrasquillo, and Flona Redway (Department of Biology, Barry University, Miami Shores, FL)

Coffee is the addictive drink of choice for many, due to the aromatic compound, caffeine, which it contains. Coffee is often added to plants to stimulate growth; however, coffee can have both a stimulatory as well as an inhibitory effect on plant growth. The project aims to study the effect of coffee on the growth of lima beans, *Phaseolus lunatus*, an underutilized legume with promising potential as a food crop. Seeds were germinated in different concentrations and pHs of brewed coffee, and observed for effects on germination, root emergence, number and sizes of lateral roots. Seedlings will be transferred to soil and further growth observed including stem and leaf sizes, and margins, to determine if coffee improves the quality of these growth measures.

Funding provided by the Department of Biology at Barry University.

23. **Predatory pit construction by ant-lions, myrmeleon**

Ainsley Vanderhyde, Genesis Rodriguez, Gabrielle Laforest, Anayeli Garcia, Dicarlo Davis, Ernest Charles, Kimberly Castriota, and Michael Robinson (Department of Biology, Barry University, Miami Shores, FL)

Ant lions are the long-lived larval stages in the family Myrmeleontidae. Ant lions live in the soil and construct conical pits. They lie in wait at the bottoms of these pits, buried under the sediment. When potential prey (e.g., ants, spiders) fall in the ant lions grab them with large mandibles and pull them under the sediment. In some cases, the ant lion throws sediment towards the prey to cause it to fall to the bottom. The volume of sediment excavated to create the pits is much greater than the ant lion's size representing a significant energy cost. The shape of the pit likely contributes to the prey capture success: wider pits increase the likelihood of prey falling in, whereas steeper pits decrease the likelihood of prey escaping. We analyzed multiple aspects of pit shape to build a better understanding of their construction. Although pit diameter and depth were at best weakly correlated with ant lion size, the total volume of the pits was strongly correlated with ant lion size. Pit construction was consistent over time across individuals. Both of these results indicate that energetic limitations might control pit construction. Age or experience might also be important factors.

This project was performed as part of the Zoology Laboratory course in and funded by the Department of Biology at Barry University.

24. **Platelet-derived growth factor and red-light exposure effect on collagen III in murine fibroblasts**

Jared Ward, Chiara Brambilla, Virginia Rivas, and Laura Mudd (Department of Biology, Barry University, Miami Shores, FL)

Wound healing is a complex process that is important to people with a range of conditions that cause wounds or scars (Gonzalez, et. al, 2016). In the wound healing process, platelet-derived growth factor (PDGF) is known to increase fibroblast proliferation (Shreiber, 2001). The results of previous studies indicate that certain wavelengths including red-light reduce inflammation and increase the production of collagen (Hochstein, 2014). Collagen is an important factor in wound healing because it lays the tracks for fibroblasts to migrate across the lesion (Singh, 2023). Collagen III is the first type of collagen secreted by fibroblasts during wound repair (Singh, 2023). Collagen III in murine fibroblasts treated with PDGF with or without exposure to red-light (~640nm) will be measured using antibodies against collagen III.

Funding provided by the Department of Biology at Barry University.

25. Effects of red light on cell migration of murine fibroblasts

Virginia Rivas, Chiara Brambilla, Jared Ward, Ana Lichtenberger, and Laura Mudd (Department of Biology, Barry University, Miami Shores, FL)

Wound healing is a natural process where the body repairs itself after tissue injury (Wallace, 2023). Understanding how the body repairs itself is important for cases of skin trauma, repair of surgical scars, and consequences of diabetes. The stages of wound repair include an inflammatory reaction, cell proliferation, and re-synthesis and remodeling of the extracellular matrix (Gonzalez, et. al, 2016). In this research, NIH3T3 murine fibroblasts were grown in culture and a scratch assay was used to assess the effects of red light on migration.

Funding provided by the Department of Biology at Barry University.

DEPARTMENT OF CHEMISTRY & PHYSICS

26. **In-vitro characterization of active pharmaceutical ingredient for research and development of dry powder inhalation**

Jacqueline Kim Correa (Department of Chemistry & Physics, Barry University, Miami Shores, FL)

Fluticasone propionate (FP) is an inflammatory steroid used as a nasal spray, for treating rhinitis and as an inhaler for managing asthma. In this research, we employed methods to characterize FP and identify its compatibility with excipients used in dry powder inhaler (DPI) formulations. By employing various analytical techniques such as particle size distribution (PSD) by laser diffraction, Brunauer-Emmett Teller (BET) surface area analysis, Differential Scanning Calorimetry (DSC), Powder Rheometer, and Scanning Electron Microscopy (SEM) researchers can assess FP's properties and behavior. These techniques provide valuable insights into factors guiding us in optimizing formulations, maintaining quality control, ensuring formulation stability, and

medication effectiveness. By integrating these techniques, we can effectively develop DPIs containing FP for clinical use ultimately improving inhalation therapies for respiratory diseases.

Funding provided by Teva Pharmaceuticals, Respiratory Research and Development.

27. **Synthesis of M1-selective agonists for pharmaceutical applications**

Faiyaz Nirob, Carly Bebe, and John Boulos (Department of Chemistry & Physics, Barry University, Miami Shores, FL)

Current medications for treating symptoms of Alzheimer's disease exhibit partial bias for either Gq or Gio G-proteins coupled to M1 and M4 muscarinic receptors, respectively, resulting in adverse side effects. Several in-vitro and in ex-vivo studies suggest that highly selective M1, Gq-biased, agonists can lead to preferential activation of specific signaling pathways and inhibition of non-preferential pathways, thus avoiding undesirable side effects. This study attempts to synthesize M1 selective agonists of muscarinic receptors and builds on previous work done at Barry University that led to the discovery of M2 selective, Gio -biased muscarinic agonists which were shown to retain their selectivity and efficacy profile in native tissues expressing muscarinic receptors. These M2 selective agonists are currently being investigated for their analgesic benefits and as alternatives to addictive opioids for pain management. The overall goal is to develop a new class of drugs that can activate a singular signaling pathway (Gq), thus greatly reducing negative side effects associated with currently prescribed nonselective drugs. These agonists are synthesized via multi-step reaction routes starting with thiozole-5-methanol. All target compounds and reaction intermediates are purified by either vacuum distillation or recrystallization. Compounds are characterized by infrared-spectroscopy (FT-IR), proton nuclear magnetic resonance spectroscopy (NMR), and mass spectrometry (MS).

Funding provided by the Department of Chemistry and Physics, Barry University.

28. Development of in vitro FRET assays to probe dual SARS-CoV-2 inhibitors

Stephanie Salterini, and Conrad Fischer (Department of Chemistry & Physics, Barry University, Miami Shores, FL)

The impact of COVID-19 on human health, the robustness of global health care systems and the economy demands continuing efforts to develop therapies for current and preventive measures for future coronavirus outbreaks. Recently, dual inhibitors of SARS-CoV-2's main protease and human cathepsin L gained attention as potent double-edged sword against SARS-CoV-2. We here describe the synthesis, via Solid Phase Peptide Synthesis (SPPS), of two oligopeptide substrates with specific target affinity that allow more precision in the identification of dual SARS-CoV-2 inhibitors. Depending on the substrates recognition pattern, a Fluorescence Resonance Energy Transfer (FRET) assay can be used to characterize potential main protease inhibitors. Utilizing analytical techniques such as high-pressure liquid chromatography (HPLC), nuclear magnetic resonance (NMR) and liquid chromatography-mass spectrometry (LC-MS), the oligopeptide was characterized. In vitro IC50 assays point to (sub)micromolar inhibition concentrations of some identified lead compounds. However, comparison of inhibitor performance between different publications is problematic due to broad variation in the assay types used and substrates among other factors. With the synthesis of new FRET substrates, we hope to continue the development of

potent antiviral compounds against SAR-CoV-2.

Funding provided by the Department of Chemistry and Physics, Barry University.

29. **Muscarinic receptors and their pharmaceutical drug applications**

Andrenique Dames and John Boulos (Department of Chemistry and Physics, Barry University, Miami Shores, FL)

Muscarinic acetylcholine receptors (M1-M5) are important G-protein coupled in both the central nervous and peripheral systems which play vital roles in various functions. Recent research has reinvigorated interest in these receptors, with a focus on their structure and modulation by different types of drugs. Researchers have made significant progress in understanding the structural aspects of muscarinic receptors, both in their active and inactive states. Additionally, there has been a greater understanding of how these receptors are modulated by allosteric modulators. Recent advancements have led to the development of novel muscarinic receptor subtype-selective ligands, showing promise in treating several illnesses, including Alzheimer's disease, schizophrenia, drug addiction, type 2 diabetes, and cancer. Researchers are exploring different modulators to bind muscarinic acetylcholine receptor (mAChR) subunits to enhance the effectiveness of allosteric modulation. The three major ligands in this fieldwork are orthosteric, allosteric, and bitopic ligands. Experimental work has primarily been conducted on novel mAChR mouse models. Understanding the complex pharmacology of muscarinic receptors is crucial for developing novel therapeutics with advanced efficacy and reduced side effects. This review focuses on the emerging strategies and challenges in the development of novel muscarinic drugs. By elucidating the intricate pharmacology of muscarinic receptors, researchers aim to pave the way for the development of innovative therapeutics with enhanced efficacy and minimized side effects.

30. Gravitational wave signatures of low-scale seesaw mechanism for neutrinos

Dyori Polynice[1], Luka Thompson[2], and Bartosz Fornal[1] ([1]Department of Chemistry & Physics, Barry University, Miami Shores, FL, [2]Department of Biology, Barry University, Miami Shores, FL)

Neutrinos are the most elusive particles of the Standard Model. The mechanism responsible for their mass generation remains unknown and requires introducing new hypothetical particles and interactions. Usually, a very high mass scale is considered for this new physics, making it difficult to probe such scenarios in conventional particle physics experiments. We consider the possibility of having a low-scale seesaw mechanism generating neutrino masses within a framework of a model with gauged lepton number. Surprisingly, such a model can be tested in gravitational wave experiments. Domain wall annihilation in the early Universe leads to a characteristic peak structure in the gravitational wave spectrum. The results presented here are relevant for upcoming gravitational wave experiments, and this scenario is consistent with the recent signal detected by NANOGrav.

This research was supported by the National Science Foundation under Grant No. PHY-2213144.

31. Probing dark sectors with gravitational waves

Nelleke Bunji, Kassandra Garcia, and Bartosz Fornal (Department of Chemistry & Physics, Barry University, Miami Shores, FL)

One of the greatest unsolved mysteries in particle physics is the nature of dark matter. Thus far, no indisputable direct dark matter detection has been made. It might be that the dark matter particle is part of a dark sector completely secluded or only very weakly coupled to the visible sector, in which case conventional experiments might never detect it. As we demonstrate, gravitational waves arising from first order phase transitions in the early Universe can be used to look for signatures of such models. Focusing on a particular extension of the Standard Model with a dark gauge group constructed to address the neutron lifetime puzzle, we show how such signatures can be searched for in upcoming gravitational wave experiments, such as LISA and Pulsar Timing Arrays, and how the recent NANOGrav signal can be accommodated in this scenario.

This research was supported by the National Science Foundation under Grant No. PHY-2213144.

32. Inspiring school students and local communities with the wonders of the Universe

Maximillian Buckalew[1], Lily Hernandez[1], Valentina Montagna[1], Ashley Torrentes Palacios[1], Bartosz Fornal[2], and Lubomir Markov[3] ([1]Department of Biology, Barry University, Miami Shores, FL, [2]Department of Chemistry & Physics, Barry University, Miami Shores, FL, [3]Department of Mathematics & Computer Science, Barry University, Miami Shores, FL)

The Astro-Math-Physics (A.M.P.) Club is committed to fulfilling Barry University's mission through its activities and organized events. Given its scientific nature, the A.M.P. Club aims to promote Knowledge and Truth through various activities, such as physics and math talks and our visit to the Kennedy Space Center. This also ties closely to the second core commitment of Inclusive Community; these events enable a wider group of Barry students to learn about STEM, particularly those who otherwise would not have first-hand access to scientific knowledge. This is further facilitated through less formal events, such as the "Interstellar" and "Quantumania" movie screenings, to encourage non-STEM majors to engage in science. The solar eclipse-watching event boosted the community's interest in astronomy and triggered questions about our place in the Universe. Finally, by joining efforts with the Community Science Academy, the A.M.P. Club pursued Social Justice and Collaborative Service commitments by visiting the Pierre Toussaint Leadership Center in Little Haiti to raise awareness among school students about the dangers arising from global warming, demonstrate the uniqueness of the Earth's localization in the Solar System, and to discuss various ways in which we can work together to protect our planet.

DEPARTMENT OF HEALTH PROMOTION & CLINICAL PRACTICE

33. **Physiological determinants of firefighter physical ability test performance: a follow-up investigation into anaerobic fitness parameters.**

Logan LaRochelle[1], Peter Beitia[2], Andreas Stamatis[3], and Zacharias Papadakis[4] ([1]Department of Biology, Barry University, Miami Shores, FL, [2] ADAPT, Miami, FL, [3]Department of Health & Sport Science and Department of Sports Medicine, University of Louisville, Louisville, KY, [4]Department of Health Promotion & Clinical Practice, Barry University, Miami Shores, FL)

BACKGROUND: The Physical Ability Test (PAT) is essential for assessing firefighters' fitness for

occupational tasks. While aerobic fitness's role in PAT is established, anaerobic fitness's contribution remains uncertain. This study builds upon previous research to explore the relationship between specific anaerobic fitness (AF) parameters and PAT performance. Therefore, the purpose of this study was to determine if specific anaerobic fitness parameters can effectively predict PAT performance, shedding light on the physiological factors influencing firefighters' occupational fitness. METHODS: Sixty-two male firefighters from two southern Florida Fire departments participated in a two-day data collection process. On the first day, firefighters completed the PAT, consisting of occupationally specific tasks while wearing full gear. On the second day, they performed a series of anaerobic fitness assessments, including handgrip dynamometry (HG), maximal vertical jump (VJ), Margaria-Kalamen staircase test (MK), and the 300-yard shuttle run (300YD), all while wearing full gear. A Pearson-product moment correlation coefficients and linear regression analysis were employed, using R statistical packages in Jamovi version 2.4.8 ($p < 0.05$). RESULTS: The findings reveal significant negative correlations between PAT and HG ($r = -0.67$, $p < 0.001$), VJ ($r = -0.60$, $p < 0.001$), and the MK ($r = -0.47$, $p < 0.001$), with a notable positive correlation with the 300YD ($r = 0.46$, $p < 0.001$). These AF parameters elucidate 65% of the variation in PAT ($F (4, 57) = 26.6$, $p < 0.001$). Specifically, PAT performance is predicted by HG ($\beta = -3.38$, $p < 0.001$, 95%CI [-5.27, -1.50]), VJ ($\beta = -0.03$, $p = 0.02$, 95%CI [-0.05, -0.00]), and 300YD ($\beta = 1.05$, $p < 0.001$, 95%CI [0.48, 1.61]). CONCLUSION: This study reaffirms the significance of specific anaerobic subsystems in PAT performance among firefighters. It emphasizes the need to optimize anaerobic fitness training to enhance occupational performance during the PAT.

34. **Inter-rate reliability of mental toughness scores by head and assistant coaches: a repeated-measure design**

Maya Caon [1], Charlotte Armstrong [1], Andreas Stamatis [2], Claire Egret [1], Tal Amasay [1], and Zacharias Papadakis [1] ([1]Department of Health Promotion & Clinical Practice, Barry University, Miami Shores, FL, [2]Department of Health & Sport Science and Department of Sports Medicine, University of Louisville, Louisville, KY)

Mental toughness (MT) is a crucial attribute in sports, often linked to superior performance. Female sports such as rowing are underrepresented in MT research. In addition, MT research has primarily relied on cross-sectional self-assessment, raising questions about the reliability of scores. Recently, external evaluation (e.g., supervisors, peers, experts) has been proposed as an alternative method of MT assessment. PURPOSE: To investigate the inter-rater reliability (IRR) of MT assessments provided by the head coach (HC) and the assistant coach (AC) in the context of collegiate female rowing, using a repeated-measure design. METHODS: Twelve Division II female rowers (Age: 20.8 ± 2.1 years, mean $\pm$ (SD)) participated in the study. MT was assessed by both HC and AC using the Mental Toughness Index (MTI) integrated into their periodization program. Data collection spanned three months, with MTI completed before each of the four in-season 2K races. IRR between HC and AC regarding average MTI scores was calculated using the interclass correlation coefficient (ICC) in the R statistical package irr, within Jamovi version 2.4.8 ($p < 0.05$). The two-way mixed model, agreement, average-measures ICC was employed to assess the level of agreement between HC and AC in their MT scores across these four occasions. RESULTS: The resulting ICC (0.83) fell within the good reliability range ($0.75 \leq ICC \leq 0.90$) ($F (11,10.6) = 6.74$, $p < .001$, 95%CI [.44, .95]), indicating substantial agreement between HC and AC in their MT assessments, suggesting that MT was consistently rated across the coaches. CONCLUSION: This investigation highlights the robust reliability of the MTI scores across divergent coaching

evaluations. These findings constitute strong evidence for the psychometrically-sound properties of MTI, affirming its capacity in capturing the latent MT construct within this athletic cohort. As such, practitioners, both in the realms of sport psychology and coaching, can readily embrace MTI as an instrument for MT assessment.

35. **Occupational firefighters' readiness: a body mass index and age association study**

Giovanni Galatioto [1], Cristian Acuna [1], Peter Beitia [2], Andreas Stamatis [3], and Zacharias Papadakis [1] ([1]Department of Health Promotion & Clinical Practice, Barry University, Miami Shores, FL, [2]ADAPT, Miami, FL, [3]Department of Health & Sport Science and Department of Sports Medicine, University of Louisville, Louisville, KY)

The National Fire Protection Association 1582 has recognized the pressing issue of obesity within firefighters. This recognition has led to the recommendation of using body mass index (BMI)for assessing obesity among firefighters. Astonishingly, despite a substantial 80% of firefighters falling within the overweight or obese categories, this concern has been largely overlooked in research, despite its potential to significantly impact their readiness for duty. Firefighters' readiness is evaluated through the Physical Ability Test (PAT). However, as obesity rates increase with age, the utility of BMI as an indicator of firefighters' readiness remains uncertain. Therefore, the purpose of this study was to investigate the relationship between BMI and age on the PAT. METHODS: Sixty-two males underwent a PAT equipped with their personal protective equipment (PPE). BMI categories were established following the World Health Organization's classification. To discern potential differences, linear regression analysis was conducted using Jamovi version 2.4.8, with significance level at $p < 0.05$. RESULTS: The PAT assessments yielded no discernible age-related disparities ($F(2,57) = 0.8$, $p = 0.5$). Intriguingly, the 30-39 yrs cohort, constituting 24% of the total, demonstrated the most efficient PAT performance, followed by the 40-49 yrs group, representing a mere 3% of the total participants. In contrast, the 20-29 yrs category, encompassing a substantial 73% of the participants, exhibited relatively slower PAT completion times. Furthermore, PAT scores exhibited no statistically significant discrepancies across the various BMI classifications ($F(2,57) = 2.8$, $p = 0.07$). Surprisingly, the obese subgroup, constituting 24% of the participants, outperformed the overweight cohort (49% of the total), with the normal weight category (29% of the total) trailing closely behind. CONCLUSION: Contrary to expectations, increasing age and obesity did not appear to substantially influence the occupational readiness of firefighters when assessed through the PAT while wearing full PPE. This study challenges existing assumptions about the impact of age and obesity on firefighters' readiness, highlighting the need for a nuanced understanding of the factors influencing their performance in the demanding and critical field of firefighting.

36. **Association of body composition methods and occupational readiness: differences between veterans and rookies**

Vinicius L Ribeiro [1], Peter Beitia [2], Andreas Stamatis [3], and Zacharias Papadakis [1] ([1]Department of Health Promotion & Clinical Practice, Barry University, Miami Shores, FL, [2]ADAPT, Miami, FL, [3]Department of Health & Sport Science and Department of Sports Medicine, University of Louisville, Louisville, KY)

The increasing prevalence of obesity among United States firefighters has prompted concerns. Current guidelines from National Fire Protection Association 1582 rely on body mass index (BMI) for obesity assessment. However, BMI's inability to distinguish between fat and lean mass raises

validity issues. An alternative measurement, body fat percentage (BF%) has emerged as a potentially more accurate tool for assessing obesity. Moreover, the widely used Physical Ability Test (PAT) may face complexities in evaluating firefighters' readiness due to variations in body composition (BC) among individuals. Additionally, the combined influence of years in service, BC variations, and the aforementioned factors could potentially impact PAT performance and, consequently, firefighters' overall readiness. PURPOSE: To examine whether differences exist in obesity categorization when using BMI compared to BF% and how these measurements affect the performance of rookie (R) and veteran (V) firefighters in the PAT. METHODS: Sixty-two male firefighters were analyzed, categorized per American College of Sports Medicine (ACSM) and World Health Organization (WHO) guidelines. Veteran status was determined by having more than one year of experience. Firefighters underwent full gear PAT assessments on separate days. Log-linear and linear modeling, with Obese as the reference for BMI and BF%, and R for experience, were used. Age was controlled in linear modeling. Statistical analysis was conducted in Jamovi version 2.4.8, with significance set at $p < 0.05$. RESULTS: Categorical modeling was significant, highlighting the impact of years of experience, BF%, BMI, and the interaction between BF% and BMI (x^2_{29} = 78.34, $p < 0.001$). The continuous PAT model also showed significance, with significant differences observed in years of experience, BMI, and BF% ($F(8,53) = 5.02$, $p < 0.001$, $R^2 = 0.43$). CONCLUSION: This study supports previous work from our laboratory and highlights the ongoing debate surrounding the use of BMI in assessing obesity among firefighters. It emphasizes the potential disparities between BMI and BF% categorization and their impact on firefighters' performance in the PAT, shedding light on the complex relationship between body composition, years of experience, and occupational readiness.

37. **Is firefighters' mental toughness accurately assessed? concurrent evaluation of current practices.**

Ross Leach[1], Martilus Dervil[1], Peter Beitia[2], Andreas Stamatis[3], and Zacharias Papadakis[1]
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BACKGROUND: The concept of mental toughness (MT) has been extensively investigated in various high-stress domains, including sports and the military. It is associated with superior performance in challenging environments. Presently, the Sports Mental Toughness Questionnaire (SMTQ) and Military Training Mental Toughness Inventory (MTMTI) are administered to assess MT in firefighters. Previous research suggested these instruments may lack specificity for firefighting. Therefore, this study aimed to investigate the concurrent validity of SMTQ and MTMTI in the context of firefighters. In addition, to determine whether the SMTQ and MTMTI could validly assess MT in firefighters. METHODS: Sixty-two male firefighters from two southern Florida Fire departments participated in a two-day data collection process. They completed the SMTQ (self-assessment), while a colleague and an officer rated their MT using the MTMTI. Mean MTMTI scores per day for both assessors were computed, and both surveys were converted into z-scores for statistical analysis. This analysis involved Pearson correlation (r), Cohen'Kappa (k), and two-way random Intraclass correlation coefficient (ICC2k) using R statistical packages in Jamovi version 2.4.8 ($p < 0.05$). RESULTS: On Day 1, inventory scores were negatively correlated ($r = -0.09$, $p = 0.5$), while on Day 2, they were positively correlated ($r = 0.1$, $p = 0.5$). The reliability agreement on Day 1 was extremely poor ($ICC_{2k} < 0.001$, 95%CI [-0.53, 0.35]). On Day 2, reliability improved but remained relatively low ($ICC_{2k} = 0.13$, 95%CI [-0.33, 0.43]). Cohen'kappa for both days indicated no agreement between the

inventory scores (k < 0.001). CONCLUSION: The results suggest weak and non-significant correlations between the MT inventory scores on both Day 1 and Day 2, along with poor reliability and agreement between the measurements. These findings indicate a need for caution when interpreting and relying on these inventory scores for making inferences. Further development of firefighting-specific MT assessment tools may be warranted.

38. **Mental toughness explains rowing performance: a mixed model analysis.**

Patricia Mayorca Arocha [1], Samuel Norwood [2], Charlotte Armstrong [1], Andreas Stamatis [3], Claire Egret [1], Tal Amasay [1], and Zacharias Papadakis [1] ([1]Department of Health Promotion & Clinical Practice, Barry University, Miami Shores, FL, [2]Department of Teaching and Learning, Florida International University, Miami, FL, [3]Department of Health & Sport Science and Department of Sports Medicine, University of Louisville, Louisville, KY)

BACKGROUND: In the quest to enhance rowing performance, coaches and athletes are seeking ways to gain a competitive edge. One potential catalyst that has emerged in this pursuit is the concept of mental toughness (MT). Despite its potential significance, the sport of rowing has remained notably underrepresented in MT research, predominantly relying on cross-sectional study designs. Collegiate rowing, a sport demanding both physical and mental prowess, employs the 2K time trial as a pivotal benchmark for evaluating rowers' performance. Therefore, the purpose of this study was whether MT is a significant factor in explaining 2K rowing performance utilizing a repeated subjects design. METHODS: Drawing from an observational and hypothesis-generating framework, a total of 12 Division II female collegiate rowers participated in this study. They completed the Mental Toughness Index (MTI) on four occasions preceding their respective 2K time trials, integrated into their annual performance evaluation. Analysis employed a linear mixed model utilizing the GAMLj module in Jamovi version 2.4.8, with a significance level set at $p < 0.05$. MT was considered a fixed factor, while athlete, MT, and Athlete*MT interaction served as random factors to account for possible individual variations. RESULTS: Analysis revealed three mixed models in which MT was found to be significant and negatively related to 2K performance: Model #1, MT with Athlete Intercept: $F(1) = 7.58$, $p = 0.009$, $\beta = -0.93$, 95%CI [-1.58, -0.27], $p = 0.009$; Model #2, MT with MT Intercept: $F(1) = 5.88$, $p = 0.019$, $\beta = -0.98$, 95%CI [-1.77, -0.19], $p = 0.019$; and Model #3, MT with Athlete and MT Intercept: $F(1) = 5.34$, $p = 0.029$, $\beta = -0.81$, 95%CI [-1.50, -0.12], $p = 0.029$. CONCLUSIONS: Collectively, these models demonstrate the significance of MT in explaining rowing performance, whether considered independently, accounting for athlete-specific differences, or factoring in the baseline level of MT. Findings suggest the potential practical application of MT-oriented interventions within rowing. However, it is essential to acknowledge the study's small sample size. Future investigations should explore larger participant cohorts and delve deeper into the impact of MT interventions on the dynamics of rowing performance.

39. **Inter-rater reliability validation via the military training mental toughness inventory in firefighters: follow-up psychometric analysis**

Angel Gonzalez Ramos [1], Shane Phillips [2] Peter Beitia [3], Andreas Stamatis [4], Zacharias Papadakis [1], and Amerigo Rossi [2] ([1]Department of Health Promotion & Clinical Practice, Barry University, Miami Shores, FL, [2]Interdisciplinary Health Sciences, New York Institute of Technology, Old Westbury, NY, [3]ADAPT, Miami, FL, [4]Department of Health & Sport Science and Department of Sports Medicine, University of Louisville, Louisville, KY)

Mental toughness (MT) is a critical psychological attribute, often assessed using cross-sectional self-assessment methods. Research links MT to superior performance, particularly within high-stress domains like tactical environments (e.g., firefighting). The Military Training Mental Toughness Inventory (MTMTI) is an established tool for measuring MT from a tactical perspective. Despite the relevance of MT in high-pressure professions, research in this context is limited, and specific instruments for assessing firefighting-related MT are absent. Preliminary work on examining the inter-rater reliability of MTMTI on firefighters concluded that there was no agreement on MT peer-rating by using the MTMTI. Since still there is no specialized instrument tailored to evaluate MT in firefighting, continuation of data was deemed justified. PURPOSE: To validate the inter-rater reliability of MTMTI in firefighters in a two-point longitudinal design. METHODS: Sixty-two male firefighters from two southern Florida fire departments participated in this study, completing an MTMTI survey over two days. The survey was administered by a colleague and an officer who conducted peer-ratings. The MTMTI comprises six items, each rated on a 7-point Likert scale, evaluating an individual's ability to maintain performance under stressful conditions. Statistical measures, including Cohen' kappa (κ), Cronbach's alpha (α), McDonald's omega (ω), and the Interclass correlation coefficient (ICC), were employed for inter-rater reliability assessment. The analysis was performed using R statistical packages within Jamovi version 2.4.8 ($p < .05$). RESULTS: The inter-rater reliability, indicated by the Kappa coefficient, was minimal on both days, with low agreement between raters. Internal consistency measures (Alpha and Omega) were also unacceptable on both days. Inter-rater correlations were weak. CONCLUSION: The study's findings do not demonstrate concurrence between the two raters, reinforcing previous data. Consequently, the inferences drawn regarding the MTMTI scores assigned by these two distinct raters also lack accord. Factors contributing to this lack of agreement should be explored. Future research should aim to refine measurement tools and explore the multifaceted nature of MT within firefighting.

40. **Replication crisis in sport and exercise science**

Christopher Saavedra[1], Zacharias Papadakis[1], and Jennifer Murphy[2] ([1]Department of Health Promotion & Clinical Practice, Barry University, Miami Shores, FL, [2]Department of Applied Science, Technological University Dublin, Dublin, Ireland)

In Sport and Exercise Science (SES), 82% of published studies report significant findings indicating these studies have a robust research design that examines true effects with high statistical power. However, small sample sizes and underpowered designs are common in SES. Related literature in psychology reports that only 37% of replicated effects yield similar results to the original. Replication studies in SES are still rare, raising concerns about the overwhelming reported significant findings despite the small sample sizes. PURPOSE: To replicate the findings of a published SES study and compare results. METHODS: Based on the criteria published by Murphy et al., 2023, the Effects of Caffeine on Vertical Jump Height and Execution in Collegiate Athletes by Bloms et al., 2015 was selected as the original study. The replication study, mirroring the original design, utilized a single-blind, randomized, crossover approach. Like the original, participants engaged in training sessions lasting 8-20 hours per week and were administered a caffeine dosage of 5 mg/kg or a placebo. Following a 60-minute interval post-caffeine ingestion, squat jump (SJ) and countermovement jump (CMJ) were performed. Key distinctions between the replication and original studies encompassed athlete levels, force platform types, and analysis software, as well as the range of sports included, alongside a sample size disparity (40 vs. 25). A paired t-test compared jump height (cm) under both caffeine and placebo conditions. RESULTS: The original study showed that caffeine consumption compared to placebo (μcaffeine (SD) vs. μplacebo (SD))

improved both SJ (34.5 (6.7) vs. 32.8 (6.2), p = .001) and CMJ (37.9 (7.4) vs. 36.4 (6.9), p = .001) heights. In the replication study, caffeine consumption did not improve SJ (29.8 (7) vs. 29.5 (7), 0.2 ± 2.7cm, t38 = 0.56, p = 0.58, dz = 0.1, 95%CI [-.23, .40]) nor CMJ (32.4 (8) vs. 31.7 (8), 0.7 ± 3.2cm, t39 = 1.34, p = .19, dz = 0.2, 95%CI [-.10, .52]). CONCLUSION: The observed replicability bias in SES, indicated by the divergence of replication study results from the original findings, points towards potential issues of publication bias and false positives within the field. This underscores the need for cautious interpretation of reported significant findings and a call for more rigorous research practices in SES.

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41. **Jumping for joy... or not? examining the effects of NCAA-regulated caffeine dose on vertical jump performance**

Roy Shohat[1], Maya Caon[1], Samuel Vilmeau[1], Samuel Norwood[2], Vinicius Ribeiro[1], Claire Egret[1], Tal Amasay[1], and Vassilios Panoutsakopoulos[3] ([1]Department of Health Promotion & Clinical Practice, Barry University, Miami Shores, FL, [2]Department of Teaching and Learning, Florida International University, Miami, FL, [3]Department of Physical Education & Sport Science, Aristotle University of Thessaloniki, Thessaloniki, Greece)

Caffeine is a popular ergogenic aid, potentially enhancing performance in high-intensity power movements like jumping. The World Anti-Doping Agency (WADA) removed caffeine from its banned list, but the National Collegiate Athletic Association (NCAA) restricts caffeine intake (5 mg/kg). Past research has examined the effects of caffeine supplementation on vertical jumping performance, since comprises reliable physical fitness test, but mixed results were reported. PURPOSE: This study examined the effects of caffeine at the NCAA limit on vertical jump performance in real-world training conditions. METHODS: Forty collegiate Division II athletes (Male = 22) from sports like basketball, volleyball, soccer, tennis, cross country, and softball during real-life training conditions participated in a single-blind, randomized, crossover design. They consumed either caffeine (5 mg/kg) or placebo, followed by 60-minute waiting period and a standardized warm-up. Three squat (SJ) and 3 countermovement jumps (CMJ) were performed on a Noraxon AMTI force platform. Jump height (m) was calculated using the fight time method. The average of the 3 respective jumps was used for statistical analysis. Normality of the data was evaluated by Kolmogorov-Smirnov and a paired t-test in Jamovi vs 2.4.14 ($p < .05$) was used to compare the differences in SJ and CMJ between placebo and caffeine conditions. RESULTS: In comparison with placebo (μplacebo – μcaffeine ≠ 0), caffeine consumption did not improve SJ (t(39) = -.32, p = .75, μdiff = -.01 95%CI [-.01, .01], d = -.05, 95%CI [-.36, .26]) nor CMJ (t(39) = -1.32, p = .20, μdiff = -.01 95%CI [-.02, .00], d = -.21, 95%CI [-.52, .11]) vertical jump performance. CONCLUSION: Consuming caffeine at the NCAA limit did not enhance vertical jump performance in a large sample of Division II athletes during real-life training. These findings may inform the NCAA to consider revising its caffeine regulations to align with evidence-based WADA guidelines.

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42. **Body mass index misclassify obesity in firefighter**

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Among firefighters the issue of obesity has gained significant attention due to its correlation with adverse health consequences. The National Fire Protection Association 1582 has endorsed the utilization of the body mass index (BMI) to assess obesity. However, long-standing concerns have emerged regarding BMI's reliability in accurately representing body composition (BC), especially in distinguishing between lean and fat mass. Firefighters' work is physically demanding, which often leads to increased muscle mass, BMI use may misclassify them as obese. This can result in false positives where firefighters are categorized as obese based on BMI even when their BC aligns with non-obese definition by body fat percentage (BF%) and/or waist circumference (WC) measurements. PURPOSE: To examine potential misclassifications of obesity using BMI with equivalent BF% and WC standards. METHODS: BMI, WC, and BF% measurements were employed on 62 male firefighters. BMI classifications followed the World Health Organization (WHO) guidelines, and WC and BF% were assessed based on American College of Sports Medicine (ACSM). Firefighters categorized as non-obese or obese with specific cutoff criteria: BMI ≥ 30 kgm2, BF> 25%, and WC >102 cm. Using the ClinicoPath package in Jamovi 2.4.8, misclassification presence was assessed, with statistical significance set at $p < 0.05$. The BF% or WC categories served as the "golden standard," while BMI-based categories considered the "new test." RESULTS: BMI yielded higher rates of obesity at 23%, compared to 10% and 6% recorded by BF% and WC, respectively. Approximately 33% and 50% of BF%- and WC-defined obese participants were misclassified as non-obese using BMI, resulting in false negatives. Conversely, 73.3% and 86.6% of non-obese firefighters defined by BF% and WC were identified as obese using BMI, leading to false positives. BMI exhibited 66.7% sensitivity and 80.4%specificity when compared to BF%, while in contrast to WC, it demonstrated sensitivity of 50% and specificity of 77.6%. CONCLUSION: This inquiry underscores the intricate limitations of BMI as an assessment tool in firefighters. It accentuates the compelling advantages offered by alternative and more precise BC measurement methods, such as BF% and WC, for the accurate identification of obesity among firefighters.

43. **Advancing the self-verification theory in female rowers through the lens of mental toughness: implications for positive sport psychology**

Devin Wright Ramos[1], Marc-Antoine Harris[1], Charlotte Armstrong[1], Andreas Stamatis[2], Clair Egret[1], Tal Amasay[1], and Zacharias Papadakis[1] ([1]Department of Health Promotion & Clinical Practice, Barry University, Miami Shores, FL, [2] Department of Health & Sport Science and Department of Sports Medicine, University of Louisville, Louisville, KY)

BACKGROUND: In Positive Psychology (PP), Mental Toughness (MT) and Self-Verification (SV) concepts are linked to individual well-being. MT is critical for sports success; yet, its role in female rowing is underexplored. SV theory suggests people seek confirmation of their self-views, offering insights into athlete-coach dynamics. Earlier pioneering research from our group in MT and SV among female rowers showed athletes sought self-view-aligned associations. Therefore, the purpose of this study was to enrich the emerging literature in understanding SV' theory applicability in PP and MT'role in female rowing. METHODS: Division II rowers (n = 12) completed the Mental Toughness Index (MTI) prior four in-season 2K races. Athletes self-evaluated their MT, provided responses on MTIs reflecting the perspectives of both their Head and Assistant coaches, and

indicated their preferred coach for interaction. To assess differences between the preferred collaborator coach and the coach whose perceived MTI scores closely matched the athletes' self-assessments, four chi-square tests were conducted using Jamovi version 2.4.8, with a significance level of $p < 0.05$. Similarity in MTI scores was evaluated by identifying the smallest absolute difference between coach and athlete scores. In cases of equal differences, preference was determined based on the smallest absolute difference relative to the maximum possible MTI score. RESULTS: The McNemar paired-samples test conducted for each of the four trials 1st $x^2 = 0.1$, $p = 0.7$; (#2nd $x^2 < 0.001$, $p = 1$; #3rd $x^2 = 0.2$, $p = 0.7$; #4th $x^2 < 0.001$, $p = 1$) indicated no significant differences between the preferred coach for collaboration and the coach selected based on SV theory. CONCLUSION: These findings provide additional support for the relevance of MT and SV in the context of female rowers. Specifically, in terms of MT, this study demonstrated that athletes' choices for collaboration with coaches did not significantly differ from the coaches expected based on SV theory in four distinct instances. This research contributes to a deeper understanding of the potential implications of SV theory in Positive Sport Psychology and underscores the significance of comprehending how self-views can impact relationships in sports contexts.

44. **The impact of personal protective equipment on anaerobic fitness assessment in firefighters.**

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BACKGROUND: The utilization of personal protective equipment (PPE) is of paramount importance in ensuring the safety and effectiveness of firefighters during emergency responses. Research has highlighted potential drawbacks associated with the use of owned PPE. A significant 12% reduction in anaerobic squat jump assessment was reported when firefighters are equipped with their PPE. This reduction in anaerobic fitness (AF) could have profound implications for their operational readiness. The Physical Ability Test (PAT)assesses firefighters' preparedness by having them wear full PPE, simulating real-world conditions that could increase anaerobic physiological strain. In contrast, using regular exercise clothing for occupational evaluations, while aligning with common tests, might limit specificity. Therefore, the purpose of this study was to analyze the impact of PPE on AF assessment. METHODS: Sixty-two male firefighters underwent occupational-specific AF testing, including handgrip dynamometry (HG), vertical jump (VJ), Margaria-Kalamen (MK), and a 300-yard shuttle run (300YD), both with full PPE (WPPE) and without PPE (NPPE). AF measurements were adjusted for body weight (e.g., NPPE) and occupational weight (e.g., WPPE). Statistical analysis used a repeated measures design in Jamovi version 2.4.8 at a significance level of $p < 0.05$. RESULTS: In comparison to the NPPE condition, WPPE condition revealed a remarkable 58.7% reduction in relative HG strength, an 11% decline in relative VJ peak power, a substantial 49.3% drop in the mean power during the Margaria-Kalamen test, and an 18.3% increase in the time required for the 300-yard shuttle run ($p < 0.05$). CONCLUSION: Findings confirm that the use of PPE significantly diminishes anaerobic performance during specific occupational tests. This underscores the critical importance of recognizing occupational specificity in fitness assessments. Understanding how PPE impacts anaerobic fitness testing parameters has the potential to change not only testing protocols but also training regimens, aimed at enhancing the safety and efficacy of this physically demanding profession. Consequently, physical training programs tailored to augment anaerobic fitness levels should incorporate strategies to alleviate the performance decrements stemming from PPE utilization.

DEPARTMENT OF CLINICAL LABORATORY SCIENCES

45. Evaluating biofilm production in carbapenemase-negative, carbapenem-resistant *Pseudomonas aeruginosa*

Jacqueline Llerena, Cristina Perez, Luka Thompson, Daniel Charley, Maria Montalban, Inshan Ali (Department of Clinical Laboratory Sciences, Barry University, Miami Shores, FL)

Pseudomonas aeruginosa is a Gram-negative bacterium capable of causing acute, chronic, and nosocomial infections in healthcare settings globally. Particularly, carbapenem-resistant *P. aeruginosa* is listed as a category 1 priority pathogen by the World Health Organization for which more research and development is critically needed to find treatment solutions (1). This organism also possesses the propensity to form biofilms. Most strains of carbapenem-resistant *P. aeruginosa* in the United States do not produce carbapenemase enzymes and possess different mechanisms for conference of carbapenem resistance (2). In this study we evaluated and quantified biofilm production in clinical strains of carbapenemase-negative, carbapenem-resistant *P. aeruginosa* (cnCRPA). Antibiotic susceptibility testing was performed on clinical isolates of *P. aeruginosa* and those exhibiting varying degrees of carbapenem resistance were selected and screened for production of carbapenemases. Biofilm production was then measured in cnCRPA isolates by both the crystal violet assay and the gold standard colony forming unit assay. Our findings indicate that the results of both assays methods correlated with each other and that there is an association between the degree of carbapenem resistance and the quantity of biofilm produced by cnCRPA isolates.

This research was supported by the Department of Clinical Laboratory Sciences at Barry University.

DEPARTMENT OF HEALTH SCIENCES

46. **Annotation of the eIF4G1 gene sequence from *Drosophila willistoni*s F element**

Arielle James[1], Yalena Anderson[2], Gabriela Jansen[1], Maat Henderson[1], and Christoph Hengartner[2] ([1]Department of Health Sciences, Barry University, Miami Shores, FL, [2]Department of Biology, Barry University, Miami Shores, FL)

More than a century after Thomas Morgan used the fruit fly *Drosophila melanogaster* to demonstrate that chromosomes contain the genetic material, Drosophila remains a vital research tool and model organism to investigate chromosome structure, genetics, development, and evolution. In 2000, its entire DNA was sequenced, and it was shown that ~60 percent of Drosophila genes are shared with humans. The Drosophila genome consists of four chromosomes that underwent rearrangements in some Drosophila species. According to the Muller nomenclature, each separate chromosome arm is labeled from A to F. The F element (aka dot chromosome) is usually the smallest chromosome; however, in some Drosophila species, the F element grew longer through expansion of repeated sequences and is generally packaged as heterochromatin. Interestingly, as time has passed, the banded portion of the F element containing about 80 protein

coding-genes showcases a range of expression levels that resemble genes in the euchromatic domains. This has resulted in the F element genes having unique features that enable them to function in a heterochromatic environment. We have joined the Genome Education Partnership (GEP), an association of over 150 research institutions that integrate undergraduate students in original genetic and bioinformatics research projects. We joined other GEP students and faculty in a crowd-sourcing approach to annotate the genes (coding region and transcription start site) in the F elements of *Drosophilia willistoni*. Our DNA annotation will use both experimental data (e.g. gene expression and evolutionary conservation) and computational evidence (e.g. gene prediction algorithms) to identify gene elements such as exon and intron boundaries. The data of this comparative genome analysis will help us better understand the consequences of radical evolutionary changes in chromosome and gene structure. Studying the evolutionary forces that maintain and modify the chromosomes of these fruit flies may help us better understand how eukaryotic genomes grew so much larger than bacteria. For our project, we have chosen to examine a 73 kb region of *D. Willistoni*'s F element. We present here our methodology and approach for locating critical gene elements within this DNA sequence, and we present our proposed exon-intron structure for the eIF4G1 gene.

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DEPARTMENT OF MATH & COMPUTER SCIENCE

47. **Image processing for security systems**

Jahfiyah Gumbs, Jeffrey Diaz, and James Haralambides (Department of Math & Computer Science, Barry University, Miami Shores, FL)

We are creating an application for object detection for a security system monitored by a stationary camera. Harnessing the capabilities of computer vision techniques, the system will identify missing or repositioned objects on captured images. Objects are identified and stored during a pre-processing step using a set of user-defined points. For each selected object, an enclosing polygon is formed with all its interior pixels identified using a polygon inclusion algorithm. To increase the efficiency of the algorithm only pixels within the bounding box of the object are considered. A corresponding color histogram for all interior pixels is generated. We are using four intensity levels per color component of the RGB model producing histograms of 64 bins. Histogram values are normalized to accommodate varying pixel counts. Images that are generated by the camera at regular intervals are compared to detect object repositioning or removal. We are using a sliding window technique to scan the images and compare the histograms that correspond to the sliding windows to those generated for the selected objects. Histograms are compared using the chi-squared distance metric. The sliding window having the minimum distance from a particular object is reported and drawn on the image. The user may opt for more sliding windows of minimum distance to be reported. This may assist the identification process in cases of smaller objects or objects which lack color uniformity. Since objects of various sizes may be present, the sliding window dimensions may be adjusted accordingly.

48. **A comparison study of acetaminophen levels in painkillers using data analytics**

Herve Jean-Baptiste[1], Genesis Michel[2], Herleyd Remy[2], Kimberly Simmons[3] and James Haralambides[1] ([1]Department of Math & Computer Science, Barry University, Miami Shores, FL, [2]Department of Biology, Barry University, Miami Shores, FL, [3]Department of Chemistry and Physics)

The objective of this study is to use a thorough analytical approach to assess the acetaminophen levels in four painkiller brands: Genexa, Walgreens-branded Tylenol, Aquate, and Tylenol. The goal is to supply useful data regarding the accuracy and consistency of acetaminophen levels in different painkiller brands to consumers, healthcare providers, and regulatory agencies. We measured the amounts of acetaminophen in several batches of each brand, obtained from different production lots, using a Fourier-transform infrared (FTIR) spectroscopy. Acetaminophen, a widely used over-the-counter pain reliever, was chosen as the focal point due to its prevalence and importance in managing pain and fever. The experimental design incorporated computer science methodologies, including a data management system, and data analytics and visualization techniques to improve computational efficiency and data representation. The Principal Component Analysis (PCA), a linear dimensionality reduction technique, will also be used to explore, process, and visualize the differences among the various brands. After the spectroscopic data were acquired, they were organized methodically, and any outliers and patterns were explored. Variations in acetaminophen levels among the analgesic brands were identified using both numerical and graphical analyses. Accurate evaluations of acetaminophen consistency were made possible by employing computer science methodologies and FTIR technology, the integration of which enhanced the experimentation process. The results highlight the need for openness and quality control in the drug industry and offer insightful information about the consistency of acetaminophen levels in popular painkiller products.

Funding provided by the Department of Chemistry and Physics, Barry University.

49. **Comparing bacterial growth in an interdisciplinary setting**

Donovan Johnson[1], Verna Liburd[2], Snowbird Rubio[1], Maighen Chavez[2], Christoph Hengartner[2], and James Haralambides[1] ([1]Department of Math & Computer Science, Barry University, Miami Shores, FL, [2]Department of Biology, Barry University, Miami Shores, FL)

Using interdisciplinary techniques integrating the skills and knowledge of biology, computer science, and mathematics, a comparison of growth rates between two bacteria based on qualitative and quantitative analytical data will be made. In a controlled environment, the bacterial growth of *Staphylococcus epidermis* (S.epi) and *Escherichia coli* (*E. coli*) inside of a cell media plate and microtiter plate was observed. The data collected will be analyzed by comparing the growth rates and absorbance values obtained at regular intervals over the two-day experimentation process. To record and collect the data from the media plates, we are using a cellular device to take pictures in JPEG format. The images are analyzed with Gwyddion, a modular program for SPM (scanning probe microscopy) data visualization and analysis. Software application Gen5 from the microplate reader is also used to record the absorbance rates of the bacteria. Results are transferred into an Excel spreadsheet where the numerical data will be processed, and graphical representations will be drawn. The biology component will work towards growing the bacteria and collecting all needed data. The mathematics and computer science component will work to analyze, process, and visualize the data in a clear and easy to read way, identifying patterns and

correlations. This experiment has allowed us to better identify and visualize the differences in bacterial growth rates by employing cross-disciplinary methodologies. A better appreciation and understanding of the individual disciplines that contributed to the project was gained as a result.

50. **Utilizing sensor data on wearable devices to monitor anxiety attacks on individuals with autism spectrum disorder**

Roger Osorio, Lola Umarova, and James Haralambides (Department of Math & Computer Science, Barry University, Miami Shores, FL)

Music therapy has long been recognized as an effective intervention for individuals with autism spectrum disorder (ASD). We explore the potential of leveraging technology to automate and personalize music therapy for autistic clients through the development of a dedicated mobile application. The application will automate the process of data transfer between these devices by handling health monitoring events generated on smartphones and smartwatches such as the heart rate, movements, and distance for select devices. The app will integrate tailored playlists, biofeedback mechanisms, and artificial intelligence algorithms to create a user-centric experience that adapts to the unique needs and preferences of each individual. By offering real-time feedback through the use of three different sensors feature on the device, this innovative app aims to make music therapy more accessible, engaging, and effective for autistic clients, potentially improving their emotional regulation, communication skills, and overall well-being. Future hardware advances will help bring a relaxing environment to the client much faster by analyzing the data gathered by the device sensors, identifying repetitive movements that commonly indicate stress and anxiety in individuals with autism and streaming personalized music therapy playlists tailored to alleviate these symptoms. This project will automatically deescalate noisy and rambunctious situations that many clients may be a part of. Additionally, this project highlights the potential benefits and challenges of such an approach, emphasizing the importance of ongoing research and collaboration between musicians, technologists, and the autism community to ensure the app's success in enhancing the lives of those with ASD.

51. **Automation of detection and quantification methods for high-performance liquid chromatography**

Wilyn St-Armand[1], Fanny Herrera-Carreon[2], Nathaly Feliz[2], Rickson Costa[1], Kimberly Simmons[3], and James Haralambides[1] ([1]Department of Math & Computer Science, Barry University, Miami Shores, FL, [2]Department of Biology, Barry University, Miami Shores, FL, [3]Department of Chemistry and Physics)

Our research focuses on semi-automating the process of identifying and processing compounds that have been analyzed using High-Performance Liquid Chromatography (HPLC). HPLC is a sophisticated analytical method crucial for separating, identifying, and quantifying compounds from a given sample. This separation method allows for the detection, quantification, and analysis of a compound's constituent components, a critical process in various scientific fields. In this study, we specifically examined three commonly found compounds - acetaminophen, caffeine, and acetylsalicylic acid - sourced from different pill brands, including Equate, Excedrin, and the equivalent Walgreens brand. Employing the dilution technique with machine-grade specific liquid and HPLC, we ran three samples with varying concentrations alongside a base sample for comparison purposes. Experimentation results include absorbance intensities measured in mAu

(milli-Absorbance units) represented graphically and stored in pdf format as well as numerically and stored in Excel format. Libraries of compound spectra such as PubChem, a repository of freely accessible chemical information located at https://pubchem.ncbi.nlm.nih.gov were utilized to compare compound components identified by HPLC to well-defined chemical compounds stored in these libraries. The purpose of our study is to reduce processing times and streamline the identification process through automated data analysis and visualization of results produced by the instrument. By eliminating the need for manual data entry and analysis by observation, our approach minimizes the possibility of human errors.

Funding provided by the Department of Chemistry and Physics, Barry University.

52. Frame-Based Video Analysis for Tackles in American Football

Sean Chin Loy[1], Lola Umarova[1], Scott Dietrich[1], Nasik Muhammad Nafi[2], William Hsu[2], and Ahsan Zaidi[2] *([1]Department of Math & Computer Science, Barry University, Miami Shores, FL; [2]Department of Computer Science, Kansas State University)*

Improper tackling form accounts for the root cause of a lot of the injuries American football players face. Most of the time, in-person coaching is used to provide a foundation for players to base their tackling form from. To aid in this, we collaborated with researchers from Kansas State University to develop a method for distinguishing “risky” from “safe” tackles using computer vision. The main purpose of this research was to develop an application that could analyze football tackles and categorize them as “risky” or “safe” based on several factors, such as the angle of impact and points of contact made with the player. To accomplish this, research regarding different computer vision transformers was conducted to find an optimal transformer for our application. Over 100 videos of player tackles were recorded and processed (categorized by a human) to use as a dataset, and a data-loader was created to ensure that the selected transformer, ViViT (Video Vision Transformer), was compatible with our dataset. While the final product is still in the process of development, we have successfully trained a model that can identify a “risky” or “safe” tackle correctly ~60% of the time. The accuracy of the model was calculated on a small portion of the dataset during model creation by taking the average of the “valid accuracy” (accuracy of the model on a small set of images) across 60 iterations of training (epochs). The development of a model capable of distinguishing "risky" from "safe" tackles marks a significant step towards enhancing player safety in football through the application of computer vision technology. In the future, similar programs could be applied in other areas too, serving as cross-platform applications.

DEPARTMENT OF HISTORY & POLITICAL SCIENCE

53. **Presidential linguistic styles vs. polling numbers**

Imani McClammy (Department of History & Political Science, Barry University, Miami Shores, FL)

The polling numbers of the 2020 presidential race are correlated to the linguistic styles in both candidates' tweets and speech. In this paper, I use the data of the number of tweets monthly of Biden and Trump and see if there is a causal relationship between the Trump and Biden Polling methods. For the statistical test, I perform two bivariate statistical analyses to prove whether the number of tweets in each month correlates with the polling number. Through the two regression

models, there was suggestive evidence that polling results could increase due to fewer tweets. There are both causal and correlated relationships between the charts and the regression models, but a large amount of improvement is needed to improve this research.

DEPARTMENT OF PSYCHOLOGY

54. Association between personality traits and academic alienation in a diverse sample of ethnic minority college students: An exploratory study.

Jaden Beckles, Sabrina Des Rosiers, Guillermo Wated (Department of Psychology, Barry University, Miami Shores, FL)

This study evaluated the patterns of association between personality characteristics and academic alienation among minority college students. Academic alienation can be defined as a sense of estrangement from learning and knowledge (e.g., Buzzai et al., 2022). Research shows college students who report academic alienation are more likely to experience low academic achievement. Several contextual factors have been shown to predict academic alienation. They included a hostile relationship with faculty or classmate, the experiences of marginalization related to social status, educational background, and economic status (e.g., Reid,1981; Zolfaghari et al., 2021). Generally, studies show these adverse experiences are positively correlated with academic alienation such that the more college students report such adversity the more likely they feel alienated from learning and their academic community (Hascher, 2018). Adverse consequences associated with academic alienation have been reported more often by students who identify with a racial or ethnic minority group (Marine, Sohyun, et al., 2019). Studies have identified a combination of contextual and individual characteristics like personality traits are associated with the likelihood of maladjustment and have identified academic alienation is associated with lower-level adjustment, few studies have examined this relationship in ethnic minority college students (Erzen et al., 2023). Given academic alienation can interfere with students' academic performance and psychological well-being (Buzzai, Filippello et al., 2022), additional investigations are warranted for describing whether individual characteristics like personality traits are differentially associated with academic alienation. According to Costa and McCrae (1987), personality traits are enduring patterns of thoughts and behaviors that influence individuals' perception of their context. The present study was based on Costa and McCrae (1970) conceptualization of personality to assess the relationship between personality traits and academic alienation in a sample of minority college students. Data for the present study were collected from an archived study on well-being, family processes and transitions to college (FPTC; Des Rosiers and Wated, 2018). The sample included 209 college students they were primarily sophomore (33.1%). They self- identified as women (78.7%), with a mean age of 20 (*SD* = 4.17). In terms of ethnicity, nearly the majority self-reported to be Hispanic (27.2%), and Black from various national heritage (25.2%). They self-reported their GPA (*M*= 3.20*, SD*= 3.59). School alienation scale (Studsrod & Bru, 2009) measured the degree to which participants reported feelings of being ostracize. Reliability analysis revealed good internal consistency in this sample (α = .77). The BFI-44 Personality Inventory (John & Sirvastava, 1999) measured agreeableness (α = .82), conscientiousness (α = .79), neuroticism (α = .82) and openness (α = .74). Results from a multiple linear regression revealed the regression model that included predictors of agreeableness, conscientiousness, openness, and neuroticism was associated with variability in school alienation such that the linear combination of predictor variables of agreeableness, conscientiousness, openness, and neuroticism predicted school

alienation, ΔF (4, 209) = 9.90, $p < .001$, $R^2 = .11$, $\Delta R^2 = .10$, Adjusted $R^2 = .09$. Neuroticism was observed to be a positive predictor of school alienation (β = .12, t = -1.98, $p < .05$); agreeableness was a negative predictor of school alienation (β= -.20, t = -3.08, $p < .01$). Conscientiousness (β= -.12, t = -1.81, *ns*) and Openness (β= -.01, t = -11, *ns*) were not observed to be statistically significant predictors of school alienation. These findings replicated previous research and highlighted patterns of a positive association between neuroticism and school alienation and an inverse association between agreeableness and school alienation. Future research should consider longitudinal approaches to clarify the direction of these relationships and the potential factors that explain the positive association between school alienation and neuroticism as well as the negative association observed between agreeableness and school alienation.

55. Individual- and contextual-level cultural stressors associated subjective well-being in immigrant college students.

Sadia Campbell, Sabrina Des Rosiers, Guillermo Wated (Department of Psychology, Barry University, Miami Shores, FL)

The United States' immigrant population has reached 49.5 million, making it the country with the highest population of immigrants (Camarota, 2023). Cultural stress, including perceived discrimination and acculturative stress has been identified as a factor that affect immigrants' adaptive functioning (Cano et al., 2018). Immigrants who report experiencing cultural stressors report lower levels of subjective well-being (Schwartz et al., 2022) and such adverse experiences predispose them to internalizing and externalizing problems (Lorenzo-Blanco et al., 2021). The present study aims to investigate the relationship between cultural stressors and subjective well-being in immigrant college students. Drawing from Lorenzo-Blanco et al., (2019) conceptualization of cultural stress, it is hypothesized perceived discrimination and acculturative stress will be inversely associated with subjective well-being. Consequently, it is expected the higher level of cultural stressors will be associated with lower levels of subjective well-being. Findings from the present study will shed light on the association between cultural stressors and subjective well-being in immigrant college students. Expected findings may have implications for addressing the cultural stressors faced by immigrant college students that may interfere with their subjective well-being.

56. Word Learning in Sentences: Evidence from Monolingual and Bilinguals

Julia Dye and Justin Lauro (Department of Psychology, Barry University, Miami Shores, FL)

This study examines the Context Variability Hypothesis, which suggests that encountering words in different contexts, particularly semantically diverse contexts, is essential for understanding, and forming complex networks of word meaning(s) (Bolger et al., 2008). This effect has been observed in monolingual studies (e.g., Bolger et al., 2008) as well as in bilinguals first language (Lauro et al., 2020) and second language (Lauro et al., 2020; Lauro & Toassi, under review). However, bilinguals also have the unique experience of encountering words in varied language contexts. For example, a bilingual could encounter a word in one language, and later encounter it in their other language. The present research examines vocabulary acquisition in both monolingual and bilingual learners. We examine the effects of two key variables: 1) repetition or variability of semantic context in which participants learn new words, and 2) repetition or variability of the language in which participants learn new words. Monolingual participants studied novel words in repeated (word repeated four

times in the same sentence), varied (word repeated in four different sentences), and combined (word repeated twice in the same sentence and presented in two separate sentences) semantic contexts. Bilingual participants studied novel words in repeated or varied semantic contexts, as well as in repeated or varied language contexts. Following the study session, all participants complete a recall and recognition test of the recently studied words. Data from 48 monolinguals and 30 bilinguals is analyzed and discussed within the instance-based framework of word learning.

57. Parentification and well-being in emerging adults.

Emilyanne Eckardt, Sabrina Des Rosiers, Guillermo Wated (Department of Psychology, Barry University, Miami Shores, FL)

Emerging adulthood, characterized by transitional phases in education, career, and personal relationships, is a critical period for well-being (Arnett, 2007, 2014, 2021). Parentification, where children assume adult roles and responsibilities without boundaries, is a phenomenon with limited research and generally predicts unfavorable outcomes in social and emotional domains. While some studies suggest negative outcomes are associated with parentification during this developmental stage, the relationship between parentification and subjective well-being remains underexplored. Subjective well-being, encompassing life satisfaction, positive affect, and negative affect, is a consistent predictor of overall psychological health (Diener, 1985; Anglim et al 2020). Parentification is influenced by various factors such as the number of siblings, birth order, ethnicity, gender, and family structure. However, there is a gap in the literature regarding the specific association between parentification and subjective well-being in emerging adults in college. The present study is based on Diener (1985) conceptualization of subjective well-being to: (1) describe individual and familial variations in parentification among emerging adults aged 18-29 in college, and (2), investigate the nature and strength of the relationship between parentification and subjective well-being. Participants will complete an anonymous survey on their early experiences and self-reported levels of subjective well-being. Findings from this investigation have the potential to inform counseling practices and parental approaches to supporting the well-being of emerging adults in college who report early experiences of parentification.

58. **Individualism, collectivism, context of reception, and familial factors in immigrant youth: Relationship with self-esteem**

Kiarra Harris, Sabrina Des Rosiers, Guillermo Wated (Department of Psychology, Barry University, Miami Shores, FL)

A vast landscape of research has highlighted the importance of contextual factors including proximal social settings like family, schools, peers as well as more distal factors like cultural values including individualism and collectivism on child developmental trajectories (e.g., Bornstein & Leventhal, 2015; Saracho,2023). Self-esteem characterized by the subjective judgments one constructs about the self is shaped by various factors, including social interactions, personal experiences, and feedback from various context including peers, parents, and the larger cultural context. With Hispanic youth projected to constitute 27% of the U.S. adolescent population by 2030 (U.S. Census, 2020), understanding the relationship between cultural values, negative context of reception, familial context and self-esteem in this demographic is crucial. Research revealed associations between cultural values and a host of other contexts of development including family functioning (Lorenzo-Blanco et al., 2012; Escobedo et al., 2001) predict

developmental outcomes in immigrant youth. According to Sircar and colleagues (2021) cultural values like familismo, respeto, and machismo are linked with improved family functioning and cohesion which predicted adaptive functioning in some immigrant youth. Another line of research has suggested context of reception defined by Portes and Rumbaut(1996) as the specific local settings in which immigrants settle, encompassing the opportunity structures such as the policies, the characteristics, and the conditions of the ethnic community of the receiving context is related to the adaptability and integration processes of immigrant groups. Schwartz and colleagues (2015) have suggested the notion of perceived context of reception and contends those who perceive their context of reception as negative are more likely to report unfavorable outcomes. For example, Lichter, (2012) and Taskin, et al., (2023) reported immigrants who settled in rural settings were more likely to report higher levels of perceived discrimination due to disparities in community integration whereas Martinez and colleagues (2016) found those who settle in established immigrant communities a more positive perceived context of reception reported more favorable psychological functioning. This research is based on Bronfenbrenner's bioecological model (Bronfenbrenner, 1965), to explore the nature of the association between the familial microsystem, a context that has immediate influence on the child and the macrosystem, specifically the shared cultural values like individualism and collectivism as well as negative perceived context of reception and self-esteem in a sample of immigrant youth. Findings may inform patterns of relationship between various environments and their association with self-esteem among youth from immigrant backgrounds.

59. Differences in substance use involvement among immigrant college students with a family history of substance use: Does locus of control matter?

Shania Howard, Guillermo Wated, Sabrina Des Rosiers (Department of Psychology, Barry University, Miami Shores, FL)

Immigrant college students constitute a significant proportion of the U.S. student population, with recent statistics indicating they comprise 31% of students (Pew Research Center, 2021). Studies have revealed varying rates of substance use disorders across generations, with first-generation immigrants exhibiting lower prevalence compared to their native-born and second-generation counterparts (Salas-Wright et al., 2014). Moreover, individuals with a family history of substance abuse are at an increased risk of engaging in substance use behaviors themselves (e.g., Catalano et al., 2003). While existing research has examined patterns of association between family history of substance use and offspring substance use behaviors, investigations into cognitive correlates associated with such patterns remain limited. Rotter's theory of locus of control (1954) underscores the influence of personal beliefs and expectations on behavior, particularly the perceived control over outcomes. Studies have highlighted the predictive nature of locus of control on diverse behavioral and cognitive outcomes (Nieben et al., 2022), with individuals exhibiting an internal locus of control attributing their achievements to personal efforts and choices, while those with an external locus of control often relying on external factors. Furthermore, research indicates that individuals with an external locus of control may demonstrate reduced motivation to change their substance use behaviors compared to those with an internal locus of control (Dahal et al., 2021). Despite the prevalence of substance use behaviors on college campuses as indicated by recent data from the National Survey on Drug Use and Health (NSDUH, 2022), limited research has explored the link between locus of control and substance use and related risk behaviors among college students, particularly within the immigrant student population with a reported family history of substance abuse. This study is grounded in Rotter's theory of locus of control to examine

the association between locus of control and substance use and related-risk behaviors among first-generation immigrant college students. The expected findings may inform preventive interventions and tailored support strategies for addressing substance use and related-risk behaviors among first-generation immigrant college students with a reported family history of substance use.

60. Entitled students in the workplace: Exploring the relationship between academic entitlement and counterproductive work behavior

Steven Lieb, Guillermo Wated, Sabrina Des Rosiers (Department of Psychology, Barry University, Miami Shores, FL)

Counterproductive work behavior (CWB) is defined as volitional acts that result in harm to both organizations and their stakeholders, costing organizations billions of dollars annually (Fox & Spector, 2006; CNBC, 2017). Several studies have tried to understand the predictors of CWB in the general workforce, including organizational constraints, job stressors, and personality factors (Zhou et al., 2014; O'Brien et al., 2021). Yet, the emerging adult population, or Generation Z (born between 1995 and 2009) is severely underrepresented in the current CWB literature despite making up 27% of the current global workforce and projected to make up one-third of the U.S. workforce by 2030 (McCrindle, 2024; Kumar, 2023). Personal characteristics and attitudes such as academic entitlement have been often used to shed light into outcomes that are relevant for this population, e.g., academic performance (Fromuth et al., 2019). Academic entitlement refers to students' expectation of academic success with little to no consideration of actual deservingness (Peirone & Maticka-Tyndale, 2016). It has been linked to multiple negative academic outcomes such as academic dishonesty (Greenberg et al., 2008). Yet, to the best of our knowledge no studies have explored the relationship between academic entitlement and CWB among working college students. Drawing from the trait activation model (O'Brien et al., 2021), which places personal factors at the forefront of counterproductive behavior, we hypothesize that academic entitlement will predict counterproductive behavior at work. Students will be recruited from several universities in the U.S. An electronic/web-based survey will be deployed to collect the data. Fifty-five participants will be used to test the studies hypothesis (Faul et al., 2009). Findings are expected to reveal a positive relationship between academic entitlement and CWB. Such results can have important implications regarding the development of academic and workplace interventions early in students' careers to help curve the impact of academic entitlement in workplace deviance.

FINE ARTS

61. ART 335 Typography: Scientific Infographic Project

For this project, students were asked to reenvision the presentation of scientific information through infographic posters. These posters combine typography, data, and imagery to effectively convey research ideas. By clearly illustrating relationships between various elements, creating size variations, providing directional cues, utilizing color coding, repeating shapes, maintaining consistency, achieving balance, incorporating whitespace, and incorporating clear supporting elements, the poster facilitates easy comprehension of complex scientific concepts.

THOMAS A. EDISON EDUCATIONAL CENTER

62. **iTech @ Thomas A. Edison Educational Center Cybersecurity Project**

This project uses a man-in-the-middle (MITM) attack technique to explore network sniffing. This technique utilizes Address Resolution Protocol (ARP) poisoning to intercept and release packets intended for the target and their recipient. Next, the recipient will forward the intercepted packets to the intended destination, and their content will be analyzed using Wireshark to identify any valuable information. Professionals must comprehensively understand computer networks to effectively engage in cybersecurity practices, including how endpoints transmit and receive data. Furthermore, familiarity with various network devices, such as switches, routers, firewalls, demilitarized zones (DMZ), intrusion detection systems (IDS), and intrusion prevention systems (IPS), is crucial. Additionally, cybersecurity experts should be well-versed in communication protocols like secure shell (SSH), hypertext transfer protocol (HTTP), and HTTP secure (HTTPS), along with their associated TCP and UDP port numbers. Knowledge of address resolution protocol (ARP) and a basic understanding of computer programming are prerequisites. The project requires a minimum of two devices, one running Kali Linux and another with Windows 10 Pro, connected to a local area network (LAN) with proper authorization. Essential sniffing techniques and analysis tools include Nmap, Ettercap, and Wireshark, all pre-installed in Kali Linux. As an ethical hacker, any cyberattack must never commence (i.e., to bring or come into activity, being, or operation) on someone's or a business network without explicit written consent between the practitioner and the network owner. This project not only delves into the technical aspects of network sniffing but also underscores the importance of ethical considerations in cybersecurity experimentation and research.

AMERICAN HERITAGE SCHOOL

63. Understanding the PSEN1 G206A Mutation in Alzheimer's Disease

Malcolm Owusu *(American Heritage School)*

Familial Alzheimer's Disease (FAD) affects around 3 million people worldwide and is responsible for the use of around $7 billion to care for patients. Genetic mutations of the PSEN1 gene are a prevalent cause of FAD, specifically early-onset Alzheimer's. A familial-linked missense mutation of PSEN1 called G206A has been identified in a Puerto Rican subpopulation. G206A is a mutation of interest as it differs from typical PSEN1 mutations by causing AD with a large variable range of onset ranging from ages 40 to 73 rather than strictly early onset mutations. Through studying this mutation, I can identify modifiers in the age of onset of Alzheimer's disease that will lead to the discovery of drug targets. I plan to take a two-pronged approach to the matter, looking at both clinical cognitive function and biological sample data. By comparing the cognitive function of diseased individuals with G206A to diseased and healthy
individuals without G206A, I can identify clinical features that are distinctive to G206A. In collaboration with the Hussman P. Institute of Human Genomics, I will use induced pluripotent stem cells (iPSC) and brain samples from G206A carriers and non-carriers to assay for bulk RNA expression. These RNA expression levels will provide insight into the gene expression levels in carriers vs. non-carriers, which will help identify disease modifiers that are specific to G206A. With this data, future studies can aim to develop drugs targeting new modifiers that may be able to delay

or stop AD onset.

64. Chemical Re-engineering of Epithelial Cells into Stem Cells

Shrika Kantipudi *(American Heritage School)*

This study investigates induced pluripotent stem cells (iPSCs) through an alternative approach aimed at overcoming challenges in reprogramming pluripotent stem cells. The conventional method, employing transcription factors, poses risks such as tumorigenicity and genomic insertion. In contrast, this study explores the use of sugar-based chemical compounds to induce pluripotency, thereby avoiding the inherent pitfalls associated with gene-based reprogramming. The research focuses on utilizing modified manosamines, undisclosed metabolic analogs, as chemical inducers. A human pancreas cell line underwent in vitro treatment with the proprietary analog for a week. Following this, immunocytochemistry was performed using the Invitrogen™ PSC Immunocytochemistry Kit to assess pluripotency markers. The obtained results revealed compelling evidence of successful reprogramming. Immunocytochemistry demonstrated the expression of OCT4 and SSEA4, robust indicators of pluripotency, in the treated cells. Notably, these markers signify the acquisition of an embryonic stem cell-like state, affirming the effectiveness of the sugar-based chemical approach in inducing pluripotency. This innovative methodology offers significant advantages over traditional gene-based reprogramming. The use of chemicals circumvents tumorigenic risks associated with genes, as these molecules do not induce cancer. Moreover, unlike gene insertion, the metabolization and excretion potential of these chemicals prevent genomic integration, reducing the risk of mutagenesis. The synthesis of sugar-based molecules in-house further underscores the practicality and accessibility of this approach. By leveraging modified manosamines and undisclosed analogs, this study presents a promising avenue for inducing pluripotency, potentially revolutionizing iPSC generation and its applications in regenerative medicine.

65. Use of *Pueraria montana* extracts as novel treatments for the dysfunctional dopaminergic neurons seen in ADHD

Akshay Kumar *(American Heritage School)*

This study's purpose is to determine if kudzu root and leaf extracts are capable of treating the dysfunctional dopaminergic neurons associated with attention-deficit/hyperactivity disorder (ADHD). The neurodevelopmental disorder ADHD is common, has genetic and environmental causes, and affects people of all demographics. This disorder is often connected to dysfunctional dopaminergic neurons, or dysfunction in the neurons that produce and secrete the neurotransmitter dopamine. Estrogenic therapies have been shown to treat impaired dopaminergic neurons. The invasive vine *Pueraria montana*, or kudzu, root and leaf extracts contain high concentrations of phytoestrogenic isoflavones. Genetic and chemical models for ADHD (flies raised in 400pM imidacloprid and mutants deficient in Dopamine Active Transporter) will be used to holistically represent ADHD. Due to their phytoestrogenic content, if kudzu root and leaf extracts are used to treat drosophila models for ADHD, then drosophila will show reduced symptoms and have minimal side-effects. This experiment compares the phytoestrogenic extracts to the popular pharmaceutical treatment atomoxetine in terms of their

impact on the common symptoms of hyperactivity, social behavior, long-term memory/learning, and dopamine concentration. Sleep is also assessed to determine if treatments resulted in negative side effects. Kudzu extracts were shown to induce statistically significant improvements in symptoms in all assays, sometimes even outperforming the pharmaceutical treatment. Extract treatments did not always significantly alter drosophila sleeping behavior, and thus did not result in severe side effects. These results demonstrated that kudzu root and leaf extracts were successful treatments for ADHD resulting from their impact on dysfunctional dopaminergic neurons.

66. The Effect of Intermittent Fasting on Immune Defense to Bacterial Infections in *Drosophila melanogaster*

Hanna Zhang *(American Heritage School)*

Intermittent fasting (IF) has gained popularity as a weight loss method, involving alternating periods of eating and fasting. While studies suggest that there are many health benefits, recent findings have raised concerns about IF's impact on the immune system's ability to combat infections. This study aimed to evaluate the effects of IF on immune defense against systemic bacterial infection using *Drosophila melanogaster* as a model organism. Flies underwent fasting or non-fasting conditions, followed by infection with *Pseudomonas aeruginosa* or *Escherichia coli*. Survivorship, negative geotaxis, and bacterial load post-infection were assessed. The fasted groups of the control and *P. aeruginosa* had a significantly higher survival rate than the nonfasted groups ($p < .0001$). However, there was no significant difference in *E. coli* ($p = .47$). The negative geotaxis assay demonstrated altered climbing abilities in flies infected with *E. coli* ($p < .0001$) but not in other groups. The bacterial load assay post-infection and 24 hours post-infection showed no significant differences across all groups ($p > .05$). However, it demonstrates a trend: the nonfasted group has a higher bacteria load 24 hours post-infection, whereas the fasted group has a lower bacterial load. Overall, the study's findings suggest that IF may protect against systemic bacterial infection in flies. Despite limitations in sample size during fasting and potential variability in bacterial dosages delivered from the septic pinprick, the study provides insights into the relationship between IF and immune defense against infections.

67. A Novel 3D-Printed Nerve Implant for Neuroglial Regeneration: Advancing Central Nervous System Recovery and Repair

Iris Fan *(American Heritage School)*

Neurological disorders, including traumatic brain injuries (TBIs), spinal cord injuries (SCIs), peripheral nerve injuries (PNIs), and neurodegenerative disorders (NDs), affect 1 in 6 individuals globally. The central nervous system (CNS) has a limited regenerative capacity following injury or disease leaving long-lasting cognitive dysfunction. The field's current gold standard, nerve grafts, poses risks of infection, functional limitations, and substantial costs. Neuroglia, specifically astrocytes with distinct A1 and A2 categories play a crucial role in homeostasis and neurogenesis in the CNS. A1 reactive astrocytes induce neuron death while A2 reactive astrocytes promote neuron growth. This investigation aimed to enhance CNS recovery by developing a 3D-printed hydrogel-integrated scaffold. A novel scaffold was printed with polyethylene terephthalate glycol (PETG) chemically crosslinked with a gelatin/chitosan/silk fibroin hydrogel incorporated with nerve growth factor (NGF) and chondroitinase ABC (ChABC) to stimulate nerve growth and mitigate

tissue scarring. Biomaterial and biological characterization was done against the positive control, a murine nerve graft. An SEM analysis indicated a 75μm pore size and a porosity appropriate for astrocyte growth. A rheological frequency sweep found a complex modulus up to 162 Pascals. The implant absorbed water up to 92% of its dry mass and a slow degradability. Cell growth increased 167% within a 3-day period with 94% cell viability. The implant also displayed a significantly lower amount of neuroinflammatory markers and axon growth of 45μm. Overall, this novel integrated implant holds promise for CNS regeneration and neural engineering applications, offering a biocompatible, functional, cost-effective alternative to current standards.

68. Using Sargassum Sp. Extracts to Alleviate Multiple Sclerosis-like Symptoms and Reduce Oxidative Stress

Scott Shin *(American Heritage School)*

Multiple Sclerosis (MS), a chronic neurodegenerative disease, affects approximately 2.8 million people worldwide. With no cure for MS and treatment being costly and often ineffective, individuals with this condition face limited options. This study investigates the potential of the Sargassum species, native to the Atlantic Ocean, to act as a treatment for MS by activating the nrf2 pathway. To obtain the extract, ethanol extraction was conducted using dried samples of Sargassum, which were soaked in a 70% ethanol solution. Precise extracts were processed using a separatory funnel and rotary evaporation. The experimental design involved an induction of MS-like symptoms at approximately 3dpf, followed by 24-hour before introducing each respective extract. Part 1 of the study included a Collagen and Myelin Quantification Assay to measure collagen and myelin levels after each treatment. The results indicated that the hexanes group showed the highest levels of collagen and myelin ($p < 0.05$). In Part 2, a behavioral assay was conducted to analyze how the treatments may have influenced responses to stimuli. The results revealed that the hexanes group was the least impacted by the induction of LPS-like
symptoms ($p< 0.05$). Part 3 involved an ELISA to measure the protein Heme-oxygenase 1, a product of the nrf2 pathway, to analyze pathway activity. Results indicated that the nrf2 pathway was most active in the hexanes group ($p < 0.05$). All parts of the study indicate that the hexanes group had the most significant effect, activating the nrf2 pathway and effectively combating MS-like symptoms.

69. Effects of Liraglutide on modulating GABA neurotransmission and increasing dopamine levels using L-dopa and carbidopa to reduce of ethanol addiction in *Drosophila melanogaster*

Laila Rozenberg *(American Heritage School)*

The research investigates how voluntary Liraglutide administration modulates GABA neurotransmission and examines the potential dopamine level enhancement via voluntary intake of L-dopa and carbidopa to combat ethanol addiction in Drosophila melanogaster. The aim is to propose novel pharmacotherapeutic strategies for substance use disorders. Alcohol Use Disorder (AUD) is a pressing global health issue. This study focuses on understanding addiction neurobiological mechanisms, emphasizing GABA and dopamine pathways, to introduce innovative treatments. Using Drosophila as a model, the experiment replicates human addiction traits, demonstrating fly resilience to ethanol toxicity and preference for ethanol consumption. The procedure encompasses various assays: monitoring GABA neurotransmission with behavioral

assays, quantifying dopamine levels using ELISA, and assessing ethanol preference via a Y-maze. Results indicated notable GABA modulation and reduced ethanol preference in Liraglutide-treated flies, supporting the primary hypothesis. However, there was inconclusive data regarding enhanced dopamine levels. Data reliability was affected by limited funding, time constraints, and initial fly mortality issues. Repeating experiments with diverse samples and dosages improved accuracy. Implementing these findings in practical settings could lead to novel pharmaceutical interventions for alcohol addiction. Future research may explore alternative GLP-1 analogs, refine delivery techniques, and transition to human trials for better translatability from animal models. This study illuminates potential pharmacological approaches for alcohol addiction, but further investigation is essential to overcome limitations and fully exploit these findings in clinical practice.

70. Studying the Effects of Isolation and Overcrowding on *Drosophila melanogaster*

Maya Jos *(American Heritage School)*

This experiment aims to investigate social conditions, their effects, and the relationships between isolated, low-density, and overcrowded social conditions. This was tested by utilizing *Drosophila melanogaster* and subjecting them to different social conditions, while also switching them between social conditions for a period of about 20-30 days. At the end of this period, they were tested. Their activity levels were tested using a Drosophila Activity Monitor (DAM). Their interaction levels were tested through an interaction assay utilizing Petri dishes. Their learning abilities were tested through the Adult Olfactory Shock Assay. Their serotonin levels were also tested using a Serotonin ELISA kit. The results of these assays indicated that *D. melanogaster*'s activity levels are dependent on the social condition they are placed in during their developmental stages; their interaction levels are dependent on their past social experiences; their learning abilities are dependent on social interactions, and their serotonin levels have no significant correlation with their social conditions. In conclusion, the effects of social conditions are primarily based on either social experience or the social condition the *D. melanogaster* were exposed to in their developmental stages.

71. The Investigation of the Therapeutic Effects of High Nitrate Concentration Beetroot Juice on the Pathophysiological Progression of Duchenne Muscular Dystrophy with Drosophila Model

Mikaella Mishiev *(American Heritage School)*

The purpose of this study was to investigate the potential therapeutic effects of high nitrate concentration beetroot juice on the pathophysiological progression of Duchenne Muscular Dystrophy, utilizing a *Drosophila melanogaster* model. Four diets, with different concentrations of beetroot juice (0%, 10%, 25%, 50%), were prepared and administered to dystrophic flies (Bloomington #25210) and wild type flies (Carolina Stocks #172100). Muscle function was assessed using a negative geotaxis assay, which recorded the percentage of flies to reach 8 centimeters in 12 seconds, and with the Drosophila Activity Monitor which measured the number of times individual flies crossed the center of a small tube. Nitrite levels, an indirect measurement of nitric oxide, were assessed with a nitric oxide assay kit. Data from this study indicates that walking frequency increased in the dystrophic flies fed 10%, 25%, and 50% beetroot juice diets,

while climbing ability improved in those fed 25% and 50% beetroot juice diets. Nitric oxide levels significantly increased in the dystrophic flies fed a 50% beetroot juice diet. Beetroot juice improved muscle function and reversed the effects of Duchenne Muscular Dystrophy in *Drosophila*. Beetroot juice also restored the nitric oxide levels in the dystrophic flies, suggesting increased vasodilation and mitochondrial efficiency. This study suggests that patients with Duchenne Muscular Dystrophy may benefit from a diet rich in beetroot juice. This study may have implications on future pharmaceutical and nutraceutical product development which may be able to combat this currently incurable disease.

72. Metabolic Modulation of Neuroinflammatory Responses and Behavior of *Caenorhabditis Elegans*: Implications for Neuronal Resilience and Function

Shania Srivastav *(American Heritage School)*

This research investigates the impact of dietary interventions on neuroinflammatory responses and behavior in *Caenorhabditis elegans (C. elegans)*, serving as a model organism. The purpose of the study is to elucidate the relationship between specific nutrients and metabolic alterations with neurobehavioral outcomes, aiming to contribute insights with potential implications for understanding neurodegenerative processes in more complex organisms, including humans. The procedure involved implementing distinct dietary interventions, including omega 3 supplementation, vitamin E administration, and curcumin exposure, followed by thrashing and locomotive assays to assess neurobehavioral responses. The results revealed that omega 3 supplementation positively correlated with increased thrashing and locomotion, while vitamin E exhibited a trend towards reduction in both behaviors. Curcumin demonstrated an intermediate impact, suggesting a nuanced influence on neurobehavior in *C. elegans*. These findings highlight nutrient-specific effects on neuroinflammation and behavior, emphasizing the potential role of dietary components in modulating neuronal activity. The observed variations in thrashing and locomotion across different dietary interventions provide valuable insights for further exploration in neurobiology research. In conclusion, this study underscores the significance of dietary factors in shaping neurobehavioral outcomes in *C. elegans*, laying the groundwork for future investigations into the molecular mechanisms underlying these observed effects and their relevance to more complex organisms, including humans.

73. The Effects of Caffeine on Memory Recovery Caused by Sleep Deprivation Using *Drosophila melanogaster* as a Model Organism

Susana Regueira *(American Heritage School)*

The purpose of this experiment is to determine if caffeine can recover memory loss caused by insomnia. The research question is, how does caffeine affect memory recovery and depression caused by sleep deprivation in *Drosophila melanogaster*? The null hypothesis is caffeine will have no effect on memory recovery in *Drosophila melanogaster* derived from insomnia. The alternative hypothesis is if *Drosophila melanogaster* are given caffeine, then it will recover the memory deficit caused by insomnia. In order to determine whether caffeine has a significant effect the following assays were performed: geotaxis assay, larval crawling assay, and aversive phototaxic suppression assay. The geotaxis assay demonstrates the amount of drosophila that climbed above the eight

centimeter mark by ten seconds. This depicts cognitive activity in response to different conditions. The aversive phototaxic Suppression Assay shows how drosophila learn to avoid light paired with aversive stimulus which tests the short-term memory. The larval crawling assay measures the peristalsis contractions per minute in drosophila melanogaster larvae. The data demonstrated a clear trend in increased cognitive activity and response in drosophila that were exposed to caffeine and lower response to those affected by insomnia or abnormal circadian rhythm. When the One-Way ANOVA was performed for the Geotaxis Assay the p-values had a significant increase when not affected by insomnia or treated with caffeine. This supports the expected results demonstrating that caffeine does have a positive effect in memory recovery caused by insomnia or sleep deprivation in *Drosophila melanogaster*.

74. **Investigating the Association of Drug Addiction and Autoimmune Disorders Based on Regulatory T-Cell Function, and the Effects of Methylcobalamin in Curbing Nicotine Addiction and Lupus, Using *Danio rerio* as a Model Organism**

Vid Yash *(American Heritage School)*

This study used *Danio rerio* embryos to investigate the association between drug addiction and autoimmune disorders, as well as the effects of an immune-boosting antioxidant, Methylcobalamin, on both conditions. Autoimmune conditions and substance abuse disorders are on the rise globally. The numbers in the US alone in 2023 stand at a staggering 20.4 million diagnosed with addictions and over 50 million affected with some kind of an autoimmune disorder. The United States spends over $35 billion annually to treat substance disorders, and another $100 billion on autoimmune disorders. A compromised immune system lies at the core of both conditions, yet few attempts have been made to establish an association between them. The results showed that the antioxidant groups performed better than the non-antioxidant groups in all of the assays. However, the nicotine and lupus groups were not closely matched across assays, suggesting that the effects may be specific to the exact conditions tested, nicotine addiction and lupus, not addiction and autoimmune disorders broadly. The findings suggest that Methylcobalamin could be an effective treatment for nicotine addiction and lupus. The study also emphasizes the importance of exploring the potential of antioxidants in treating other autoimmune disorders and identifying specific nutritional deficiencies caused by substance abuse that lead to autoimmune conditions. Overall, this research provides valuable insights into the relationship between drug addiction and autoimmune disorders and that if the *Danio rerio* model is applicable to humans, antioxidants like Methylcobalamin, can be extremely effective and affordable treatment options to treat both disorders.

List of students who contributed to STEAM 2024:

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