25TH ANNUAL FALL STUDENT RESEARCH SYMPOSIUM PROGRAM BOOK

Emerging Caribbean Scientists

September 15, 2024
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College of Science & Mathematics
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ECS Mission

The mission of the Emerging Caribbean Scientists (ECS) Program is to increase research training and promote excellence for STEM (science, technology, engineering, and mathematics) students at the University of the Virgin Islands

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Student Abstracts

MCAVS POSITIVELY RESPOND BETTER IN MODERATE DEPTS OF WATER

Na'Kia Armstrong

Mentor: Semoya Phillips
The Nature Conservancy

Montastrea cavernosa, (MCAVs) are usually green, orange, red, and gray Great Star Coral, that frequently have their tentacles (at the end of their polyps) out.* They retract their polyps when stressed, usually when changes in temperature or light occur. This research project experimentally investigated the effect of four different water depths displayed in different tanks, mimicked by lights, and how the four genotypes of MCAVs responded. The hypothesis was made that the genotypes of MCAVs would display a positive reaction in shallower water conditions, which were displayed in tanks number one and three stemming from their characterization of shallow water corals. One of each of the four MCAV genotypes (UNKS3B, 018B, 020B, 042B), cut into four parts each, were placed in one of four 40-gallon tanks of different mimicked depths. Using an underwater camera, I gathered images of numerous angles for each tank for thirteen days. On day thirteen, I analyzed the number of polyps; opened, extended, or closed for each genotype in the various water depths. Overall, MCAVUNKS3B reacted more positively in tank number four where on average 13.09 percent were extended. As for MCAV018B, 20.55 was the average of extended polyps, also in tank four. MCAV020B and MCAV042A had close averages in opened and extended polyps and reacted positively in tanks number one (second deepest) and number three (deepest). Therefore, on average, MCAV genotypes more positively reacted to more shallow conditions as observed in tank number four.

Urethane has no Effect on Liver miRNA Expression in Male and Female Mice

Annadelle Brown Omar Borges-Sosa, Maksat Babayev

Mentors: Sarah Commodore PhD & Patricia Silveyra, PhD
University of Indiana Bloomington

Research has shown that urethane, a crystalline compound used medicinally as an antineoplastic agent, is used as a carcinogen shown to induce lung adenoma and adenocarcinoma in mouse models, however, not much is known about potential effects on the liver. Metastasis has shown that the livers of urethane-exposed mice could also develop tumors. MicroRNAs (miRNAs) are non-coding RNAs that aid in controlling gene expression through transcription. We hypothesized that sex-specific miRNA expression in the liver mediates immune responses to urethane challenge in male and female C57BL/6 mice. Male and female C57BL/6 mice were treated with urethane at a dose of 1g/kg body weight to induce lung adenocarcinoma or phosphate buffer saline (PBS) as control, through weekly intraperitoneal administration for ten weeks. After the last intraperitoneal injection, mice were monitored for another 20 weeks (tumor induction period)and sacrificed to study differences in tumor initiation, for which liver tissue was harvested and snap frozen. The sample size was 4 mice of each sex (females = XXF, males = XYM) of 2 challenge groups (urethane, PBS) for a total of 16 mice. Total RNA was extracted from pulverized whole liver tissue using TRIzol and the Direct-Zol RNA extraction kit and miRNA expression was determined with a PCR-based array (QIAGEN). The PCR results were analyzed using QuantStudio 12 K Flex software and the limma package on R studio. While we did not observe statistically significant differences in the expression of liver miRNAs in urethane vs. control mice after correcting for multiple comparisons, several miRNAs displayed sex-specific trends in expression with urethane treatment. For example, mmu-miR-140-5p was decreased in urethane-treated females, but increased in males, vs. the respective controls (not significant). In conclusion, urethane treatment likely affects liver miRNA expression in a sex-specific manner, but an experiment with a larger sample size would need to be conducted to validate these findings.

Expressing the Poly-3-hydroxybutyrate Pathway in Zymomonas mobilis

Mia Bruno

Mentors: Dr Elhussiny Aboulnaga & Dr Michaela TerAvest
Michigan State University

Petroleum-based products such as fuels and plastics have had detrimental impacts on the earth's climate, temperatures, and ecosystems. Conversely, plant biomass production is healthy for the earth as it reduces global warming by decreasing the amount of carbon dioxide in the atmosphere. Plant biomass contains sugars that can be utilized by bacteria to generate products like ethanol and biodegradable plastics. *Zymomonas mobilis* is a unique bacterium being harnessed due to its ability to produce and resist high ethanol, through the breakdown of sugars like glucose. *Z. mobilis*, unlike most other bacteria, uses acetaldehyde rather than acetyl-CoA as its major central metabolite. However, many important pathways depend on acetyl-CoA for the synthesis of bioproducts. One such pathway is the poly-3-hydroxybutyrate (PHB) pathway which produces PHB, a biodegradable plastic. Here we are investigating why *Z. mobilis* does not use acetyl-CoA as its major central metabolite, and how the PHB pathway expression affects its metabolism. To address this question, we cloned the PHB-operon from *Cupriavidus necator* H16 into a vector for expression in *Z. mobilis*. Afterward, we tested PHB production in *E. coli*, and it was found to work successfully. When we transferred the plasmid to *Z. mobilis*, there was no effect on the growth of the cells when it was not induced, however, when it was induced, we detected PHB production and a decrease in cell growth. We are currently working with *Z. mobilis* to optimize the PHB production.

Determining Important Factors of Readmittance Rates of Diabetic Patients using XGBoost and Support Vector Machine Models.

Joleen Buchanan, Zidane Byron, Makayla Todman

Mentor: Dr. Aaron Rapp
University of the Virgin Islands

According to the World Health Organization, approximately 422 million people were living with diabetes worldwide in 2014. Even though diabetes is the 8th leading cause of death in the world, many diabetic patients do not receive consistent or adequate treatment during hospital visits, with many being discharged early and later needing to be readmitted. This inconsistent treatment can result in poor glycemic control, higher patient mortality, and higher costs for hospitals due to patient readmission. Our research explored the use of the machine learning models XGBoost and Support Vector Machine (SVM) to identify important features for predicting the rate of hospital readmittance within 30 days of discharge for diabetic patients. We hypothesized that by leveraging these models, we could enhance diabetes management in hospitals, ultimately improving patient outcomes and reducing healthcare costs. We trained various models on the electronic health records of patients diagnosed with diabetes and ran feature selection to determine which characteristics of patients were correlated with readmittance to hospitals in under 30 days. After testing numerous techniques, we found that most models, including the SVM, tended to overpredict patient readmission. The SVM, even enhanced with techniques like SMOTEENN for handling class imbalance, faced challenges like other models in accurately predicting readmission rates. While the SVM offered some improvements in managing class imbalance, it did not significantly outperform other approaches. The XGBoost model, specifically the "Optimized XGBoost with Chi-Squared Features and Class Weights," displayed a middle ground in predicting both classes rather than skewing to one. However, like the SVM, it still struggled to accurately predict readmittance rates. Overall, none of the models displayed a strong ability to accurately predict readmittance rates of diabetic patients. We attribute this to the data being noisy and the readmittance class being too small, a common issue when working with electronic health records and real-world data.

Anxiety Among First Responders

Jesse Colbert

Mentors: Mr. Lisle Evelyn, MA, NRP, CPM & Dr. Deborah Jones Weiss
CREW (Cardiovascular Research Empowerment Workforce)

First responders are at risk of cardiovascular disease and higher PTSD, depression, and anger rates compared to civilians (Bryant RA., 2022). This is due to their exposure to working in a high-stress environment, which makes them susceptible to anxiety. Anxiety is a mental disorder that causes "persistent feelings of anxiety or dread" which can be categorized as generalized anxiety disorder (National Institute of Mental Health, April 2024). Prolonged exposure to traumatic events can also take a toll on an individual's physical health by increasing stress levels which worsen cardiovascular health by causing inflammation and arterial plaque buildup. Mental health is not a topic that is sufficiently discussed in the territory, particularly in the workplace. As first responders frequently encounter trauma firsthand, it's important for them to prioritize their physical and mental well-being. This study expands on Lisle Evelyn's previous work for his CPM Project, "Exploring the impact of low EMS staffing levels and increased call volumes on the psychological and cardiovascular health of EMS Practitioners in the U.S. Virgin Islands."

The aim of this project was to assess anxiety rates among first responders in the U.S. Virgin Islands. Data was collected among three groups of first responders (EMS practitioners, police officers, and firefighters) through a confidential, 10-question survey that was created by drawing inspiration from relevant articles and pre-existing anxiety questionnaires. The responses were analyzed to compare stress and anxiety levels across the three groups. Results showed that firefighters were the first responder group with a large number of anxiety-related symptoms out of the three that were evaluated. Though, EMS practitioners strongly recommended mental health support. Overall, the vast majority of respondents supported using mental health education as a workplace intervention. The long-term research goal is to explore how anxiety impacts the cardiovascular health of first responders.

Recreational Accessibility in the USVI

Brenique Dawson

Mentor: Dr.Gregory Guannel
University of the Virgin Islands

Recreational spaces (parks, beaches, etc.) are crucial to an individual's mental and physical health, impacting their quality of life. These spaces promote a sense of joy, foster social relationships, exercise, and open the door for a holistic approach to health. Beaches and access to them in the U.S. Virgin Islands are viewed as an economic development pull factor for tourism. Images of luxurious tropical landscapes in commercial and cultural representations give the impression that access to quality spaces is available and plentiful. However, to date, no study has measured the accessibility and quality of recreational spaces in the U.S. Virgin Islands. More research needs to be conducted on these challenges within the territory. To address this knowledge gap, we first identified recreational spaces using remote sensing techniques. Then, we cataloged and analyzed each space, focusing on beaches, using criteria such as location, population majority, and road access to measure accessibility and quality in St. Thomas. We also conducted a desktop analysis of 3,530 Google reviews to gage public perception and quality of the sites. We will present results in this poster and hope this will start conversations and raise awareness about the availability and quality of access to recreational spaces in the U.S. Virgin Islands.

Structural Changes In The Prefrontal Cortex Associated with Racism Burden

Danesha Derima

Mentor: Karin Schon PhD, Tahlia Bragg PhD
Boston University

Alzheimer's disease is the most common form of dementia. Alzheimer's is a progressive disease that begins with mild memory loss that worsens over time. The disease can also interfere with other cognitive abilities that will hinder the completion of everyday tasks. Older African American adults are twice as more likely to develop Alzheimer's disease. There is a critical unmet need for understanding social and societal contributors to disparities in brain health. We aim to fill the gap in knowledge between Black communities and research; To understand how societal and social factors contribute to brain health in Black communities. We expect to see lower volume and/or cortical thickness in the prefrontal cortex with greater levels of racism, Racial discrimination and racism induced stress will cause difficulty in executive functioning, and Individuals with higher levels of racial burden and anxiety will have difficulty with performing memory tasks. Our recruitment methods will be done through building trust within the community through community engagement activities and faith-based panel discussions. Data will be analyzed by the Freesurfer software that will be able to quantify structural MRI imaging

Keywords: Executive Functioning , Freesurfer, Racial Burden, Prefrontal Cortex

Cellular Reception Quality in the U.S. Virgin Islands

Asimian Edmead

Mentor: Gregory Guannel
University of the Virgin Islands

Cellphone connectivity is crucial because it allows for effective communication with others, particularly during times of crisis. Since the devastating hurricanes in 2017, the quality of cellphone reception in the territory has varied greatly. Recently, numerous residents in the territory have been expressing dissatisfaction with their service provider. Understanding the quality of service each carrier provides is vital, as it impacts daily communication. So, what is the reception quality provided by each carrier within the territory? This study intends to analyze cellular reception quality within the territory, focusing on both spatial and temporal variations across different carriers. By examining fluctuations in signal strength at various locations and times, we intend to uncover data that may indicate vulnerabilities such as dead zones or inconsistent signal quality. This analysis will provide valuable insight into how each carrier's service compares, highlighting areas that require improvement, and which areas are doing well. Using data collection devices, data analysis, and geospatial analysis our findings will enable us to develop targeted strategies to enhance cellular connectivity for all users in the territory. This will ensure more reliable communication, especially in critical situations. Ultimately, this research seeks to contribute to the ongoing efforts to improve the overall quality of cellphone reception, fostering a more connected and resilient community.

Experiential Learning: Enhancing Critical Thinking Skills among the Rising Caribbean Generation of Students

Kierra Enrique

Mentor: Dr Gregory Guannel
University of the Virgin Islands

In the Caribbean, students' learning environments have been disrupted by many changes in the community throughout the years such as severe, back-to-back Category Five Hurricanes in 2017, to the global COVID-19 pandemic, causing fluctuations in students' education. To address this, experiential learning—through engaging, first-hand activities offering direct learning—provides a positive, educational approach to these community challenges and its impact on Caribbean lives. Our research explores experiential learning, particularly in critical thinking skills of freshmen, through the University of the Virgin Islands' (UVI) Science 100 course, a class focused on the natural features of the Caribbean region and their impacts on the community. Students chose between two Caribbean-focused semester assignments: an Action project, which involves planning, executing, and presenting research-related activities, or writing a traditional Research paper. Within the 2023-2024 academic year, we had a 15% consent rate out of 220 enrolled students, with seven being omitted due to their incomplete submissions. The final study consisted of 10 Action students and 17 Research students we assessed with the AAC&U VALUE Rubric of Critical Thinking based on the five rubric dimensions: Explanation of Issues, Evidence, Influence of Context and Assumptions, Student's Position, and Conclusions and Related Outcomes. Findings determined that students who completed an action project, rather than a research paper, displayed significantly higher ratings in three of the five critical thinking dimensions. Further research will extend into the upcoming academic year with revised assignment prompts to better align student learning and critical thinking outcomes for future studies.

Preserving Records: The Enslaved People of St. Croix

Aaliyah George

Mentor: Dr. Molly Perry
University of the Virgin Islands

Knowing where your lineage comes from is important for understanding more about yourself, but for people of African origin, especially Caribbean people, this task becomes nearly impossible. The main issue is a crippling lack of records for people who were alive during the times of enslavement, and because of this historical gap, many families within our islands do not know where they come from. Information is scattered everywhere, but it is crucial to organize and store as much information as possible in one place. The St. Croix African Roots Project (SCARP) aims to rectify this issue, and this data collection (which has information from 1734-1917) was created by Mr. George F. Tyson in 2002, along with other colleagues. This database of information houses "nearly two million biographical records compiled from a vast array of historical documents archived in Denmark, the U.S., and the Virgin Islands." This data was collected from slave trade shipping records, property inventories, church records, immigration records, and more. The majority, if not all of the information collected was found in written records since other sources such as word of mouth are not as reliable. This summer, our goal was to re-examine the database and port it to a modern and online experience, allowing for it to be open to the public for those who are interested in St. Croix's history of enslavement.

The Curriculum Analysis of Texts in a Developmental Mathematics Course at a Caribbean University

Carissa George

Mentor: Dr. Diana Bowen
University of the Virgin Islands

Open-access textbooks create a more convenient and equitable way for students to have immediate access to textbooks and provide teachers with supplemental materials to help guide and teach classes. We discuss strengths and shortcomings of the open-access *OpenStax Elementary Algebra 2e* textbook and insights for instructors and suggestions for supplemental content like the Peer-led Team Learning (PLTL) workshops.

We decided to code some questions from the textbook and PLTL workshops into six categories. Two of those categories include procedural fluency and conceptual understanding. When coding 206 problems from the *OpenStax Elementary Algebra 2e* textbook, we found that there were more procedural fluency questions than conceptual understanding questions. When coding 115 PLTL Workshop Supplementary Curriculum questions, we found that there were more procedural fluency questions than conceptual understanding questions. The OpenStax textbook and the PLTL workshops are not well balanced in the type of questions being asked. This means instructors need to include supplemental materials with questions that require students to think critically and require students to explain, interpret, and justify so students move beyond procedures. At UVI, the supplemental PLTL Supplemental Curriculum needs revisions to include more conceptual understanding questions, more open-ended or flexible strategy questions, real-world, relevant applications, and questions that asks students to explain or justify their reasoning.

Assessing the Impact of a Robotics Program on Informal STEM Learning

Zhoriarna George

Mentor: Amber McCammon
SEAS Islands Alliance and The Virgin Islands Children's Museum

This research investigates the impact of a Lego robotics and coding workshop program implemented at The Virgin Islands Children's Museum, which aims to enhance informal STREAM (Science, Technology, Reading, Engineering, Arts, and Mathematics) learning through interactive exhibits and programs designed to facilitate family engagement and learning through play. Participants are introduced to physics, engineering, and computer science terminology through practical illustrations to enhance their understanding of key concepts and enhance scientific literacy; they actively engage in hands-on engineering and computer programming activities, applying the scientific method to test, innovate, and enhance their robot constructions. The primary objective of this study is to examine the influence of the robotics program on children's learning outcomes, confidence, and overall interest in STEM fields. The research employs a mixed-methods approach involving quantitative and qualitative data collection and analysis of pre- and post-survey assessments to evaluate achievement in learning, behavioural changes, and emotional responses, as well as participants' likes and dislikes about the program to inform improvements. Preliminary findings indicate that a significant proportion of participants come from public schools, with a notable higher engagement from male students. While the research is ongoing, initial results suggest that the robotics program positively impacts students' STEM learning outcomes, boosting their confidence and interest in STEM subjects. This research highlights the potential of robotics workshops in informal learning settings to support and enrich STEM education, offering valuable hands-on experiences that encourage continued learning and exploration in STEM fields.

Highly Conducting Ionic Smectic Liquid Crystal Elastomer for Possible Battery Application

Aaliah Heart Saret

Mentors: Zakaria Siddiquee & Antal Jakli
Kent State University

Our research group at Kent State University, in collaboration with researchers in Akron University, has recently started studying ionic liquid crystal elastomers (iLCEs) as an electrolyte for solid state lithium-ion batteries due to its high ionic conductivity, chemical stability, and molecular organization [1]. Particularly, the idea of utilizing the parallel molecular alignment of smectic liquid crystal. With its high degree of positional and orientational order, it may allow faster ion transport as the alignment could be effective in serving as direct ion pathways rather than the random mesh regular solid polymer electrolytes form after polymerization. Motivated by this, this research emphasizes on the development of a liquid crystal elastomer that conducts high ionic conductivity in its smectic phase.

Reference(s): [1] Zakaria Siddiquee, Hyunsang Lee, Weinan Xu, Thein Qiu, Antal Jákli, "Ionic Liquid Crystal Elastomer Electrolyte Based Lithium Batteries with Enhanced Ion Transport", to be submitted (2024).

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Characterization of Pathogen-Specific Cytokine and Chemokine Responses in
Peripheral Blood Mononuclear Cells and the Role of Extracellular Vesicles

Akilah Hodge

Mentor: Dr. Elke Bergmann-Leitner
WRAIR

Extracellular vesicles (EVs) are membrane-bound particles containing proteins, nucleic acids, and lipids, found in various bodily fluids, including blood, urine, breast milk, ascites, and cerebrospinal fluid. EVs are categorized into exosomes, microvesicles, and apoptotic bodies (ApoBDs). Exosomes transport cellular proteins, DNA, and RNA, while microvesicles, which bud from the cell membrane, carry receptors, cytokines, chemokines, signaling proteins, lipids, carbohydrates, and genetic material like mRNA and miRNAs. ApoBDs are remnants of apoptotic cells. Toll-like receptors (TLRs), a type of pattern recognition receptor (PRR) found on immune cells (such as dendritic cells, macrophages, natural killer cells, and other antigen-presenting cells) and somatic cells, recognize pathogen-associated molecular patterns (PAMPs) and damage-associated molecular patterns (DAMPs). EVs, once underappreciated in cell-cell communication, have recently gained prominence in cancer and infectious disease research due to their roles in promoting infections, modulating immune responses, and facilitating metastasis. This study aims to elucidate the role of EVs in early immune responses to infections by using a model system with human peripheral blood mononuclear cells (PBMCs) stimulated with PAMPs. These PAMPs bind to PRRs, triggering the secretion of cytokines and chemokines that alert surrounding cells and systemically activate innate immune cells. We hypothesize that understanding the differential secretion of cytokines—whether freely released or packaged in EVs—will reveal immunoregulatory networks and provide insights into immune modulation by different pathogens. To test this hypothesis, cryopreserved PBMCs from five healthy donors will be thawed and cultured with TLR ligands, specifically stimulating TLRs 1-9 for 24 hours. Post-incubation, cells and supernatants will be collected, and EVs isolated. EVs will be analyzed using Nanoparticle Tracking Analysis (NTA), flow cytometry, and mesoscale multiplex assays to assess their size, concentration, and cytokine content. The expected findings are currently uncertain.

Keywords: Extracellular vesicles, cytokines, chemokines, PAMPS, immune response

Protecting the Environment/ The use of Permits for Parks

Hiba Hussein

Mentor: Ms Kristina Edwards
Department of Planning and Natural Resources/SEAS Islands Alliance

While interning at DPNR, we researched ways terrestrial and marine areas can be protected through different codes and regulations part of the Virgin Islands. This research was done through finding online platforms. During my internship, I helped to gather permits that can be utilized for the parks that are already in existence or are being reserved in the Virgin Islands. This research is important because a healthy ecosystem is mandatory for an individual's physical, mental, and emotional well-being. For an ecosystem to be healthy, the environment needs to be protected. This can happen in different ways. For example, mangroves in the VI may have similar work to keep a healthy environment. Mangroves have many roles, but one important role is that they absorb carbon dioxide from the ecosystem to keep the atmosphere clean for one's breathing and health. As individuals we must protect them for the environment to continue to be efficient. As mentioned, a damaged ecosystem can impact an individual's physical, mental, and emotional well-being, but it can also impact one's financial income and status. In the Virgin Islands, income mainly comes from tourists and if our parks, water, forests, sands, etc, are damaged, then slowly but surely tourists will stop coming to the island and the island will slowly begin to lose its monetary value. These two topics are vital to understanding why there is a need to protect our environment and well as gather the necessary permits to control access to these treasured environments.

School-Based Agricultural Education and Dietary Behaviors

Allana Jackson

Mentors: Dr. Sonjia Kenya & Dr. Janis Valmond
University of Miami, Miller School of Medicine

The link between diet and health is well-established, with fruits and vegetables consistently shown to offer numerous health benefits. Despite this, regions such as the U.S. Virgin Islands (USVI) suffer from high rates of poor nutritional knowledge and unhealthy consumption behaviors. The issue is further exacerbated by a fundamental lack of locally available fresh foods, as approximately 97% of all produce is imported. Evidence indicates that dietary habits formed in childhood can influence practices into adolescence and adulthood, highlighting the critical need for early intervention. This research explores whether school-based agricultural education (SBAE) and activities in youth can positively influence dietary behaviors and habits, leading to better health outcomes in adulthood. Employing a cross-sectional survey design, this investigation observes the correlations between participation in SBAE during youth and dietary behaviors in adulthood. The survey instrument collected retrospective data from 16 adult participants regarding their past educational experiences, current health status, and dietary habits. Preliminary findings suggest a potential correlation between SBAE in youth and positive dietary habits in adulthood. These results imply that incorporating SBAE in school curriculums could be a strategic approach to improving long-term health outcomes. Further studies are needed to strengthen the evidence for this relationship and to explore the mechanisms through which SBAE influences dietary behaviors.

Allelopathic effects of *Leucaena leucocephala* litter on germination and growth of four crop plants in the Virgin Islands

SaVaughna D. John-Baptiste

Mentors: David A. Hensley and Nicholas Pichardo
University of the Virgin Islands

In the Virgin Islands, *Leucaena leucocephala* (tan-tan), an invasive tree species, is widespread on farms and often dominates abandoned fields. Previous research has suggested that this tree may release allelopathic chemicals, which could explain its ability to outcompete other vegetation. This study aimed to evaluate the allelopathic effects of tan-tan litter on the germination and growth of four crop plants commonly cultivated in the Virgin Islands. We conducted a randomized complete block design experiment in pots, with split-plot treatments and five replications. The primary treatment involved the application of tan-tan litter, while the secondary treatment included four crop species. We measured germination success, growth rates, and yield, focusing particularly on cowpea and maize. Data were analyzed using linear mixed-effects modeling to assess the impact of tan-tan litter on these crops.
Our findings indicate that the presence of tan-tan litter affected germination rates, with varying effects depending on the crop species. However, in many cases, the additional organic material and nutrients provided by the litter seemed to counterbalance any potential allelopathic effects. These results suggest that while tan-tan litter can influence crop germination and growth, the overall impact may be less detrimental than previously thought. Further research in field conditions is necessary to fully understand the complexities of *L. leucocephala* allelopathy.

What is the best method of capturing fish for acoustic tagging?:
A study in Bonaire

Drake Nemeth

Mentors: Dr. Rick Nemeth, Elizabeth 'Shaun' Kadison, Taylor Hobbs and Caren Eckrich
University of the Virgin Islands

Fish spawning aggregations (FSA) are spectacular, episodic events where hundreds of individuals gather to spawn during specific lunar phases. However, FSA sites are extremely vulnerable to overfishing which can cause the collapse of local fish populations. There are many locations where little is known about FSA sites. Grouper and snapper populations have been largely overfished and under-managed in Bonaire and require improved regulations and protection. The motivation for the study derives from the lack of information on many species in Bonaire including predators (groupers, snappers) and large parrotfish (rainbow, blue, and midnight). The use of acoustic telemetry is an effective way of tracking fish to their spawning aggregations. An acoustic tag was surgically inserted into the body cavity of each fish. Tagged fish will be monitored by acoustic receivers previously anchored around Bonaire to track movement patterns and locate potential FSA's. A variety of techniques were used to catch predators and parrotfish, including hook and line, barrier nets, and night diving with hand nets. We found night diving with hand nets to be the most effective and efficient (catch per unit effort) method of collecting fish compared to barrier nets and hook and line. Preliminary data is presented on species tagged, locations, and fishing methods. This data will hopefully aid in creating protected areas and eventually reviving the local populations

Assessing the gap: medication management, lifestyle interventions, and improved education and support for seniors.

Alonzo L. Moore IV

Mentors: Dr. D. Galiber
University of Miami Miller School of Medicine

Metformin, introduced in the 1950s and now a staple on the World Health Organization's list of essential medicines, is the second most prescribed drug in the United States with over 91 million prescriptions annually. While widely used for managing diabetes and cardiovascular disease. Recent research suggests that the long-term effects of medications like metformin, particularly regarding cardiovascular health, are not fully understood. This study assesses the factors influencing medication management, lifestyle interventions, education, and support for seniors in the US Virgin Islands. The data analysis highlights the benefits and barriers to medication management and lifestyle interventions, informing more nuanced and effective strategies for cardiovascular conditions in the US Virgin Islands.

Assessing Nutritional Education and Weight Management in USVI Youth: Are We Meeting the Mark?

Chaenelle Ravariere

Mentor: Dr. Tess Richards
Cardiovascular Research Empowerment Workforce Program

The United States Virgin Islands (USVI) faces unique challenges in ensuring that its children receive adequate education and resources regarding nutrition and weight management. This research evaluates nutritional education and weight management school programs for youth in the United States Virgin Islands (USVI). With nearly half of high school students in the USVI being overweight or obese and cardiovascular diseases responsible for about 34% of all deaths, addressing these issues is crucial. The study aims to assess the effectiveness of existing educational initiatives and the level of parental involvement. A survey conducted in July 2024 with parents at East End Clinic revealed a significant need for enhanced programs and greater parental engagement. Results indicate that while parents recognize the importance of nutrition and weight management, current efforts are inadequate. The study calls for improved educational strategies and increased parental involvement to better tackle these health challenges. Future research should focus on developing targeted interventions and closing existing gaps in nutrition education.

Examining the Relationship between Sodium Intake and Lifestyle Factors in University Students

Leyonna Ravariere

Mentors: Dr. Stolz & Dr. Carrasquillo
University of the Virgin Islands & CREW

Introduction: Hypertension is a significant concern in the US Virgin Islands (USVI), affecting around 50% of residents and potentially leading to severe cardiovascular disease (CVD). Excessive sodium intake is a known risk factor for hypertension, but research on this issue among university students in the USVI is limited. This project investigates the relationship between sodium intake and various akillifestyle factors among university students aged 18-24, including stress, physical activity, processed food consumption, and family history of hypertension.

Methods: A cross-sectional study was conducted with university students as a class project for educational purposes and not as research. The project collected data on sodium intake, stress levels, physical activity, dietary habits, and family history of hypertension through surveys, including dietary assessment questions. Statistical analyses, including correlation, were used to analyze the data.

Results: The study revealed that 57% of participants use sodium-based seasoning daily, and 60% consume processed foods daily. Furthermore, 81% do not exercise regularly, and the average stress level reported was 5 out of 10. Notably, 57% have a family history of hypertension, and weight categories were distributed as 9 in balanced weight, 6 in high body weight, and 10 in elevated weight.

Conclusion: The findings reveal a link between high sodium intake and adverse lifestyle factors, including processed food consumption, low physical activity, and high stress. This connection indicates an increased hypertension risk among university students in the USVI. Targeted interventions addressing these factors may be crucial for hypertension prevention in this demographic.

Investigating HDAC11 and AR-v7 in Liver Cancer

La'Quan Reid

Mentors: Jenna Clements & Dr Edward Seto, PhD
George Washington University

Liver cancer is a leading cause of cancer-related deaths, accounting for over 800,000 fatalities globally each year 1. Patients often develop resistance to the standard of care, Sorafenib, leading to relapse and patient death 2. Liver cancer is also a male dominant disease1, and recent studies have identified Androgen Receptor (AR) and its splicing variant, AR variant 7 (AR-v7), as drivers of liver carcinogenesis. AR-v7, in prostate cancer, is responsible for drug resistance and poor patient outcome. Previous, unpublished work in our lab has identified SF3B2, the regulator of AR-v7, as a substrate of the protein Histone Deacetylase 11 (HDAC11). Separate work has also established that HDAC11 knockdown sensitizes cells to Sorafenib treatment. Therefore, it was hypothesized that AR-v7 may be a driver of drug resistance in liver cancer as well.

We investigated whether AR-v7 is the link between HDAC11 and liver cancer progression. To test whether HDAC11 effects AR-v7 expression or drug sensitivity, we applied western blotting, cell viability assays, colony formation assays, and an in vivo tumorigenesis model. We also sought to establish HDAC11 KO cells using a CRISPR Cas9 system. Western blotting revealed a cell type-specific response increase or decrease to sorafenib or HDAC11 inhibitor, respectively. By colony formation and cell viability assays, HDAC11 inhibitors had a subtle, but inconsistent, effect on Sorafenib sensitivity, warranting repeat experiments. Taken together, these data indicate that HDAC11 plays a role in liver cancer progression but does not yet clearly tie HDAC11 to Sorafenib resistance.

Analyzing the Role and Genetic Interactions of HSF-1 and Smyd1b in Skeletal Muscle Development of Zebrafish

Maura Monee Richardson

Mentor: Dr. Jim Du
Institute of Marine and Environmental Technology

Our research investigates the genetic and developmental implications of gene mutations in zebrafish (Danio rerio), focusing on the Smyd-1b and HSF-1 genes. These genes are crucial for various physiological processes, including muscle development and heat shock response. We utilized an in-cross breeding strategy of Smyd-1b(+/-) and HSF-1(+/-) zebrafish mutants to produce offspring with varying genetic profiles. We identified the genetic status of individual zebrafish and bred selected mutants through precise genotyping methods to observe their muscle development. Our study aims to elucidate these genes' specific roles in zebrafish development and how their mutations affect overall phenotype and physiological functions. Initial findings indicate significant variations in muscle development and stress response among different genotypes. Specifically, Smyd1b(-/-) mutant embryos showed defective sarcomere organization in skeletal muscles. The muscle defects became more severe in the Smyd-1b(-/-) and HSF-1(-/-) double mutants. These results contribute to a deeper understanding of the genetic mechanisms underlying these processes and offer potential insights into similar genetic conditions in humans. Our research highlights the utility of zebrafish as a model organism for studying gene function and mutation effects, providing a foundation for further investigation into therapeutic approaches for related human mutations and muscle development.

Understanding the Readmittance Rates of Diabetic Patients Through Random Forest

Michael Roberts & Lilian Alexander

Mentor: Dr Aaron Rapp
University of the Virgin Islands

Despite strong evidence supporting the effectiveness of preventive and therapeutic interventions for diabetic patients, inconsistent hospital management often results in poor glycemic control and increased hospital readmissions. Previous research, such as the "Impact of HbA1c Measurement on Hospital Readmission Rates: Analysis of 70,000 Clinical Database Patient Records," used multivariable logistic regression to identify factors affecting readmission. In this study, we apply a Random Forest Classifier to analyze electronic health records (EHR) of diabetic patients, focusing on predicting hospital readmittance within 30 days of discharge. By addressing the models limitations with further research and data analysis it could lead to successful applications of the Random Forest model in EHR systems in the US Virgin Islands, contributing to reduced healthcare costs and improved patient outcomes through enhanced predictive modeling.

Liquid Crystal Patterns to Command Living Matter

Abigail Rose

Mentors: Dr Oleg D. Lavrentovich & Dr Ali Alqarni
Kent State University

In recent years, the study of liquid crystal patterns and their influence on cellular behavior has garnered significant interest, particularly in the fields of active matter and microbiology. This emerging research explores the potential to manipulate the collective behavior of cells within living tissues by utilizing photo-patterned liquid crystal elastomer (LCE) substrates. The innovative approach of combining LCE substrates with cellular systems aims to create controlled environments where cellular alignment and motion can be precisely guided. Initial experiments have successfully demonstrated the patterning and polymerization of LCE substrates, laying the groundwork for subsequent biological studies.

In the next phase of research, living cells such as human dermal fibroblasts (HDF) are seeded onto these LCE substrates. By employing live imaging techniques over a 72-hour period, researchers can observe and analyze tissue alignment and cell movement in real-time. These observations are crucial for understanding how cells interact with their engineered environments. The ultimate goal of this research is to provide valuable insights into the mechanisms that govern cell behavior within living tissues, potentially opening new avenues for advancements in tissue engineering and regenerative medicine. The ability to control cell behavior in such a precise manner could lead to significant breakthroughs in creating engineered tissues for therapeutic applications.

Understanding the Role of Lipases and Lysolipids in Coral Thermal Tolerance

Darnilla Samuel

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Corals are colonial organisms that live in a symbiotic relationship with the dinoflagellates of the family Symbiodiniaceae. Although it is well-documented that rising ocean temperatures disrupt coral-algal symbiosis, several studies have shown that there is a spectrum of thermal tolerance across the coral-reef Symbiodiniaceae. Corals associated with symbionts of the genus *Durusdinium* are more thermally tolerant than those hosting *Cladocopium*. However, the molecular mechanism underlying thermal tolerance in *Durusdinium* symbionts is not well understood. Previous comparison of the metabolomes of coral associated with either *Durusdinium* or *Cladocopium* showed *Durusdinium*-dominant corals having higher abundances of lyso forms of betaine lipids and phospholipids compared to *Cladocopium* corals, which have higher levels of diacyl forms of these lipids. The aim of this research is to determine if there are varied lipase activity between *Durusdinium* and *Cladocopium* hosting corals resulting in a higher ratio of lyso lipids to diacyl lipids in their metabolome. To explore this, 42 tentacle tissue samples of the coral species *Galaxea fasicularis* hosting either algal genus was left at room temperature for 24hrs to allow for lipolysis activity. Samples were collected at different time points and extracted for lipidomic analysis using HPLC-MS/MS mass spectrometry. Pearson's correlation analysis on lipids of interest with time was used to determine if the molecules are changing differently between the two algae. Our data showed higher levels of lyso lipids, and lower levels of diacylglyceride in *Durusdinium*-dominant corals compared to *Cladocopium*-dominant corals and the *Cladocopium*-rich corals increased their lyso lipid abundances through time.

Exploring the Accuracy of YOLOv8 Classification using five classes of fruit

Makayla Todman

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In 2022, Americans consumed 116.21 pounds of fresh fruit per capita. Yet, despite having a population with such a large fruit intake, the labor force in the agricultural sector has steadily declined in the US, leading to a critical shortage of workers. Many stages of produce processing—such as harvesting, exporting, and scanning—can be automated to reduce the workload. The first step to making any of these ideas a reality is determining which algorithm can accurately classify fruit objects without the need for humans. After reviewing several algorithms, I selected the *You Only Look Once Version 8 algorithm* (YOLOv8), a computer vision model with high accuracy and an exceptional ability to detect and segment objects. I hypothesized that, when trained with a large fruit dataset, YOLOv8 will be able to classify fruits with an accuracy of 80% or higher, making it reliable in classifying fruits into five classes: apple, banana, grape, mango, or strawberry. I collected and annotated images for each category and used them to train the model. I then tested the model's accuracy by tasking it with classifying 100 pictures of fruits, using 20 images for each category. The model correctly identified 95 of these images, achieving an overall accuracy of 95% and demonstrating that YOLOv8 has the potential to reliably classify these five categories of fruit on an industrial scale. Based on these preliminary results, future research will seek to characterize and classify objects using Raman spectroscopy and Fourier transform infrared spectroscopy (FTIR) spectral data.

Using Microscopy to Evaluate Antibacterial Drug Activity

Zorah Williams

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Clostridioides difficile (*C. difficile*) is a Gram-positive, anaerobic, spore-forming bacterium that produces toxins and causes diarrhea and colitis. *C. difficile* infects nearly 500,000 people annually in the United States. Current antibiotic treatments cause further disruption to the commensal microbiota, leading to recurrent *C. difficile* infections. These challenges underscore the urgent need for more effective therapies targeting *C. difficile*. In this project, we utilized microscopic visualization to assess drug impacts on *C. difficile*. We compared the effect of two antibiotics (novel Drug A and the glycopeptide vancomycin) on *C. difficile* using phase contrast microscopy and Gram's staining.

We first assessed the effect of vancomycin on *C. difficile* morphology. In a dose-dependent manner, vancomycin-treated cells displayed distortion of their normal rod shape, with rough, punctate morphology. These cells also lost the ability to retain the Gram's stain, and thus appeared Gram-negative. Exposure to Drug A also resulted in a Gram-negative phenotype, suggesting the drug impacted the same aspects as vancomycin. However, phase contrast microscopy of Drug A-treated bacteria revealed normal cell morphology, but significant impact on distribution of intracellular material visualized as irregular phase-dense puncta.

Taken together, our data suggest that both vancomycin and Drug A perturbs *C. difficile*, ultimately impacting cell wall components. However, the mechanism(s) underlying this remodeling are likely unique, since novel Drug A exerts drastic impacts within the cytoplasm. Our study highlights the utility of a cost-effective, simple microscopic approach to rapidly evaluate drug impacts on bacteria and underscores the importance of visual tools for assessing antibiotic activity.

Effect of External Variables on the Density of Juvenile Caribbean Green Sea Turtles (*Chelonia mydas)*

Jordan Wilson

Mentors: Paul Jobsis, Tyler Smith

Over the past decade, green sea turtle numbers have been tracked utilizing weekly swim surveys in Brewers Bay. The number of tagged and untagged sea turtles is counted and recorded for each survey. Data was compiled from 2013 – 2023 to identify the monthly averages of turtles per swimmer per hour. The average turtle counts were compared to the monthly averages of air temperature and atmospheric pressure. A linear regression was run for each of the monthly average comparisons, and no significance was found. Yearly turtle density was graphed to show the variation of the green sea turtle population in Brewers Bay from 2013 – 2023. Seagrass data collected by the MMES program over the past decade was used to compare the yearly changes in turtle density and seagrass density. Though no statistical test was run, similarities in the changes in the yearly densities of turtles and seagrass seem to suggest a relationship. This research helps to elucidate factors potentially affecting the presence of green sea turtles in Brewers Bay and highlights possible avenues for future research.

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