Fourteenth Annual

Summer Student Research Symposium

July 29th, 2016
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Sports & Fitness Center
University of the Virgin Islands

14th Annual Summer
Student Research Symposium
Abstract Book

Friday, July 29th, 2016
Sports & Fitness Center
St. Thomas Campus
University of the Virgin Islands

Event Organized by

Emerging Caribbean Scientists Programs
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The **Emerging Caribbean Scientists Programs** increase research training and promote excellence for STEM (science, technology, engineering, and mathematics), psychology, and nursing students at the University of the Virgin Islands.

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Determining Lipid Content

Shabree Anthony
Mentor(s): Dr. Edwin Cruz-Rivera
University of the Virgin Islands

Lipid quantification is critical for understanding phenomena as different as the choices of consumers, the potential of algae for biofuels, health disparities related to obesity, and the onset of multiple diseases. This research aims to determine the most accurate method to measure lipid content on algal and plant material by comparing three widely used methods: 1) the gravimetric method of Folch et al. (1957), 2) the colorimetric vanillin method, and 3) the colorimetric charring method. These methods will be used to quantify predetermined amounts of purified commercially-available lipids, lipid content of field-collected algae and plants, and lipid content of edible market-bought seaweed, for which results can be compared to label nutritional specifications. Algae/ plants from St. Thomas will represent all major eukaryotic algal groups: *Ulva fasciata*, *Acanthophora spicifera*, *Sargassum polyceratium*, *Padina gymnospora* and *Halophila stipulacea*. It is predicted that the vanillin method will allow for better elucidation of lipids because it allows quantification over a very wide range of lipid amounts.

Hydrophilic Antioxidant Activity in Parent and Hybrid Strains of Sorrel (*Hibiscus sabdariffa*)

Anayah Ferris
Mentor(s): Bernard Castillo II, Ph.D.
University of the Virgin Islands

Antioxidants are substances that protect cells against damage from oxidizing molecules, known as free radicals. Antioxidant activity also appears to be important to disease prevention. Sorrel (*Hibiscus sabdariffa*) is grown in tropical regions, and known widely for its nutritional value and being a source of antioxidants. The University of the Virgin Islands (UVI) Biotechnology and Agroforestry Program grows and crosses sorrel lines in an attempt to study various functional properties, but there is no information on how the antioxidant activity of sorrel differs among parent and hybrid varieties. The objectives of this study were to determine and compare the Hydrophilic Antioxidant Activity (HAA) in parent and hybrid daughter strains of sorrel. We hypothesized that (1) the hybrid strains will have a higher HAA than the parent strains and (2) the hybrid strains will have a higher HAA in both the fresh and dried sorrel samples. Fresh and oven-dried samples of three different sorrel varieties were used in this study: TTB (parent), KDN (parent), [(KDN x TTB) x TTB)] F5 (hybrid). All strains were grown at the UVI, Albert Sheen Campus. Hydrophilic antioxidants from these samples were extracted in an aqueous ph = 7 phosphate buffer solution. The ABTS/H_2O_2/HRP decoloration method was used to measure the antioxidant activity. The samples were monitored at 730 nm in a UV-VIS Spectrophotometer over a course of 5 minutes. HAA was expressed as μmol of Trolox equivalent per grams of dry weight (μmol TE/ g DW). It was observed that the dried samples of all sorrel varieties had significantly higher antioxidant activity than the fresh samples. Furthermore, the HAA for the fresh [(KDN x TTB) x TTB)] F5 was in between that of the fresh parent samples. TTB had the highest HAA for the fresh samples (1487.12 μmol TE/ g DW) and KDN had the lowest (355.09 μmol TE/ g DW). [(KDN x TTB) x TTB)] F5 had the highest HAA for the dry samples (32162.67 μmol TE/ g DW) and KDN had the lowest (999.28 μmol TE/ g DW).

The Nature Of Solar Atmospheric Bright Points

Ulric Baptiste Jr.
Mentor(s): Dr. Norton B. Orange
University of the Virgin Islands

Continuous research and data collection of the solar atmospheric phenomena that occurs on the Sun will improve our understanding to many outstanding solar physics questions. Our project focused on the ubiquitous solar atmospheric transient events referred to as bright points (BPs). These phenomena are useful for understanding magnetic reconnection, plasma acceleration, heating processes, etc. Utilizing the Solar Informatics Network Via Temporally Uncovered Sources (SINVICTUS) and six years' worth of observational data , just around of these BP's were analyzed from spectroscopic and narrowband observations provided by the Extreme Ultraviolet Imaging Spectrometer (EIS) and Atmospheric Imaging Assembly (AIA), respectively. Large number statistics that emphasized our BPs diverse temperature and plasma conditions, were derived. These results presented evidence in favor of self-similar plasma heating, across large temperature gradients as expected by the nanoflare model. Thereby, our work has enhanced our understanding to the role of multi-scaled self-similar heating of solar atmospheric plasmas particularly in the presence of dynamic small-scale transients, while further contributing to the growing evidence of its possible functional dependence on thermodynamic conditions.

Creating Low-Earth Orbit Pressure

Markeith Cornwall
Mentor(s): Dr. David Morris
University of the Virgin Islands

Pressure in space differs from that on Earth, and because of this, molecules behave differently. We have demonstrated the ability to achieve space-like pressure conditions in the laboratory through use of a high-vacuum chamber. Our ultimate goal is to construct a high-vacuum chamber capable of reaching pressures $< 1 \times 10^{-6}$ mbar (one billionth of an atmosphere). This work describes the construction and preliminary testing of UVI's high-vacuum chamber. Our tests of incrementally more complex vacuum chamber configurations have demonstrated our ability to achieve pressures $< 1 \times 10^{-6}$ mbar. We also use our pump-down data to predict the ultimate pressure achievable as a function of time and discuss potential techniques that might be used to accelerate the pumping rate.

Honeypots: Enhancing Network Security by Gathering New Insights Into the Mind of a Hacker.

Israel Dennie and Donus Thomas
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University of the Virgin Islands

The world is becoming increasingly dependent on interconnected computerized devices. A wide range of task including casual communications, medical care, the operation of power grids, as well as the transfer of sensitive financial information, have all become heavily reliant on computers and computer networks. As new technologies emerge so do threats and vulnerabilities, which many individuals and organizations have become proficient at exploiting. Conventional security schemes such as anti-virus software and firewalls are somewhat effective at defending computers and computer networks from these cyber threats, but do not deliver much, if any, useful information about the threats themselves. Additionally, anti-virus software is ineffective against newly developed malware, as well as network hackers.

To complement anti-virus software and firewalls, network administrators have turned to Honeypots. Honeypots can distract, delay, and even deter attackers who wish to target production systems (the live computer networks we rely on daily). Furthermore, Honeypots can alert network administrators of attacks in the earlier "non-lethal" stages of a network intrusion attempt. Honeypots also enable network administrators and researchers to gather valuable information about attackers which they can then analyze to better prepare themselves to react to future threats, as well as to fix possible vulnerabilities in their networks. Internet Protocol addresses, location, tools utilized, methods, and motives are just a few examples of the information which can be gathered using Honeypots.

This research will focus on the potential threats that the University of the Virgin Islands' (UVI) computer network is facing. In order to monitor possible cyber attacks against UVI's network, several honeypots will be deployed on the network, utilizing cost efficient, credit card-sized computers known as Raspberry Pis. This study will utilize both low interaction and medium interaction honeypots, such as Dionaea and Kippo, to monitor various network based attacks. It is expected that this research will show that Raspberry Pis are a cost effective sensor to deploy in order to monitor the network. Furthermore, it is expected that this study will confirm that UVI's network is being explicitly targeted by hackers.

Wireless Security: Simulation of Network Jamming

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Mentor(s): Dr. Marc Boumedine[1] and Dr. Michel Kinsy[2]

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Jamming attacks block normal communication by generated interference in networks. Jamming is classified as a subset of denial of service (DoS) attacks. In order to study and understand this problem, we survey jamming techniques used fin wireless networks. Jamming devices are simple to make but illegal for civilian use. Only authorized government agencies can deploy them. Since the aim of the research project is to investigate how they work and how we can combat against them, we will design our experiments using the OMNET++ simulator. OMNET++ offers a set of C++ libraries that allow programmers to deploy a wide range of communication devices as well as their functionality.

Jammers operate by sending large packets of information in a way that floods the communicating devices and make them inoperable. To simulate a jamming process, we design three experiments and implement the first two under this research activity. The first experiment shows how two devices communicate without interference. The second experiment demonstrates how the jammer blocks packets. The last experiment combines the first two experiments to illustrate the inability of two devices to effectively communicate once the jammer is activated. Based on these experiments, we are able to characterize out how real jammers work, the components that carry out different tasks, and how to defend against a jammer.

Total Antioxidant Activity in Virgin Islands Plants

Torhera Durand
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Antioxidants have been portrayed as substances that are greatly beneficial to human health and are widely used in a number of cosmetic and nutritional products. Antioxidants work to quench the formation of free radicals, thus, preventing cellular oxidation and the formation of certain illnesses like cancers, degenerative and cognitive illnesses, and the effects of aging. In nature, antioxidants can be found in a number of products, including, but not limited to, fruits, vegetables, and herbs. The purpose of our research was to determine the Total Antioxidant Activity in locally grown Virgin Islands plants (St. Croix, USVI) and to determine which plant had the highest Total Antioxidant Activity. Total Antioxidant Activity can be obtained from the Hydrophilic Antioxidant Activity (HAA) and the Lipophilic Antioxidant Activity (LAA). We hypothesized that for each of the plants tested the HAA would be significantly greater than that of the LAA. Six locally grown plants were tested, *Laurus nobilis* (Bayleaf), *Moringa oleifera* (Moringa), *Carica papaya* (Papaya), *Cymbopogon citratus* (Lemon Grass), *Capsicum anuum* (Bell Pepper) and *Plectranthus amboinicus* (French Thyme). The antioxidant compounds for all six plants were extracted in aqueous and organic solutions for the HAA and the LAA, respectively. The antioxidant activities were measured using the ABTS/H_2O_2/HRP decoloration method using a UV-Visible Spectrophotometer at a wavelength of 730 nm for 5 minutes. The resulting antioxidant activities were expressed as (µmole Trolox Equivalent per gram dry weight). For all of the plants tested the HAA was generally higher than the LAA. *Laurus nobilis* (Bayleaf) had the highest Total Antioxidant activity (504.02 ± 36.17 µmole Trolox Equivalent per gram dry weight) while *Plectranthus amboinicus* (French Thyme) had the lowest Total Antioxidant Activity (31.86 ± 5.34 µmole Trolox Equivalent per gram dry weight).

Clustering Malware: Towards Extracting Features Using Hashes

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Malware produce ongoing dangerous security and privacy problems for users and industries. Due to the large volume of malware created, anti-virus and anti-malware programs are inefficient for identifying most recent attacks. It is important to create malware analysis tools in order to defend against these threats. In order to have a better understanding of malware, we developed clustering data mining techniques to group malware based on their attributes. In order to perform our experiments, we needed a safe virtual environment such as VMware. We extracted hash features from both normal and unsafe programs with GTKHash. Three types of hashes were selected: MD5, SHA1, and SHA256. We then collected malware hashes from reliable sites such as virusshare.com and checked the hashes on virustotal.com in order to determine the types of malware. We also selected 20 trojans and 11 adware. The hashes of 20 trojans, 20 normal (safe) programs, and 11 adware were analyzed with Weka K-means algorithm in order to cluster programs based on hashes features. The K-means algorithm did not grouped the programs as expected. The main reason is that K-means algorithm requires numerical features in order to cluster objects in groups, and the hashes were a mix of numbers and letters. The next step will be to extract numerical features from program hashes so the clustering algorithm could group the malware in meaningful categories.

Comparing Data from Telescopic X-Ray Instruments: Can We Trust All Satellites?

Alexander Fortenberry and Quianah T. Joyce
Mentor(s): Dr. Bruce Gendre
University of the Virgin Islands

In astronomy and astrophysics, x-ray emissions from cosmic entities aid in revealing what type of sources they emanate from. Swift, NASA's latest x-ray satellite, has not been operating at its intended configurations. The satellite is experiencing difficulties maintaining a stable temperature in its charge capture device. This research intends to determine if this complication causes discrepancies in Swift's collected data by using gamma-ray burst data. Gamma-ray bursts are excellent comparison candidates due to their brightness and fluctuations. We compared archived data of GRB 130427A and GRB 090423A from Swift and the European Space Agency's XMM-Newton observatory. Next, we reduced the data and produced the respective spectra. We then analyzed and compared the spectra to one another to find any discrepancies. We have determined, based on data analysis of the spectra, that Swift is working properly despite the cooling malfunction.

Comparison of Fluorescence Spectra of Toxic and Non-toxic Fish

Jamisha Francis
Mentor(s): Paul Jobsis, Ph. D.
University of the Virgin Islands

Ciguatera fish poisoning (CFP) is the most common marine non-bacterial food poisoning in the world. CFP is the most common food poison in the Virgin Islands, with about 3 of every 1,000 people poisoned. CFP in the Virgin Islands is caused by the consumption of local reef fish that have consumed other fishes with the toxin present. Small fish consume the micro algae dinoflagellate *Gambeirdiscus toxicus* species that is the known to produce the ciguatoxin (CTX) in its cells. CTX is known to bio-accumulate, the concentration increases as it continues up the food chain; top predator fishes have the highest concentrations. However, sharks are the exception, apparently sharks have enzymes that can break down the CTX. Prior studies showed that CTX is composed of a long chain of cyclic molecules. Cyclic molecules usually fluoresce; this led us to attempt to measure the fluorescence spectrometer of fish to look at differences between toxic and non-toxic fish spectra. Fish samples were mashed with water at a 2:1 ratio with a mortar and pestle. 3 mL of in situ fish samples were placed in Cary fluorescence spectrometer for analysis. Emission spectra were scanned using a 5 nm slit width from 400 to 620 wavelength range. Files were saved using comma separated values (CSV) and exported to excel to analyze and compare data. We found there is a possibility that fluorescence spectrometers could be used to identify CTX poison. This was not a definitive study. Future work has to be done. Collaboration with other ciguatera researchers and additional fish samples could be used to further study if our findings correlate with the lab test.

Parrotfish (*Scarus iserti*) Herbivory Towards Invasive Sea Grass (*Halophila stipulacea*)

Cequoyah A. George
Mentor(s): Dr. Teresa Turner
University of the Virgin Islands

Invasive species can be as a threat to its new environment and with *Halophila stipulacea* being a new invasive species to the Caribbean Sea, the possibility of its threats to the native marine life and ways to control its rapid growth are in question. Being that *Scarus iserti* parrot fish are common herbivores in the Caribbean, I tested the hypothesis that this species could be used as a biocontrol for this invasive sea grass. In a multi-choice feeding experiment juvenile parrotfish were collected then separated into ten individual containers where they were exposed to two previously weighed amounts of the native sea grasses, *Syringodium filiforme* and *Thalassia testudinum,* and a previously weighed amount of the invasive sea grass, *Halophilia stipulacea* for a 24 h time period in order to determine the parrotfish food preferences. This experiment resulted in the native sea grass, *Syringodium filiforme* being the preferred by the parrotfish in comparison to *Halophilia stipulacea* and *Thalassia testudinum.* In a no-choice experiment the fish were fed either the invasive sea grass or the most preferred native sea grass from the first experiment (*Syringodium filiforme*). Results from this experiment showed significantly that the native sea grass, *Syringodium filiforme* was eaten at a higher rate although the fish that were exposed to the invasive sea grass, *Halophilia stipulacea,* did eat a some of it. Thus, the parrotfish, *Scarus iserti,* could control *Halophilia stipulacea* only without the presence of the *Syringodium filiforme.* In future studies habitat preferences for this fish should also be studied in addition to the difference in feeding preferences for that of juvenile fish in comparison to full grown adults.

The Effects of the Invasive Seagrass *Halophila stipulacea* on The West Indian Sea Egg (*Tripneustes ventricosus*)

Kyle Jerris
Mentor(s): Dr. Teresa Turner
University of the Virgin Islands

The West Indian Sea Egg (*Tripneustes ventricosus*) is one of the most prominent grazers on Caribbean seagrass beds. On some Caribbean islands such Martinique and St. Lucia, there is a commercial fishery for it. Because Caribbean seagrass beds are being invaded by the Indian Ocean seagrass *Halophila stipulacea, T. ventricosus* is a prime candidate to control it. This study conducted on St. Thomas United States Virgin Islands, aimed to determine whether *Tripneustes* can act as a biological control for *Halophila* as well as what effects this seagrass might have on the urchin. To test this hypothesis a multi-choice feeding experiment was conducted to determine preference among the seagrass species found on the island. The experiment showed that *T. ventricosus* preferred *Thalassia testudinum* over the other seagrasses but did not eat significantly more of the other native seagrass *Syringodium filiforme*. A no choice experiment was also conducted to determine feeding rate. The urchins ate more *T. testudinum* than the invasive seagrass even with no choice. To further determine if the West Indian Sea egg would be a suitable biocontrol for *H. stipulacea,* urchins were fed either *Halophila* or *Thalassia* for four weeks.

Extracting Varying DNA Yields from Halophila stipulacea Plants Around the Virgin Islands

Shantae Lewis and Erlin Ravariere
Mentor(s): Dr. Alice Stanford
University of the Virgin Islands

Invasive species pose a threat to our ecosystem by outcompeting our native species for resources. One of such invasive species is the seagrass *Halophila stipulacea*. This seagrass has invaded our waters, and if not stopped, could cause detriment to our native species. A serious problem that could result from an invasive species takeover is extinction of the native species. Our goal is to find out the genetic variability of the sea grass and to make an invasion history map. To do this, leaf samples of the seagrass, *H. stipulacea*, were collected from eight different sites around the Virgin Islands and were then cleaned. So far, our results have given us varying DNA yields. At first, the yields were extremely high (72.400 nanograms/microliters) but dropped sharply (3.728 ng/ul) and stayed in that general area only fluctuating a few times. New methods are being tested in which the goal is to receive more DNA or readings that are all at a stable high (13.750 ng/ul). Results so far are inconclusive with minimal trends being seen. From our results, it can be assumed that grinding up two leaves at a time yield better amounts of DNA. To summarize, we have extracted a total of 33 out of 64 samples and of those 33, 20 of them have yielded enough DNA to continue this research. The median of our DNA quantity based on our results is 6.400 ng/ul. Extractions are still being completed at the moment and as such, we cannot test our hypothesis which states that, the genetic variability of the seagrass, *Halophila stipulacea*, will be lower than that of its place of origin.

Metric Variation in the Invasive Species: Halophila stipulacea

Calwyn Morton
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University of the Virgin Islands

This research seeks to determine if there is morphological variation in leaf length, width and area of *Halophila stipulacea* in the US Virgin Islands. *H.stipulacea* is an invasive sea grass species originally native to the Indian Ocean. It invaded the Mediterranean Sea shortly after the opening of the Suez Canal, and has recently been found in the Caribbean. Variation in sea grass leaf metrics can be a signal of genetic variability, the influence of the submarine environment, the increase or decrease in nutrient availability, the amount of organic content in the sediment and generally as a predictor of the effect of human caused disturbance in coastal habitats (May-Ku 2010). Samples of *H. stipulacea* leaves were collected from eight sites in the US Virgin Islands. These samples were scanned and leaf metrics were analyzed using the image processing program: ImageJ for their length, width and area. These data were then compared to that of other sites where *H.stipulacea* was found and will be used to compliment data from genetic, sediment and water column environmental analyses and be used to construct an invasion model of *H.stipulacea* in the US Virgin Islands.

Using Innovative Technologies to Measure the Development of Undergraduate Chemistry Students' Problem Solving Abilities

Angie Estien[1] and Kaila Mitchell[1]
Mentor(s): Angelicque Tucker Blackmon, Ph.D.[2] and Bernard Castillo II, Ph.D.[1]
[1]University of the Virgin Islands and [2]Innovative Learning Concepts

Chemistry courses are generally taught using traditional lecture with a formulated method that does little to encourage critical thinking and problem solving skills. Research shows that students participating in blended learning environments experience increased engagement and ability to apply knowledge to solve real-world problems. However, little is understood about the development of students' problem solving skills while inside blended learning environments. Studies have not been conducted to specifically investigate increases in students' cognitive development and engagement in real time. This research study uses innovative technologies, more specifically, Tobii Eyeglasses, to assess the development of students' problem solving skills in an undergraduate chemistry course. In this study, researchers collected data with an eye-tracking system to quantitatively determine how students used the periodic table to solve nomenclature problems. Data were collected from students enrolled in a 100 level chemistry course offered during the summer 2016 semester. Students in the course were randomly assigned to a control (traditional lecture section) or experimental (a blended learning session) group. Researchers administered pre- and post- tests to obtain data on how students in each group responded to chemistry nomenclature multiple-choice problems. The eye-tracking glasses were worn by all students during each test to collect real time fixation and area of interest data. Fixation and area of interest data reveal the amount of cognitive effort (or lack thereof) that students exert as they attempt to solve chemistry problems. Data show that on average, students in the experimental group scored higher on the post-test than those in the control group. Furthermore, data indicate that students in the experimental group had higher fixation counts and durations while solving problems compared to those in the control group. At the same time, students in the experimental group visited appropriate areas of interest more often, but on average spent less time looking at the entire periodic table. Data from this research study suggests that higher fixation in appropriate areas of interest increases students' performance on chemistry nomenclature problem solving tasks. These findings are useful to informing the design of future distance learning chemistry courses and can aide chemistry faculty in directing students' attention to certain areas of the periodic table while solving chemistry nomenclature multiple-choice problems.

The Predisposition of Synapsin III in Black Caribbean Individuals as a Potential Factor in the Development of Schizophrenia.

Ish-Shawnn Halbert
Mentor(s): Dr. Michelle Cox
University of the Virgin Islands

Schizophrenia is a chronic and severe mental disorder that affects how a person thinks, feels, and behaves (National Institute of Mental Health (NIMH), 2009). NIMH further explains that persons who suffer from such a disorder as having lost touch with their holistic environment. In the United States Virgin Islands (USVI) approximately 1064 individuals of the population suffer from schizophrenia. Of those 1064 individuals, approximately 57 African Americans suffers schizophrenia and other mental disorders. Although schizophrenia is a common mental illness, it often goes untreated. In a previous study we observed that there is a prevalence of schizophrenia than any other mental illness in St. Thomas, USVI in both males and females. Several studies from both the United Kingdom and the United States have reported high prevalence rates of schizophrenia among their black African-Caribbean populations.

Based on the results of our previous study a literature search was conducted to investigate possible genetic markers or abnormalities that may predispose members of the Caribbean community to the development of schizophrenia. The human synapsin III gene is located on chromosome 22q12–13, which has been identified as a possible schizophrenia susceptibility locus. On the basis of this localization and the well-established neurobiological roles of the synapsins, synapsin III represents a candidate gene for schizophrenia." (Kao et al., 1998).

H^1: There is no significant correlation between synapsin III and the development of schizophrenia in the black Eastern Caribbean community.

H^2: There is a correlation between synapsin III and the development of schizophrenia in the black Eastern Caribbean community.

In various studies, there is evidence that the gene synapsin III is a contributing factor to the development of schizophrenia in people of Caribbean decent.

In one study it was shown that there is a correlation between dopamine, schizophrenia, and synapsin III, which has led to further exploration of facts behind the dopamine hypothesis of schizophrenia. This hypothesis proposes that schizophrenia symptoms are due to excess activity of the neurotransmitter dopamine. Synapsin III also appears to play significant roles during neurogenesis and axon formation. These functions of synapsin III are particularly relevant to psychiatric disorders that encompass psychosis, a symptom shared by schizophrenia and bipolar disorder (Kao et al., 1998).

However further studies are needed to elucidate the correlation between synapsin III and the development of schizophrenia. It is our belief that due to synapsin III's chromosomal location, involvement with the activity of dopamine and neurogenesis it could be a good candidate not only to further our understanding the mechanistic actions of schizophrenia, but potential lead to better treatments.

Larval Fish Seasonal Assemblage

Josh Howsmon and Travis Hamlin
Mentor(s): Dr. Sennai Habtes
University of the Virgin Islands

In the past decade it has been clear that human activity and climate change has had a direct impact on marine biodiversity (Hutchings, 2000; Jackson et al., 2001). These increased stressors on the structure and function of marine ecosystems have led to the need for increased ecosystem-based monitoring and management of marine resources (Botsford et al., 1997; Browman and Stergiou, 2004; Pikitch et al., 2004; Cowen et al., 2007). For coast reef fish understanding seasonal patterns in occurrence and if stressors like climate change are affecting these important biological functions like the seasonal timing of reproduction are important to effective management. Brewers Bay is a small bay on the Southwest of St. Thomas, USVI with a broad range of habitat types and equally diverse range of coastal reef fish which inhabit its waters. As part of the Virgin Islands Experimental Program to Stimulate Competitive Research (VI EPSCoR) Mare Nostrum Ecosystem Analysis Project, we collected larval fish monthly from four predetermined transects, across a gradient from nearshore to coastal pelagic waters. The purpose of this research is to understand the seasonal occurrence of larval fish within Brewers Bay. These samplings have occurred once a month since august 2015 providing approximately one year of samples to process and explore seasonal patterns in larval fish occurrence. In addition to patterns in larval occurrence, the oceanographic conditions present in Brewers Bay will be used to determine if there is any correlation between salinity, temperature, and turbidity with the composition of larval fish. I will be using data from a CTD, (which stands for Conductivity, Temperature, and Depth.) profiles the water column are taken at 33 different sites during monthly sampling. A primary goal of my research as part of this project is to develop a database of digital images of larval fish collected in Brewers Bay. This will aid in the identification of larval fish in the waters surrounding the Virgin Islands, and allow a digital record for future analysis. This research project is ongoing and data collection will continue until one year of Mare Nostrum water quality sampling is completed.

Evaluation of Hot Iron Branding on Cortisol Concentration and Behavior in Senepol Cattle

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The objective of the study was to evaluate the impact of hot iron branding on cortisol concentrations and behavior of Senepol heifers and bulls (n = 15/sex; ~14 mo of age). This study was conducted over a 3-week period. During week 1 calves were evaluated for pen temperament using a subjective scoring system (1 = calm up to 5 = aggressive). Pen scores were evaluated in same sex groups of 5 calves at a time. Calves were then put in the chute, without catching their heads, with no squeeze applied. The chute score (1 = calm up to 5 = extremely agitated) was determined and after applying squeeze an initial blood sample was collected from the tail vein. Calves were kept in the chute for ~1 min to mimic the time it takes to brand and then a second blood sample was collected. The calf was released from the chute and Exit Velocity was measured using a pair of electric eyes and timer. A second pen temperament score was collected on all calves after they had all been through the chute. During week 2 the process was repeated with the addition of the branding using a hot iron between the two blood sample collections. During week 2 the data was collected just as it had been during week 1. Plasma was harvested from blood samples and stored at -20 °C until being assayed for cortisol and cortisol binding globulin. Preliminary analysis of the behavior data shows that Senepol cattle have calm temperaments and slow exit velocities, regardless of time relative to the stress of branding. This is in agreement with previous data collected in our lab where Senepol cattle had low chute scores and slow exit velocities. The analyses of the plasm samples for cortisol concentrations will provide more information about the acute, physiological response to the stress of branding.

A Bioinformatics Approach to Classify Viruses Using a Classification Decision Tree Model

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Viruses serve as one of the most efficient vectors for death and disease, killing millions worldwide. Because of this, my research has been targeted at the ability to automatically classify viruses based on their characteristics. To do so I downloaded and analysed 511 (+) ssRNA virus genomes for unique characteristics that identify them. By selecting a decision tree classifier available in WEKA (a data mining package), 66% of the training data was used to create a classifier model. This model was tested using the remaining data sets and was able to correctly classify the viruses with 99.4% accuracy. The importance of this classifier cannot be overstated, as faster virus identification can lead to better and more efficient treatments.

The Effects of Drying on Antioxidant Activity

Narome Belus
Mentor(s): Dr. Bernard Castillo II
University of the Virgin Islands

Antioxidants are substances that prevent the free radical oxidation of compounds. Free radicals are highly reactive unstable compounds that can cause harm to the cells. Antioxidants can be found in many different sources, such as fruits, vegetables and plants. Antioxidant compounds provide the missing electrons to the free radical then reduce it back to its stable form. The purpose of this study was to measure and compare the Hydrophilic Antioxidant Activity (HAA) of fresh and dry plant samples. Five different plant samples were used from two locally grown gardens on St. Croix, US Virgin Islands, namely: *Laurus nobilis* (Bay Leaf), *Plectranthus amboinicus* (French Thyme), *Cymbopogon* (Lemon Grass), *Moringa oleifera* (Moringa) and *Carica papaya* (Papaya). Fresh plant samples were weighed and extracted in an aqueous phosphate buffer solution and dry plant samples were placed in the oven before extraction. The drop in absorbance of each sample was monitored on the UV-VIS Spectrophotometer. The antioxidant activity was expressed as µmol of Trolox equivalent per grams of dry weight (µmol TE/ g DW). We hypothesized that the HAA of dry plant samples would be higher those of the fresh samples. The results show that 3 of the 5 plants: *Carica papaya* (Papaya), *Cymbopogon* (Lemon Grass), and *Plectranthus amboinicus* (French Thyme) had a higher dry HAA than fresh HAA.

Determining the Transmission Route of the Dusky Damselfish Apicomplexan Parasite

Shakilah Liburd
Mentor(s): Dr. Jennilee Robinson
College of Science and Mathematics, University of the Virgin Islands

The Apicomplexa is a phylum of eukaryotic parasites that infect species ranging from fish to mammals. Examples include the causative agents of human diseases toxoplasmosis and malaria. Intracellular Apicomplexa have been observed in blood cells of Caribbean fish, including *Stegastes adustus*, dusky damselfish. Our goal is to determine how dusky damselfish are infected, whether through the fecal to oral route or by blood-feeding creatures such as gnathiids. We hypothesize that fish are infected through the fecal to oral route. We collected 10 dusky damselfish from Brewer's Bay, St. Thomas. Fish were held overnight in individual buckets. The bucket water was filtered to collect fecal matter. Fish were anesthetized to draw a blood sample, and then returned to the reef. Giemsa-stained fish blood was examined and five of the ten fish were infected. Percoll density gradients were used to fractionate the fecal matter and fractions from infected and uninfected fish were compared by microscopy. We have observed objects that resemble apicomplexan oocysts in fecal fractions of infected fish, suggesting that the parasite is transmitted by the fecal to oral route. We also sought to isolate infected blood cells for further study. Percoll density gradients were used to fractionate the fish blood, hopefully separating infected from uninfected cells. Each blood fraction was examined by microscopy and DAPI staining was used to visualize host and parasite nucleic acid in infected blood cells. Future studies will include transmission experiments exposing uninfected juvenile fish to infected adults with or without the presence of hematophagous gnathiids.

Modeling the Spread of Coral Disease by a Graph-Theoretic Approach

Star Matthew
Mentor(s): Dr. Robert Stolz
University of the Virgin Islands

Coral reefs provide habitats to many marine organisms, protect coastlines from negative effects of cyclones and storms, and overall are significantly important for many reasons. They are often destroyed by various effects that include coral disease. The objective of this project is to model how the rapid tissue loss disease (White Plague Disease) might spread throughout a community of coral reefs in the Virgin Islands through the methods of dispersion and ocean currents. The approach we took in addressing this problem was using a partial differential equation: the advection diffusion equation: $N_t = -uN_x - vN_x + D(N_{xx} + N_{yy}) + \mu N$, where N is the concentration of a substance, t is the time, D is the diffusion, $\boldsymbol{\mu}$ is the growth or decay coefficient and x and y are spatial coordinates. This study will develop the model and apply it to the waters surrounding the Virgin Islands.

We started out by splitting the equation into two separate parts: advection, the first part of the equation and diffusion, the second part. Taking this approach allowed us to solve the two conditions separately, using several difference methods. The first of the finite difference methods used was the Forward Difference Method. The forward difference is an expression which calculates a new amount by taking the old amount and adding the change in time. We started by solving the two equations using this method. Information was gathered and coded in a program, Matlab. This program resulted in a moving image that displayed the concentration of the particles. However, we were unable to significantly increase the resolution because the model was numerically unstable. This resulted in moving onto using the Crank-Nicolson Method, which is a combination of the forward difference and backward difference approximations and is unconditionally stable. The same steps used in the previous example were repeated and we got a program running for this method as well, which resulted in our desired image. The working model was then applied to the local Virgin Islands waters.

This program eventually resulted in a connectivity graph that shows the connections of each of the coral sites in relation to each other. We suppose a site is connected to another based on if any of the particles in the initial concentration dropped at one site happen to pass or roll over any of the other sites. The graph stemmed from an adjacency matrix that give values of the strength and direction of the connectivity between the 13 coral monitoring sites. We developed connectivity graphs for 15 and 30 day periods.

A Solar Variability Study: Broad Plasma Conditions and Spectrum Regimes

Ruel Mitchel
Mentor(s): Dr. Brice Orange
University of the Virgin Islands

Investigations of solar variability and its magnetic energy coupling are paramount to solving many key solar and stellar physics problems. Particularly, understanding the temporal variability of magnetic energy redistribution and heating processes. Our data set will be comprised of approximately six years of the Solar Dynamic's Observatory's Atmospheric Imaging Assembly's (AIA) narrowband observations, which provides spectrum coverage of the solar atmosphere in: visible (4500 A); far ultra-violet (1700 A & 1600 A); extreme ultra-violet (131, 171, 193, 211, 304, & 335 A); and X-ray (94 A) portions of the spectrum, and Heliosemic Magnetic Imager's (HMI) line-of-sight (LOS) magnetograms, all with a temporal cadence of approximately 3 -- 5 days. From these observations we will directly investigate the recent broad electromagnetic spectrum and its accompanying underlying LOS magnetic flux modulations across broad spatial scales of the solar atmosphere. Specifically, we will characterize the solar radiative and magnetic variability of: coronal holes (CHs), quiet Sun (QS), active regions (ARs), active region cores (ARCs), full-disk (FD), sunspots (SSs), and latitudinal bands. These analyses products will be explored to enhance our understanding of solar radiative to magnetic energy coupling, as well as to investigate the feasibility of autonomous algorithms for recognizing solar activity minimum and maximum epochs. Time permitting, perform correlation analyses of these results to typical proxies of solar activity, with emphasis on those common to Sun -- Earth and atmosphere -- climate coupling (i.e., sunspot numbers, 10.7 cm radio flux), will be used to study the role of solar forcing across broad electromagnetic spectrum regimes.

Behavioral Patterns On the Index of Non-Repetitive Sequences

Chanae Ottley
Mentor(s): Dr. Chris Plyley
University of the Virgin Islands

The study of sequences of (not necessarily distinct) group elements which sum to zero has numerous applications in game theory, cryptography, Ramsey theory and graph theory. For example, the determination of Davenport's Constant (the smallest integer k such that any sequence of k-elements has a subsequence with sum 0) is considered one of the most important unsolved problems in finite group theory. If a sequence contains no repetition, then Olson's Constant (denoted $Ol(G)$) is the analog of the Davenport Constant, and is defined as the minimal integer k such that every sequence of distinct elements of length k in G has a zero-sum subsequence. Even for Z_n (the integers under addition modulo n), the precise values of the $Ol(Z_n)$ are only known for $n < 65$.

Kleitman and Lemke formulated the concept of index in 1988 while resolving a conjecture of Paul Erdos. If S is a zero-sum sequence in Z_n, then the index of S is the minimal integer multiple of n that S may be made to sum to after multiplication by an integer relatively prime to n. In 2011, the question was posed to determine the minimal integer k such that every sequence of length k has a zero-sum subsequence with index 1. In this project, we determine this value (denoted by $T(n)$) for all $n < 22$. To accomplish this, we check every sequence of a given length in Z_n for zero-subsequences of index 1. We formulate several results to reduce the number of sequences that must be checked, and use a computer program to generate a list of remaining sequences, which are then checked by hand. We also establish upper and lower bounds on the value of $T(n)$. Our data suggests that the value of $T(n)$ is likely closely linked to the value of $Ol(Z_n)$.

Identifying Parrotfish Spawning Habitat in the USVI

DeWein Pelle
Mentor(s): Sennai Habtes, PhD and Daniel Holstein, PhD
University of the Virgin Islands

The mesopelagic reef system surrounding the United States Virgin Islands (USVI) contains a series of banks which provide spawning aggregations for a vast array of species that are economically important, including snapper and grouper. To prevent overfishing, the U.S. Caribbean Fishery Management Council (CFMC) instituted seasonal fishery closures along the Grammanik Bank, located South of St. Thomas, USVI. Additionally, parrotfish in the *Scaridae* and *Sparisoma* genera inhabit similar aggregations neighboring the USVI and are larger herbivorous reef fish whose diet consist of algae from coral reefs. Unfortunately, there is insufficient information on the spawning sites inhabited by parrotfish in the USVI, in addition to supplementary data such as their behavioral and biological processes amongst these locations. In response, scientists from the National Oceanic and Atmospheric Administration (NOAA), Southeast Fisheries Science Center (SEFSC), Atmospheric and Oceanographic Laboratory (AOML), the University of the Virgin Islands (UVI), and the Virgin Islands Department of Planning and Natural Resources (VIDPNR) are utilizing the NOAA Research Vessel (R/V) Nancy Foster as part of a multi-year interdisciplinary study to investigate these processes and collect data on abundance and distributions of these species. More specifically, the researchers participating in the 2016 cruise collected larvae, early development stages of less than ten days old, of these species near coastal reefs through sampling with a variety of net systems along 100 stations in the Coastal Waters surrounding the USVI, British Virgin Islands, and Puerto Rico. The locations where larval parrotfish in the *Scaridae* and *Sparisoma* genera were found were evaluated using a Connectivity Modeling System (CMS), which observes motion for a single or group of particles using a stochastic Lagrangian framework. Additionally, this biophysical modeling system uses and array of modules to accurately delineate the pathway of any particle in respect to how it travels throughout currents or even complex topography. For this research, the CMS was modified to backtrace the movement of the collected larvae. Thereafter, it will be used to identify possible parrotfish spawning habitat in the waters surrounding the USVI.

Dromia erythropus sponge decoration preference

Cheryl Petsche
Mentor(s): Dr. Edwin Cruz-Rivera
University of the Virgin Islands

Many behaviors in nature are based on avoiding predation. One way for an animal to avoid predation is to use camouflage. *Dromia erythropus* is a decorator crab that is known for mainly using a large piece of sponge for its decoration. To determine the mechanisms of sponge selection by the crab, decoration choice was analyzed in relation to field use, active choice, and differences in handling time of different sponges. Crabs collected in Brewers Bay, St. Thomas (USVI), were most frequently decorated with the sponges *Amphimedon compressa* and an unidentified purple demosponge, but were found to use at least eight species of sponge. A multiple choice experiment using the sponges *Amphimedon compressa*, *Aplysina fulva*, *Tedania klausi*, *Ircinia strobilina* and an unidentified demosponge determined that crabs preferred the sponge *T. klausi*. Video analysis of individually-filmed crabs supported crab preference for *T. klausi* with a mean total handling time of 2.63 hours (n=3), in contrast to handling times of 4.34-11.06 hours for four other sponges. Curiously, handling time on the unidentified demosponge was higher than that on other low preference sponges, despite its high frequency of use in the field. Data suggest that multiple cues, including biomechanical and chemical, likely determine decoration choice in this crab species. More analyses, including quantification of specific behavioral sequences from videos and experiments on the roles of sponge chemistry, will follow to fully understand decoration preferences.

Evidence-Based Behavioral Risk Factors of Type 2 Diabetes Among the Adult Population in the United States: A Systematic Review

Renita Phillip
Mentor(s): Dr. Janis Valmond
Caribbean Exploratory Research Center, University of the Virgin Islands

Type 2 diabetes is one of the chronic diseases that has become a worldwide problem. Complications of this disease may lead to debilitating conditions and ultimately death. Prevention and treatment of type 2 diabetes is effective if based on a thorough understanding of the disease and risk factors. This systematic review seeks to summarize the published evidence on risk factors of type 2 diabetes among the adult population in the USA.

An extensive search of PubMed database was conducted. Studies were included of original research published in English-language peer-reviewed journals and participants were adults (18+), resided in the United States, and undiagnosed for type 2 diabetes. Two reviewers screened abstracts based on the inclusion criteria. Full texts of potential articles will be evaluated for inclusion data extraction using a data extraction form. An evidence table summarizing key information will be developed.

One hundred and ninety eight abstracts were screened and 23 potential articles selected for full text review. Foods examined either increased or decreased the likelihood of getting this disease. Physical activity decreased risk while inactivity increased an individual's chances of getting type 2 diabetes. Other factors mentioned that may increase the risk of type 2 diabetes include anti-depressant medications, snoring, and lower family income.

The studies retrieved from PubMed focused primarily on diet and physical activity. Some evidence suggests obesity and elevated body mass index are key contributors to the progression of type 2 diabetes. Further research will include searches in additional databases.

Impacts of Sponges on Coral Recruitment and Recovery

Tia Rabsatt
Mentor(s): Dr. Marilyn Brandt
University of the Virgin Islands

Corals play a major and important role in coral reef ecosystems. Corals provide a habitat and food to other organisms on the reef. However, studies show that coral cover has declined drastically due to natural disasters and anthropogenic activities over the past few decades. In contrast, sponge cover has been increasing. It is hypothesized that the increase in sponge cover is inhibiting coral recruitment and the regrowth of corals. The purpose of this experiment was to investigate whether sponges are inhibiting the recruitment of corals through space occupancy or allelopathy. The experiment consisted of scoring recruits (coral larvae) that landed on recruit plates at six shallow waters reef sites and identifying coral, sponge and macro-algae cover in the surrounding area of the plates. Coral recruit density found on plates was found to be positively related to the percent coral cover found around the plate. This study can help identify the impacts of sponges on coral resilience.

Fluorescence Spectroscopy of Metal-Ligand Complexes: Coordination Effects

Kiana Rawlins
Mentor(s): Dr. Stanley Latesky
University of the Virgin Islands

Fluorescence Spectroscopy is a very sensitive method used in analytical, inorganic, and physical chemistry to study the molecular structure of excited states. Our study involved the study of metal ion complexes of Cu^{2+} and 1,10-phenanthroline, and how the binding of the ligand to the metal affected the fluorescence of the 1,10-phenanthroline ligand. Different concentration solutions of metal and ligand were analyzed at multiple excitation wavelengths in order to study the effects of coordination. The same data can also be analyzed to determine the M-L binding constants. The initial results showed that there is a measurable shift in the fluorescence band attributed to the 1,10-phenanthroline upon coordination to the Cu^{2+}. Future studies will study the effect on both early and late transition metal ions, looking for effects due to both geometry of the complex and binding strength of the ligand to the metal.

Flash Malware Analysis and Obfuscation: Is Your System safe?

Ellod Richardson
Mentor(s): Dr. Marc Boumedine
University of the Virgin Islands

Flash Malware is very dangerous type of malware or virus and can compromise the safety of any computer system. Because of this, the focus of my research has been to understand the general properties of flash malware and the main techniques used to infect and cause damage to computer systems. I have done so by using what is known as the static analysis method which is the process of observing a specific code without executing it, to look at and study examples of flash malware. I also researched a technique used by hackers called obfuscation. This is making a computer program difficult to understand to humans and also to hide malicious commands and functions in a code to perform illegal tasks without the knowledge of the victim. This research is of great importance and can be used to make future flash malware attacks much less frequent and effective.

Caribbean Sponges Under Temperature Stress

Juliet Ruggiero
Mentor(s): Andia Chaves-Fonnegra, Ph.D.
University of the Virgin Islands

One threat to coral reefs is the increase of ocean temperatures, which can produce coral bleaching and mortality. While corals are dying, marine sponges (Phylum Porifera) have become abundant and are currently an important habitat-forming animal on Caribbean coral reefs. However, it is unknown if temperature stress has a negative effect on common species of reef sponges. This study evaluates if higher water temperature affects survival, pigmentation and "tissue" regeneration of three species of common reef sponges. Sponges were collected from the reef and placed at two experimental average temperatures (control: 28.0°C and stress: 31.5°C) for a period of 10 days. Our results showed that percentage of mortality and pigmentation did not vary with temperature. However, at species level, *Aplysina cauliformis* tend to lose pigmentation faster under temperature stress, whereas *Desmapsama anchorata* gained pigmentation in both control and stress. *Cliona delitrix* pigmentation was the same over time. Tissue regeneration occurred in both control and stress temperatures for all three species. This preliminary experimental study showed that sponges tolerate stress temperature over ten days. Future studies should focus on temperature stress effect on sponges over longer periods of time.

Microclimate Monitoring in the US Virgin Islands: Towards Real-Time Data Collection and Management Analytics

Noah Stolz[1]
Mentor(s): Dr. Brice Orange[2]
[1]Rensselaer Polytechnic Institute and [2]University of the Virgin Islands

Investigations of past and descriptions to future long term climate variability, particularly on micro scales, is in need of review. Data management protocols whose importance is maximized on Small Island States have been predicted as early warning systems for signs of climate change. Also, geographical sectors where constraints on their natural variability envelopes remain outstanding. The purpose of this project is the development of low-level software routines for direct communication between host computers and in situ weather sensing stations. Additionally, we will check if the stations deployed in the United States Virgin Islands (USVI) from successful Water Resource Research Institute project remain consistent. This project represents a fundamental step towards overcoming current software and hardware limitations that hinder addressing these issues. Specifically, it will serve as the foundation for living maintenance of in situ stations, and real-time continuous collection of their observables.

Microclimate in the US Virgin Islands: Towards Real-Time Data Management Analytics

Kyrelle Thomas
Mentor(s): David A. Morris, PhD., N. Brice Orange, PhD., Sandra Maina, M.S.
Etelman Observatory, University of the Virgin Islands

Paramount in assessing the vulnerability of Small Island States to climate change threats are microclimate variability investigations and their near real-time monitoring. Particularly, that is, given these data products represent critical tools for improving our knowledge of the precursor signals to short and long-term climate modulations. Though the existing network of USVI remote sensing stations, deployed through successful previous WRRI projects, observables provide the ideal environment for work towards addressing these fundamental gaps in our understanding, they require a paradigm shift of current data handling and hardware management analytics. This study has developed and created the foundation documentation for implementing techniques required to maintain real-time accurate microclimate monitoring in the USVIs. During these tasks we have additionally performed and implemented 90% of the required systematic station calibrations to four of the islands' 14 stations, and identified preliminary protocols required for station longevity in data collection.

<u>Internet of Things Program Project Posters</u>

A

Bird Detection Using Image Segmentation and Edge Features

Jordan Atemazen, Joseph Charles, and Natisha Hodge
Mentor(s): Dr. Michael A. Smith
University of the Virgin Islands

B

Architecture for a Frog Recording App

Sean R. Benjamin Jr., Khadijah O'Neill, and Colleen Toussaint
Mentor(s): Dr. Michael A. Smith
University of the Virgin Islands

C

Does Music Improve the Quality of Your Sleep?

Shanice James, Travis Jarvis, and De-Vaughn Taylor
Mentor(s): Dr. Michael A. Smith
University of the Virgin Islands

2016 Summer Participants

Summer Sophomore Research Institute (SSRI)	Summer Undergraduate Research Experience (SURE)	VI-EPSCOR Summer Undergraduate Research Program	Mathematics Behind the Science (MBS) Program	The Internet of Things (IoT) Program
Narome Belus Anayah Ferris Cequoyah George Jhara Irish Samuel Liburd Shakilah Liburd Erlin Ravariere Ellod Richardson	Angie Estien Shabree Anthony Markeith Cornwall Israel Dennie Kelvin Dover Rhonda Forbes Matthew Fortenberry Ish-Shawnn Halbert Serena Joseph Quianah Joyce Leroy Matthias, Jr. Ruel Mitchel Kaila Mitchell Chanae Ottley Renita Phillip Kiana Rawlins Donus Thomas Kyrelle Thomas	Diana Ashhab Jamisha Francis Travis Hamlin Josh Howsmon Kyle Jerris Calwyn Morton DeWein Pelle Cheryl Petsche Tia Rabsatt Juliet Ruggiero	Jendahye Antoine Robert Ash D'Briault Atemazem Moesha Blyden Hairol Breton McKim Colaire Destiny Frett Deshonda Holmes David Jeffers Jahkara Jonas Kenique Liburd Chris Murphy Kiandre Rogers Jair Smith D'Shaunique Walters Lawrence White	Jordan Atemazem Sean Benjamin Jr. Joseph Charles Natisha Hodge Shanice James Travis Jarvis Khadijah O'Neill De-Vaughn Taylor Colleen Toussaint

Summer Program Descriptions:

- Math Behind the Science (MBS) Program - A residential, summer bridge program designed to enhance the mathematics readiness of college-bound STEM students by preparing them to enter the introductory calculus course and provide an enriching experience for transition to college life.

- Summer Sophomore Research Institute (SSRI) - A summer research program that allows current UVI students to work with faculty on a research project and participate in workshops to learn basic research methods and techniques.

- Summer Undergraduate Research Experience (SURE) - A program that provides research experience for mature undergraduates to work closely with UVI faculty on challenging scientific research projects across a variety of STEM disciplines.

- Internet of Things (IoT) - Allows students to work with a faculty mentor and IoT expert Dr. Michael Smith from Intel for 3 to 4 weeks on an interdisciplinary project combining Marine and Environmental Science with Internet Technology. Dr. Smith will provide training and guidance about how to apply Internet and Maker Space technologies to Marine and Environmental Science challenges.

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Mentors

Summer Undergraduate Research Programs

Marc Boumedine	Marilyn Brandt
Bernard Castillo	Andia Chavez Fonnegra
Michelle Cox	Edwin Cruz-Rivera
Bruce Gendre	Robert Godfrey
Sennai Habtes	Paul Jobsis
Stan Latesky	Jason Lewis
David Morris	Brice Orange
Chris Plyley	Avram Primack
Jennilee Robinson	Paul Sikkel
Alice Stanford	Robert Stolz
Teresa Turner	Janis Valmond

Math Behind the Science Program

Avon Benjamin
Julie Cruz
Andre Douglas
Jason Lewis
Brandon Rhymer
Aimee Sanchez
Kymberli Simon
Robert Stolz
Teresa Turner
Linda Wymer

Internet of Things

Joseph DeMarco
Dr. Michael Smith

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Organization Team

Dr. Renata Platenberg, *SURE & SSRI Programs Summer Coordinator*
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Dr. Teresa Turner, *MARC & MBRS-RISE Program Director*
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Emerging Caribbean Scientists Programs
College of Science & Mathematics

University **V**irgin **I**slands
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