# 24th Annual UVI Student Research Symposium PROGRAM BOOK

Emerging Caribbean Scientists

**September 17, 2023**
**Emerging Caribbean Scientists Program**
**College of Science & Mathematics**
**University of the Virgin Islands**

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STT, USVI

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# Environmental contamination of parasites in urban parks

by **Zorah Williams**, Vy Thao & Gabriela Perales
Mentor: Rojelio Mejia

Baylor College of Medicine, Houston, TX

Environmental contamination with parasites pose a public health risk, especially to people who live in poverty. Some of the most common agents of human infection are *Blastocystis* species and *Enterocytozoon bieneusi* which have previously been identified in the environment as well as in animals which links the cause to zoonotic transmission and ingestion of spores from the environment. Our interest in the correlation between socioeconomic status, parasite prevalence, and human intestinal parasite burden led to our examination of 144 soil samples from 24 parks with playgrounds in the Houston area using a novel molecular method. We collected approximately 300 grams of soil from each park and used MP FastDNA spin kit for sample preparation and DNA extraction, multi-parallel real-time quantitative PCR (qPCR) for DNA Analysis. In the low median income zip code parks, *Enterocytozoon bieneusi* and *Blastocystis species* DNA were detected in 63.6% and 45.5% of parks, respectively. The Spearman correlation showed r = -0.800, p-value = 0.133 between E. bieneusi and income-associated neighborhood. These findings suggest that *Enterocytozoon bieneusi* and *Blastocystis* species are environmental contaminants in public spaces affecting people living within Houston and are associated with the socioeconomic status (SES) of the surrounding population. Further studies will expand more Houston parks and playgrounds, quantifying contamination levels to investigate other parasites, including *Acanthamoeba species, Ascaris lumbricoides, Necator americanus, Ancylostoma duodenale, Strongyloides stercoralis, Trichuris trichiura, Toxocara canis/cati, Cryptosporidium, Giardia intestinalis, Encephalitozoon intestinalis, Cystoisospora belli,* and *Entamoeba histolytica.*

Acknowledgements: Laboratory of Human Parasitology at Baylor College of Medicine and UVI
NIH NIGMS RISE Award Number R25GM061325

# Detecting the mode of chemo-symbiotic bacterial transmission in deep-sea gastropod *Ifremeria nautilei*

by **Tara N. Thompson**, Lauren N. Rice, Caitlin Q. Plowman & Shawn M. Arellano
Mentor: Craig M. Young

Oregon Institute of Marine Biology, University of Oregon, Charleston, OR

Hydrothermal vents at the Lau Back-Arc basin in the western Pacific are dominated by abyssochrysoid gastropods, such as *Ifremeria nautilei*, which rely on chemosynthetic bacteria to meet their metabolic needs. While the chemo-symbiotic associations for this species have been researched, the mode of transmission is unknown. *Ifremeria nautilei* is of special interest due to a modified mucus gland, which broods their unique Waren's larvae until release. Since embryos are exposed to the surrounding environment during transport to the brood pouch, we hypothesized that microbes might enter there, creating the possibility of symbiont acquisition in the early embryonic or larval stage. Using ROV Jason, we sampled snails from five sites in the Lau Back-Arc basin, arrayed along a latitudinal gradient at depths ranging from 1800 to 2700 m. Gonad and brood pouch tissues of *I. nautilei* were fixed at sea, then embedded in Epon resin and sectioned for electron microscopy and semi-thin light microscopy following the cruise. Here, we report preliminary observations that found no evidence of symbiotic bacteria in any section of the gonad ultrastructure or brood pouch, suggesting larvae obtain their symbionts after release from the parent. This research is part of a larger collaborative project that addresses multiple research questions relating to larval development and symbiont distribution along the axis of the Lau Back-Arc basin.

Biography: Tara Thompson is a junior marine biology major at the University of the Virgin Islands. She loves getting involved in my field by working as a peer instructor for the science 100 class, working as a mangrove restoration intern last year, and running the conservation club. She has a special love for all things weird in the marine world, such as the deep-sea and hydrothermal vent animals.

Acknowledgement: NSF Grant #1737382

# Constraining the Duty Cycle of Super Giant Fast X-ray Transients

by **Misael Solano Medina**
Mentor: Dario Carbone

University of the Virgin Islands, St. Thomas

Supergiant Fast X-ray Transients (SFXTs) are a cosmic objects composed of a compact accreting object, usually a neutron star, and a supergiant star companion. Accretion in these systems occurs at a variable rate, concentrated in short outbursts. The objective of our investigation is to constrain the duty cycle (DC) of SFXTs. The DC is the fraction of time the source spends in outburst. To achieve this, we used Monte-Carlo simulations. We simulated a total of $10^5$ sources. We simulated the light curve of each of these sources and then simulated the observations with a real observing campaign. We then calculated the simulated DC and the observed DC and looked for a correlation between the two. So far, no correlation has been found and further research is required. Nonetheless, we established that the value of some parameters that we thought were realistic needed to be modified in order to be consistent with existing observations.

Biography: Misael Solan is an applied math major. He is of Dominican descent and lives in the VI.

Acknowledgements: NASA EPSCoR Seed Grant "Constrainind the Duty Cycle of Supergiant Fast X-Ray Transients with Simulation"

# Three-Year Analysis of Metals and Non-Metals in Drinking Fountains at the University of the Virgin Islands Albert A. Sheen Campus

by **Shimeeka Stanley**
Mentor: Bernard Castillo

University of the Virgin Islands, St. Croix

Drinking water can be contaminated by a variety of sources causing extensive health issues. Because of the Clean Water Act and EPA, Maximum Contaminant Level (MCL) drinking water standards have been set in place to allow a level of contaminants that will cause no health risk. The objective of this project was to collect water samples using HACH kits to determine the concentration of metals (arsenic, copper, and lead) and non-metals (chlorine and nitrate) from different buildings on the UVI AAS campus. The second objective was to analyze trends in the concentrations of these contaminants based on time and location. Our results revealed that during every semester all buildings exceeded the MCL of lead (0.015 mg/L) and nitrate (10.0 mg/L). In terms of copper, three out of four buildings did not go over the MCL (1.3 mg/L), but during other semesters (Fall 2019 and Spring 2021) all buildings did. Chlorine was the only contaminant whose MCL (4.0 mg/L) was not exceeded, and there were no traces of arsenic (0 mg/L) found in drinking fountains. High amounts of copper (1.71 mg/L), lead (4.0 mg/L), and nitrate (79.6 mg/L) were seen in Spring 2021. There were also significant differences in the concentrations of metals and non-metals in drinking fountains recorded from different semesters (copper $p= 0.00017$, lead $p < 0.0001$, and nitrate $p < 0.0001$). Excluding chlorine, drinking fountains within these buildings on the UVI AAS campus have exceeded the EPA's MCL standards for drinking water within multiple semesters, and begin to increase as semesters become more recent.

Acknowledgements: NSF SEAS Islands Alliance and VI EPSCoR

# Evaluating Total Coliform and *Escherichia coli*'s Most Probable Number in Cistern Waters from the US Virgin Islands

By: **Aaliah Heart Saret**, Abigail Rose, and Christina Wiltshire
Mentor: Bernard Castillo II, Ph. D.

University of the Virgin Island, St. Croix

The United States Safe Drinking Water Act of 1974 encompasses drinking water security by implementing protective water standards to ensure the public receives safe drinking water, including from water sources like cisterns and reservoirs. This is vital for places like the US Virgin Islands for efficient water storage in unpredictable weather. One of the most prevalent cistern contaminants is biological contaminants, such as Total Coliform and *Escherichia coli*. Due to private owners being responsible for their cisterns, there is no guarantee that all cistern water in the USVI is free of contaminants. The main objective of this study was to assess the presence of Total Coliform and *E .coli* levels in cistern waters across the USVI. The number of bacterial contaminants is reported as Most Probable Number (MPN). EPA standards recommend zero MPN for Total Coliform in water samples used for drinking. We hypothesized that treated cistern water had little Total Coliform and *E .coli* MPN compared to untreated cisterns. Eighteen (N = 18) cistern water samples were collected and tested in October 2022. Our results showed the mean MPN for treated cisterns is 35.87 for Total Coliform and 0.67 for *E. coli*; For untreated is 652.39 for Total Coliform and 127.78 for *E.coli*. Our data showed no statistical difference between treated and untreated samples for both Total Coliform *($p = 0.3193$)* and *E.coli ($p = 0.2157$)*. For future work, we would like to collect more samples in the territory and compare levels over different months of collection.

Biography: Aaliah Heart Saret is a chemistry major at the University of the Virgin Islands with a fascination in molecular sciences. Ms. Saret continues to be eager for her future endeavors.

Acknowledgements: UVI NIH NIGMS U-RISE Award Number T34GM149392 & NSF Grant No. 1946412

# Creating models of peptides with amino acids, with either sulfur or nitrogen side chains, for binding lanthanide and actinide metal ions

by **Darnilla Samuel**
Mentor: Dr. Stanely Latesky

University of the Virgin Islands, St. Thomas

Lanthanide and Actinide metals are used for the development of heart pacemakers, jet engines, engineering, and nuclear weapons. We aim to find possible complexes with amino acids or small peptides, with either nitrogen or sulfur containing sidechains, for binding Lanthanide and Actinide Metal Ions. Our goal is to look for greener (more eco-friendly) methods to extract and bind metals by using naturally occurring amino acids, in order to reduce the environmental impact on the environment that current methods utilize. We predict that naturally occurring amino acids can be used to prepare peptides that are eco-friendly and can be used to prepare materials that can selectively bind heavy metals, similar but smaller than proteins that are found in plants that isolate metals such as lead and mercury from the soil. We are using a modeling system called Spartan and using Density Functional Theory to create 3D models of amino acid metal complexes that we are going to try and synthesize in the lab. Once synthesized, we will use UV-Vis spectroscopy to determine the binding constants for the ligands.

Biography: Darnilla Samuel is a sophomore studying for a bachelor of acience degree in chemistry at UVI. She is from an island named St. Lucia and she enjoys swimming, TV shows, and reading fictional stories.

Acknowledgement: UVI NIH NIGMS U-RISE Award Number T34GM149392

# EmpowerMIND: Thriving Together with the Dominican Women's Development Center

by **Shringmuti Danata Sams**
Mentor: Ysabel Abreu

Mailman School of Public Health, Columbia University, New York, NY

Mental health disparities are prevalent in society, particularly affecting individuals from marginalized communities. Economic inequality exacerbates these disparities, resulting in significant challenges for those already facing mental health issues. Our proposed initiative aims to bridge this gap by creating support groups that facilitate meaningful conversations and mutual support, thereby enhancing the mental well- being of individuals for small business owners from these marginalized communities. We propose the establishment of support groups focused on addressing mental health issues related to inequity and fostering cultural competency among Columbia University students and other Public Health professionals. By engaging with the community and providing a platform for open dialogue, we can foster personal growth, address economic barriers and stigmas, and improve communication skills.

Biography: Shringmuti Sams is a sophomore at the University of the Virgin Islands studying psychology. Her research interests center around mental health disparities in the Black community, particularly in relation to economic inequality.

# Seasonal Differences in Total Coliform and *Escherichia coli* from Cistern Water in St. Croix, US Virgin Islands

by **Abigail Rose**, Aaliah Heart Saret & Christina Wiltshire
Mentor: Bernard Castillo II, Ph. D.

University of the Virgin Islands, St. Croix

Cistern water often has a high count of bacteria; in most cases, the bacteria found in cisterns are nonpathogenic. The amount of bacteria present may vary due to environmental factors such as seasonal changes or because of the water treatment (or lack of). In this study, cistern water samples were collected and tested for total coliform and *Escherichia coli* (*E. coli*) from different houses across St. Croix in Fall 2022 (N = 18) and retested during Spring 2023 (N = 13). Total coliform and *E. coli* concentrations were reported as MPN (an estimate of the amount of bacteria per unit volume in a sample). We hypothesized if seasonal changes affect the amount of bacteria in cistern water. Our Total coliform data showed that there was no significant statistical difference (p = 0.1707) between the Fall samples (mean MPN of 543.61) when compared to the Spring samples (mean MPN of 128.75). Our *E. coli* data showed that there was no significant statistical difference (p = 0.4527) between the Fall samples (mean MPN of 105.39) when compared to the Spring samples (mean MPN of 8.19). However, the mean of MPN total coliform and *E. coli* was higher in the Fall than in the Spring. Based on our data and analyses, we concluded that seasonal changes might not significantly affect the amount of Total coliform and E. coli in cistern water.

Acknowledgements: UVI NIH NIGMS U-RISE Award Number T34GM149392 & NSF Grant No. 1946412

# Fitness cost associated with phage defense systems in *Vibrio cholerae*

by **Hilary Roberts** & Christopher Waters
Mentor: Jasper Gomez

Michigan State University, East Lansing, MI

*Vibrio cholerae* belongs to the *Vibrio* bacteria family, where certain strains of this bacterium can lead to a severe diarrheal condition known as cholera, while other strains typically result in less severe illnesses. Cholera is a widespread problem in countries with poor sanitation and limited access to safe drinking water. This significant global public health threat affects the treatment of various microbial infections, highlighting the necessity for alternative treatment strategies against antibiotic resistance. One potential approach is the use of bacteriophages, which are viruses that infect and kill bacteria. Phages offer distinct advantages over antibiotics specifically *Vibrio cholerae* and other bacterial illnesses, as they target only the bacteria causing the infection and do not cause harmful side effects. However, we must determine if phage defense systems have a fitness Cost. A fitness cost is the biological disadvantage or reduction in the overall survival of a microorganism. The experiment This research study will evaluate if the absence of a phage defense systems affects *Vibrio cholerae* Fitness. he experiments involved cultivating growth curves for four cultures (CR03, C6706, C6706^lacZ, CR03^lacZ), followed by competition experiments in mixtures (CR03+C6706^lacZ, C6706+CR03^lacZ, CR03+CR03 lacZ, C6706^lacZ), and colony counting. We hypothesize that in the absence of phage, bacteria strains lacking phage defense systems (-) will outcompete bacteria strains with phage defense systems (+) when phages are absent due to fitness cost. If a fitness cost is discovered through this process, additional research and experimentation will determine why there is a cost.

Biography: Hilary A. Roberts is a dedicated junior at the University of the Virgin Islands. Pursuing a biology major on the premed track, Hilary aspires to excel as an obstetrician-gynecologist. With a passion for research, she envisions a path towards an MD-PhD.

Acknowledgements: UVI NIH NIGMS RISE Award Number R25GM061325 & Waters Lab NIH award.

# A Comparative Study of Pre-Test and Post-Test Data on Student Perceptions of Marine Science and Attitudes

by **Maura Monee Richardson**
Mentors: Howard Forbes, Jarvon Stout & Jendahye Antoine

University of the Virgin Islands, St. Thomas

In our comparative study, we explored how marine science lectures and fieldwork affect student attitudes and perceptions of the field. We hypothesized that participating in these activities would significantly change students' views of Marine Science. Marine science education is essential for understanding and safeguarding marine environments. A key factor in students' engagement in science, especially marine science, is their attitudes and perceptions. To investigate this, we employed a mixed-method approach. We collected data from middle and high school students before and after their participation in the 4-week Youth Ocean Explorers (YOE) program. The YOE program covers marine, coastal, and environmental science, alongside resource management and conservation. It offers a holistic learning experience through lectures, collaborative sessions, and hands-on field activities. We assessed students' initial perceptions through a pre-test, followed by instructional interventions. A post-test then measured changes in their attitudes and perceptions. Our analysis revealed significant positive shifts in student attitudes and perceptions. Students displayed increased interest, enthusiasm, and confidence in marine science. This study underscores the potential of instructional interventions and hands-on experiences to positively influence student attitudes. These interventions create an enriched learning environment that enhances engagement and understanding in marine science. Marine science education plays a pivotal role in raising awareness about the vulnerability of marine environments. Our study demonstrates that immersive experiences can positively impact attitudes and perceptions in science education. The YOE program's multifaceted approach notably improved student perceptions and attitudes toward marine science. This study highlights the transformative power of practical education in shaping future marine science enthusiasts and advocates.

Biography: Maura Monee Richardson has a heartfelt ambition to become an aquatic veterinarian and her dream is to contribute to rejuvenating and transforming the world's aquatic realms.

Acknowledgements: NSF INCLUDES SEAS, EPA, CFVI & UVI NIH NIGMS U-RISE Award Number T34GM149392

# Investigating the potential interaction with *ism1* and *itgb1*

by **La'Quan Reid** & Sydney Arlis
Mentors: J. Robert Manak & Douglas W. Houston

University of Iowa, Iowa City, IA

Approximately 1 in every 1,000 babies are born with cleft lip/palate. Cleft lip/palate is a congenital anomaly that occurs when the facial prominences fail to completely fuse, resulting in a gap or clefts in this area. The cells that form the face are derived from a specific population of cells called cranial neural crest cells (CNCCs). During embryonic development, these cells migrate from the borders of the presumptive neural tube and differentiate into facial tissues (Adameyko et al., 20160 Our laboratory identified a gene (isthmin1) that is expressed in neural crest cells and, when deleted, is associated with clefting. Isthmin1 is an adipokine that has been implicated in a diverse array of pathophysiological processes such as cell metabolism, tumorigenesis, angiogenesis, and tissue morphogenesis. Preliminary data from our laboratory suggests that ISM1 is important for craniofacial development through regulation of the migration of CNCCs. Thus far, the exact mechanism that drives this migration is still unknown. A recent study identified integrin subunit Beta 1 (ITGB1) as an ism1 receptor during kidney development but interactions between the two genes, in the context of facial development, has yet to be studied. To investigate this potential interaction, we injected *Xenopus laevis* embryos with low dosage Morpholinos (MO) targeting both ism1, itgb1, or a combination of both. Upon examining mouth shape, we saw evidence of a synergetic interaction between ism1 and itgb1. This suggests that ism1 and itgb1 work in the same pathway to regulate neural crest migration.

Acknowledgements: UVI NIG NIGMS U-RISE Award Number T34GM149392 (L.R.) & NIH grant R01DE021071 (J.R.M.)

Work Cited: Adameyko, I., & Fried, K. (2016). The Nervous System Orchestrates and Integrates Craniofacial Development: A Review. *Frontiers in Physiology*, *7*. https://doi.org/10.3389/fphys.2016.000492

# Locations in the intertidal has a significant impact on the rate of degradation of *Sargassum*

by **Aaliya Warner Rawlins** & Kaitlin Rommelfanger
Mentor: Edwin Cruz- Rivera

University of the Virgin Islands, St. Thomas

The influx of decomposing *Sargassum* on beaches in the Caribbean, poses a threat for in-shore ecosystems, tourism, and human health. To further understand what happens to *Sargassum* during its death cycle and decomposition process, this experiment is designed to separate microbial from detritivore-driven decomposition and determine impact of location in the intertidal on the decomposition rate of *Sargassum*. Two species were collected, *Sargassum fluitans III* and *Sargassum natans VIII*, then distributed in three different locations: in-water, on-shore, and buried, with two exclusion factors, fine and coarse pore litter bags. The mass of each sample was recorded before and after the completion of the experiment. After two weeks, there was no significant effect of decomposition with mesh size. There was significantly more mass lost in shore samples than to the buried and in-water samples ($p<0.05$; Scheirer-Ray-Hare test).

Acknowledgement: NASA MUREP: Climate Change & Golden Tides (P. Jobsis, E. Cruz-Rivera, PIs)

# (LOONS) Development for Charged and Neutral Particles

by **Ryan Querrard**, Aryana Bhattacharyya & Tristan Kidwell
Mentors: Georgia Adair de Nolfo & J. Grant Mitchell

NASA Goddard Space Flight Center, Greenbelt, MD, USA

Energetic radiation including gamma-rays and neutrons come from vast distances of space and impinge on the Earth. This radiation can give rise to issues with electronics onboard satellites, rockets as well as pose serious health risks in future missions with astronauts. Instruments such as the Lunar Out-pOst Neutron Spectrometer (LOONS) use arrays of silicon photomultipliers (SiPMs) to capture scintillation light produced by gamma-rays/neutrons passing through the scintillating material. The group of interns and I have examined multiple scintillating crystals including P-terphenyl, Stilbene, PSD Plastic and Organic Glass with different radioactive materials including Cesium-137, Barium-133, Americium-241, Cobalt-60, Californium-252 and Bismuth-207 using a prototype of the LOONS electronics to compare the pulse shape discrimination (PSD) in addition to the light output reading abilities of each crystal. Out of all the test conducted, the results give us P-terphenyl as the crystal with the best light output and separation between gamma-rays and neutrons. LOONS is also looking for a way to minimize its power and noise. Removing unnecessary SiPMs can reduce the amount of noise and power needed in turn making the new LOONS device more efficient and accurate. The results and updates on the progress made will be addressed.

Acknowledgement: NASA

## Ranger Bot

by **Arbelson Mora**
Mentor: Aaron Rapp

University of the Virgin Islands, St. Thomas

To make our efforts to preserve the environment more effective, we are collaborating with cutting-edge technology and artificial intelligence experts. Monitoring marine ecosystems, with a particular emphasis on the internationally significant Great Barrier Reef, is the primary function of the Ranger Bot, which employs autonomous underwater vehicles (AUVs) and real-time image analysis. Incorporating artificial intelligence into Ranger Bot enables the autonomous recognition of a wide variety of marine organisms, which aligns with the ongoing work to classify marine species in St. Thomas. Similarly, Animal Facial Recognition technology is used in the Wild book. This technology combines machine learning and artificial intelligence to efficiently evaluate photographs of wildlife, which helps identify species and fights against extinction. This combination of autonomous underwater robotics and artificial intelligence has the potential to redefine ecological monitoring and conservation programs, thereby increasing our understanding of marine ecosystems. Our main goal is to create an adaptable system for autonomous wildlife photo analysis that can outperform current techniques and benefit from AI-powered image processing and machine learning. This initiative is essential because it intends to offer researchers and conservationists practical tools to protect ecosystems, which will contribute to preserving biodiversity not just on our islands but elsewhere.

## Essential elements for effective geospatial data science and analytics

by **Arbelson Mora**
Mentor: Marc Boumedine

University of the Virgin Islands, St. Thomas

The integration and interoperability of geospatial data play a crucial role in fully leveraging the potential of geographic information. This study first explores existing strategies and weaknesses. We then review basic algorithms for Geospatial Data Analysis. Finally we introduce an approach that seeks to tackle current obstacles by prioritizing the standardization of data formats, efficient administration of metadata, and fostering collaborative data sharing through a service-oriented architecture. This approach consists of collecting and integrating various geospatial datasets, encompassing land use/cover data and high-resolution satellite images. The datasets mentioned above are utilized as exemplars to underscore the feasibility of the suggested methodology. Using a prototype, we performed basic Geospatial Data analysis using GeoPandas and Shapely. Initial findings and experiments support our effectiveness of the proposed approach. A centralized data registry will significantly reduce the time and resources needed to locate and retrieve pertinent geospatial data. This study also showcases the enhanced efficiency of data exchange and seamless integration with recent geospatial applications such as geospatial data science. Strengthening data integration and interoperability can increase data accessibility and facilitate collaborative decision-making across diverse domains and the broader community.

Biography: Arbelson Mora is a sophomore studying computer science with a minor in mathematics and data science.

Acknowledgements: NSF INCLUDES SEAS (Ranger Bot) & NSF Award # 2219731 (M. Boumedine)

# Using CRISPRi to understand the role of MEF2C in B-cell lymphoblastic leukemia treatment response

by **Alonzo L. Moore IV**
Mentor: Miles Pufall

University of Iowa, Iowa Cita, IA

Glucocorticoids (GCs) are steroid hormones used to treat B-cell acute lymphoblastic leukemia (B-ALL), a disease of immature B cells. GCs work by binding and activating the glucocorticoid receptor (GR), a transcription factor that regulates genes that induce cell death. A functional genomics approach was used to understand how GCs work through GRs to induce cell death. This revealed that Myocyte-specific Enhancer Factor 2c (MEF2C), which is an effector gene that aids in myogenesis, forms a double negative feedback loop with GR: MEF2C restrains GC sensitivity while its expression is repressed by glucocorticoids. We also showed that GR physically interacts with MEF2C in the presence of glucocorticoids. This suggests that MEF2C restrains GC activity by repressing GR function in regulating genes. To test this model, I used CRISPR interference (CRISPRi) to knock down expression of MEF2C. We first generated CRISPRi B-ALL cells by infecting NALM6 cells with Cas9-Zim3. We then cloned two guide RNA (rRNA) expression cassettes into a vector and transfected them into our CRISPRi cells. We confirmed knockdown8i of MEF2C by western blot. Additional testing of MEF2C sensitivity included enhanced GC sensitivity testing using a cell death assay. Testing the sensitivity of a different B-ALL cell line (SUP-B15) to, progesterone, onapristone, drosperinone, medroxyprogesterone acetate, showed responsive GC activity. With these results in B-ALL sensitivity, we will further this study by performing RNA sequencing to measure how MEF2C changes how GCs regulate cell death in B-ALL.

Biography: Alonzo Moore is a junior in the School of Nursing on the UVI Albert A. Sheen Campus. A native Texan, Alonzo has taken found a love for Caribbean culture and looks forward to becoming a contributing partner in the growth and development of St. Croix's health care system.

Acknowledgement: UVI NIH NIGMS U-RISE Award Number T34GM149392

# Temperature and Background Effects on Green Anoles Measured Through Brightness

by **Derek Koon** & Justin Sanclemente
Mentor: Lance Mcbrayer

Georgia Southern University, Statesboro, GA

Color changing abilities in Anoles (*Anolis Carolinensis*) are in response to their environment. These creatures can change from a light green shade to dark brown. In this study, we examined the reason for color change in green anoles at different temperatures and with light and dark backgrounds. To do this, we photographed the backs of the anoles to measure the skin brightness. My team and I surveyed the Georgia Southern University campus and tried to catch as many anoles as we could. We calculated the percentage change in color when using different backgrounds. With our data, we made 3 graphs representing temperature, background, and temp/background which showed no significant difference. A t test was also run, but we failed to reject our hypothesis. The anoles did not display a significant change in appearance. Our results showed that neither temperature nor background caused brightness changes. A potential implication is that color changes in anoles can be used as an indicator of environmental condition in specific habitats.

Acknowledgement: NSF-SCoPES REU at Georgia Southern

# Different Virgin Islands agricultural soils affect water uptake and growth, but not total biomass, of a cover crop

by **SaVaughna D. John-Baptiste**
Mentor: David A. Hensley

University of the Virgin Islands, St. Croix

In the Virgin Islands, water use by crops is a major limiting factor to plant growth. Water use by plants is directly mediated by soil, and the effectiveness of plant water uptake is largely determined by soil properties. To assist farmers and community members to effectively manage limited water resources, we tested four agricultural soils of the Virgin Islands for soil water content and growth of a sunn hemp (*Crotalaria juncea*) cover crop planted in each soil. Using a randomized complete block design with four soil treatments ("Cramer-Victory complex," "Glynn gravelly loam," "Hogensborg clay loam," and "Sion clay"), we measured soil bulk density, water content, sunn hemp growth rates, leaf chlorophyll content, and final aboveground biomass yield. Data was statistically analyzed using a linear mixed-effects model (with a repeated structure where appropriate). Results indicated differences in soil initial bulk density, soil moisture retention, and season-long soil water content. Sunn hemp growth (height) and leaf chlorophyll was also significantly affected by soil treatment, as was final harvest weight before drying (but dried harvest weight was unaffected). The difference in apparent water content of harvested plants (fresh weight minus dry weight) indicates a possible effect of soil on water uptake, especially paired with the different moisture retention properties across the soils we measured. These results may have important implications for agricultural soil management in the Virgin Islands.

Acknowledgement: USDA-NIFA Award #01152019

# The Role of IRF6 in Periderm during Palate Development

by **Akilah Hodge**
Mentor: Brian C. Schutte

Michigan State University, East Lansing, MI

Cleft palate is a birth defect that affects 1 in 1700 babies born in the United States. This congenital disorder is characterized by an opening in the roof of the mouth. This opening occurs during early fetal development when the tissues that form the palate fail to fuse properly. Severity can vary, ranging from a small opening at the back of the palate to a complete separation extending through the entire palate. The developing palate is composed of three cell types, the mesenchymal cells, a single layer of basal epithelial cells and a superficial (outermost) layer of periderm. Previous evidence has linked DNA variation in the Interferon Regulatory Gene 6 (IRF6) with an increased risk of developing cleft palate. During palate development, IRF6 is expressed in the periderm, initially, and then the basal epithelial cells. To identify the unique role of IRF6 in the periderm, we expressed a mutant form of IRF6 specifically in periderm in mouse embryos. We hypothesize that the mutant embryos will have abnormal oral epithelial adhesions between the palatal shelves and the tongue, which may lead to cleft palate. To test this hypothesis, we will perform morphological analysis of coronal section mouse embryo heads (collected on embryonic day 13.5) to screen for abnormal adhesions of oral tissues. To date, I have analyzed eleven embryos and have seen no evidence of abnormal oral adhesions.

Biography: Akilah Hodge is a double major senior undergrad studying biology and psychology. Her future goals are to become a doctor or physician associate with a specialty in cardiology or psychiatry.

Acknowledgements: NIH R01 Award Number DE023575 & UVI NIH U-RISE Award Number T34GM149392

# VIRT Operation Scheduled and Target of Opportunity Observing

by **Dylon Smith,** Kyle Noonan & Kiwanee Smith
Mentor: Brice Orange

The Etelman Observatory is the southernmost and easternmost optical observatory in the United States and research center of University of the Virgin Islands. Designated as VIRT the Virgin Islands Robotic Telescope is a 0.5m f/10 Cassegrain telescope on an equatorial mount fork. It was designed to acquire date from short-term transients such as Gamma Ray Bursts.

Operators typically forgo scheduled observations and start an impromptu observation of the transient events sent as alerts. I was able to engage in different aspects of astronomical research and observatory operational protocol. One goal was to become proficient in the daily operations of the VIRT system. At the end of my research I was able to properly operate VIRT's control systems, run different command piplelines, complete ToO post-processing, and create three-color images from the images collected.

# Looking for astronomical transients with the Etelman Observatory

by **Rickila Hanley**
Mentor: Dario Carbone

University of the Virgin Islands, St. Thomas

The study of transient sources is a key aspect of an astronomical study. Transient sources can appear, disappear, or change in brightness. Astronomical transients are sources which are only visible for a short period of time. These sources are produced by the most intense and energetic events in the Universe such as stellar explosions. In this research, we measured the transient rate in order to investigate the origin of transients. I obtained over 1000 astronomical images of the same part of the sky from the Etelman observatory in St. Thomas. I calibrated my dataset and extracted information in order to create a light curve for each source. Finally, I inspected these light curves to identify transient candidates. I was able to identify two possible candidate sources in my dataset.

Biography: Rickila Hanley is a senior at the University of the Virgin Islands in pursuit of an undergraduate degree in physics with an engineering concentration.

Acknowledgment: NASA MIRO 6-R grant

# University of the Virgin Islands Gamma-Ray Satellite for Astrophysical Transients

by **Tamia Grant**, Asimian Edmead & Malvern Williams
Mentor: Dr. David Morris

University of the Virgin Islands, St. Thomas

Gamma-ray bursts are powerful explosions that occur in our universe. These bursts are the most energetic forms of light and can last anywhere from a few milliseconds to several minutes, shine hundreds of times brighter than a typical supernova, and are about a million trillion times as bright as the sun. Short Gamma-ray bursts originate from colliding neutron stars whereas Long Gamma-ray bursts originate from a very large star (usually at least 20 times bigger than the sun) that collapses at the end of its life. Gamma Ray Bursts are important for different areas of astrophysics such as stellar evolution and expansion as well as understanding intergalactic material. Gamma-ray bursts have only been detected in distant galaxies. However, it is possible for one to occur in our galaxy the Milky Way. If this were to happen near Earth, it would strip our planet's protective ozone layer away and expose all life to deadly ultraviolet radiation. The University of the Virgin Islands Gamma-Ray Burst Satellite for Astrophysical Transients (UVI-GRSAT) is intended to evaluate and test the effectiveness of a small, inexpensive CubeSat for GRB detection. The UVI-GRSAT will detect GRBs and send information about these GRBs in real time to the ground station where we will be able to distinguish long and short GRBs using spectral and timing data collected. We hope that our research will answer a few fundamental questions such as: what the nature of GRBs is, what is their true rate throughout the history of the universe, and whether it is feasible to replace the astronomical community's gamma-ray transient detection capability with small inexpensive cube satellites as opposed to multimillion-dollar satellites used today.

Biography: Tamia Grant is a senior majoring in chemistry and physics with a concentration in engineering and minors in mathematics and computational science. She hopes to one day become a systems engineer with a specialty in engineering management.

Acknowledgement: NASA MIRO 6-R grant University Nanosatellite Program (UNP)

# Using Drones to Collect Scientific Data

by **Adriel Granger** & Darren Paul
Mentor: Michael Henry

University of the Virgin Islands, St. Croix

Drones are unmanned aircraft systems that are designed to be remotely controlled using software flight plans. Although drones are commonly associated with the military; they have become increasingly useful in various civilian roles such as search and rescue, surveillance, traffic & weather monitoring, videography, and agriculture. We investigated whether a drone could carry out the task of collecting water samples in areas that are difficult to access because of terrain or toxicity. We modified a multi-rotor drone with lightweight materials so that it could land in water. After this was completed, we designed and attached a small cup to collect water samples. After several designs, we conducted our real-life mission. We found that the drone was able to successfully land on water and collect the water sample without any issues. Therefore, it can be concluded that the drone was capable enough to collect water samples from a challenging area. We are exploring other data sample collections using a drone.

Acknowledgements: NASA EPSCoR and MIRO

# Are We Consuming Mercury?

by **Jamila George**
Mentor: Michael Henry

University of the Virgin Islands, St. Croix

This research sought to determine whether the food that we consume contains levels of mercury similar to what is in the soil in which they grew. It is evident that although the soil may not have high levels of mercury the fruits that are produced from the trees planted in those soils especially that of the taller trees contained higher levels of mercury. The fruits and vegetables were prepared in similar ways as how they are locally prepared for consumption. Future research will be conducted to determine the cause of our findings.

Biography: Jamila George is a rising senior here at the University of the Virgin Islands. She is completing studies to gain an AS in physics and a BS in chemistry.

Acknowledgement: NASA MIRO Grant

# Modeling marine population connectivity

by **Melissa Ferreras** & **Lilian Alexander**
Mentor: Robert Stolz

University of the Virgin Islands, St. Thomas

The distribution of individuals within marine populations holds significant importance for the dynamics of meta-populations, population persistence, and species. Understanding this connectivity between distant populations is crucial to their conservation and management. For many marine species, population connectivity is essentially governed by ocean currents carrying larvae and juveniles across distant habitat areas. We used a Eulerian advection-diffusion method to model the dispersal of coral larvae between reefs throughout the St.Thomas-St.John region. We showed how this connectivity can be analyzed using a graph-theoretic approach. Analyzing the patterns common pathways will be discovered. This can highlight regions to prioritize for the conservation of marine species.

Acknowledgement: UVI SURP

# Electrophysiology recordings from octopus arms to understand sensorimotor circuits

by **Danesha Derima** & Autumn McLane-Svoboda
Mentor: Galit Pelled

Michigan State University, East Lansing, MI

Neuronal networks in the brain called sensorimotor circuits mediate the interplay between sensory inputs and motor outputs. Damage to the sensorimotor circuits can be caused by traumatic brain injuries, neurodegenerative disease, and even birth defects, which can lead to impairment in movement and sensations. We aim to fill in the knowledge gap in sensorimotor processing and controlled movements by studying neurocircuits in octopus arms to further the advancement of artificial limbs. Octopuses have a highly developed nervous system with 500 million neurons in their brain and arms, which have exceptional flexibility that allows them to bend or rotate their arms in different directions. Sensorimotor circuits control movement through an intricate mechanism, enabling people to interact with their surroundings and accomplish motor objectives. We hypothesize that there are specific patterns in processing for sensory stimulations and movements. Neurophysiology data will be collected from the Octopus bimaculoides by extracellular electrophysiology. We will also be slicing and staining octopus tissue to determine the location of neurons and where the electrodes are recording from. For our statistical analysis, the signal analysis program of Plexon will analyze the frequency, latency, and duration of each reaction after each stimulation. We have found some patterns in activity after stimulation in the sensory motor circuits, the right cord pinch had the most activity after stimulation.

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# Determining Whether a Lateral Entorhinal Cortex Neuronal Pathway is Activated by Valanced Contextual Associations

by **Brenique Dawson**
Mentors: Andrew Eagle & A.J Robinson

Michigan State University, East Lansing, MI

Motivation regulates a variety of evolutionarily conserved behaviors, including feeding, drinking, sex, and social behavior, which is critical for the survival of species. Various cortical and subcortical brain regions drive it. The nucleus accumbens (NAc) is critical for motivated behavior and receives excitatory projections from various cortical and subcortical regions. These excitatory inputs are critical for motivation and regulate different aspects of motivation. The lateral entorhinal cortex (LEC) is a cortical brain region important in associative memory. Within this region, a subpopulation of LEC neurons sends axonal projections that synapse onto NAc medium spiny neurons (LEC-NAc). However, the role of these LEC-NAc neurons has never been investigated. We have preliminary evidence that LEC-NAc neurons are necessary for encoding context and positive (cocaine) and negative (foot shock) stimuli, suggesting that LEC-NAc neurons are essential in associative memory of contexts and balanced stimuli that may occur in such contexts. This study will investigate whether LEC-NAc neurons are activated by the association of contexts with positive and negative stimuli across two experiments. We hypothesized that contextual fear conditioning would enhance c-fos expression in GFP-labeled LEC-NAc neurons, implying that foot shock-context conditioning activates LEC-NAc neurons. The findings of this study seek to bolster our prior findings that LEC-NAc neurons are essential in the associative memory encoding of a context and a balanced (positive or negative) stimulus. Furthermore, this study will identify the role of a novel brain circuit that may be critical for memories that underlie the motivation to seek out positive outcomes and avoid negative outcomes.

Biography: Brenique Dawson is a junior at the University of the Virgin Islands, majoring in physics and chemistry.

Acknowledgement: UVI NIH U-RISE Award Number T34GM149392

# Does Interferon Regulatory Factor 6 impact the presence of the periderm?

by **Mia Bruno** & Lindsey Rhea
Mentor: Martine Dunnwald

University of Iowa, Iowa City, IA

Interferon Regulatory Factor 6 (*Irf6*) is a transcription factor that is strongly expressed in epidermal cells and is thought to play a role in the development of a significant layer of embryonic skin- the periderm. Based on previous studies involving murine embryos, it is known that *Irf6* mutations lead to abnormal cutaneous, limb, and orofacial phenotypes. Murine models that lack *Irf6* do not survive following birth due to severe skin and orofacial defects. Here we investigated the earliest time point at which visible differences can be observed between wildtype and *Irf6* null (mutant) embryos, if there is a periderm in the absence of *Irf6*, or if there is a "periderm-like" structure in mutants with markers that differ from that of wildtypes. To address these questions, we harvested wildtype and mutant embryos from embryonic day (E) 9.5 to E14.5, generated sagittal sections, conducted hematoxylin and eosin and immunofluorescence stainings, and imaged selected sections. Knocking out *Irf6* resulted in mutants that displayed a poorly organized epidermis, and external abnormalities like shorter limbs, non-visible digits, and kinked tails starting at E12.5 when compared to wildtypes. Immunofluorescence staining conducted on E12.5 embryos showed the presence of occasional Keratin-17 positive cells, a marker of the periderm, in wild-type but not in mutant embryos, despite the presence of areas of stratification. Collectively, these findings suggest that *Irf6*-associated defects are visible at the same time point the periderm cells are covering the embryo (E12.5). Further investigation will include additional periderm markers and later embryonic developmental time points.

Acknowledgement: UVI NIH U-RISE Award Number T34GM149392

# What is the effect of a health empowerment program on participants' blood pressure, glucose levels, and cholesterol levels?

by **Annadelle Brown**
Mentor: Dr. Noreen Michael

University of the Virgin Islands, St. Thomas

To live a healthy life, we must care for our health. In the USVI, most of the population is black. Blacks are known to be at high risk for cardiovascular and cerebrovascular diseases. The Health Empowerment Program (HEP) is an intervention program implemented on St. Thomas and St. Croix that aims to find and educate those at high risk of cardiovascular cerebrovascular diseases by providing gardening sessions, exercise sessions, information sessions, and goal-setting sessions. The goal is to help those at high risk avoid or manage cardiovascular and cerebrovascular diseases through the Health Empowerment Program. Will there be a noticeable effect on the participants' blood pressure, glucose levels, and cholesterol levels? Upon enrollment, baseline biometric measurement of each participant's blood pressure, glucose level, and cholesterol level. Subsequently, starting with the second session, and every session thereafter, biometric data were collected for all participants in attendance. Weekly biometric data collected included blood pressure and glucose levels. The cholesterol levels were again taken at the midway point of the program and will be taken again at the end of the program. The current glucose level average is 185.4, 44.4 higher than the baseline average of 141. The current cholesterol levels average is 85.5, 11.1 lower than the baseline average of 96.6. The current blood pressure average is 133/73, which is a little higher than the baseline average of 127/74. The most recent measurements taken show that the HEP is not having a noticeable effect on the levels. All results are preliminary due to the intervention program not having been concluded yet.

Acknowledgements: Caribbean Exploratory Research Center (CERC) & UVI NIH U-RISE Award Number T34GM149392

# Decomposing Sargassum Affects pH, Turbidity, and Dissolved Oxygen in Seawater

by **Waniya Baig** & Kaitlin Rommelfanger
Mentor: Edwin Cruz-Rivera

University of the Virgin Islands, St. Thomas

Since 2011, abundant amounts of *Sargassum* have been piling on Caribbean shores, decomposing, and negatively impacting the marine ecosystem and tourism. This experiment observed the impact of fresh versus dried *Sargassum* on seawater quality. We hypothesized that fresh decomposing *Sargassum* would affect the pH, turbidity, and dissolved oxygen in seawater more than dried *Sargassum* because fresh *Sargassum* has more nutrients. In this experiment, we collected three *Sargassum* types (*S. fluitans*, *S. natans* 1, and *S. natans* 8), then placed the fresh and dried treatments in six jars with seawater for 2 weeks. We measured the pH, turbidity, and dissolved oxygen levels in each jar every 3 days. Data from day 1 and 13 were analyzed using a Kruskal-Wallis statistical test. On day 1, the fresh treatments had significantly higher pH and dissolved oxygen levels than the dried treatments, but significantly lower turbidity levels ($p<0.05$). On the last day, the fresh treatments had significantly higher turbidity levels from the control and dried treatments. Dissolved oxygen levels of fresh treatments were significantly lower than the control treatments, but there was no significant difference between the dissolved oxygen of the dried and control treatments ($p<0.05$). In conclusion, dried *Sargassum* has less impact on water quality than fresh *Sargassum*.

Acknowledgement: NASA MUREP Climate and Golden Tides

# Analyzing Gene Expression Pathways in Alzheimer's Patients

by **Calida Ambrose**
Mentor: Lavida Rogers

Alzheimer's Disease is a neurodegenerative disease and a major concern in the healthcare field due to its growing prevalence and the fact that it is hard to diagnose and treat. The disease affects millions of adults, with most patients over 75. The exact cause of Alzheimer's is not well-known either, so there is a lack of preventative methods for the disease. However, it is known that variation in gene expression is involved in the development of Alzheimer's Disease. It is also known that age and sex are two of the biggest risk factors for Alzheimer's Disease. Determining exactly which genetic variants and other factors play a role in the development of Alzheimer's can help with prevention, diagnosis, and treatment of the disease.

In 2019, Brooks and Mias discovered that that genes involved in mitochondrial function were under-expressed in Alzheimer's patients, while genes that are associated with the beta-amyloid plaque buildup and tau tangles are over-expressed in Alzheimer's patients. Wanting to build on these findings, the objective for this research project was to identify genes and pathways affected by disease state, age, and sex in Alzheimer's patients using RNA sequencing expression data.

GEO Database was used to curate expression data that was collected by high throughput sequencing on Alzheimer's patients and healthy controls. A total of 198 datasets were used to collect data from. Next, the datasets were filtered, and 67 demographic files were created for datasets that include age, sex, and disease state for each sample. Next, data will be analyzed to determine which genes are differentially expressed due to age, sex, and disease state as well as what roles and pathways they are associated with.

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