12th Annual Spring Student Research Symposium

March 22nd, 2014
St. Croix Campus
College of Science & Mathematics
University of the Virgin Islands

Twelfth Annual Spring Student Research Symposium

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Saturday, March 22, 2014
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St. Croix Campus, U.S. Virgin Islands

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Event Organized by:
Emerging Caribbean Scientists (ECS) Program
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Emerging Caribbean Scientist

Emerging Caribbean Scientists (ECS) 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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Design and Implementation of Autonomous Weather Monitoring Agents Using The Java Agent Development Environment

Andy Breton and Jamall Marsh
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University of the Virgin Islands, St. Thomas, U.S. Virgin Islands

A software agent is an autonomous software that is able to observe its surroundings and do specific tasks depending on the environment to achieve its goals. Such features are well-suited in weather monitoring to detect changes (drastic or regular) and take action autonomously according to its given parameters This study proposes a design and implementation of multi-agent architecture, which is capable of monitoring weather systems and alert users more effectively using reactive agents. These agents are able to react and take actions based on given parameters by fetching information from distributed servers and reacting to any changes or conditions specified by the users.

The agents were implemented with the Java Agent Development Framework JADE by monitoring the weather data server (Worldweatheronline.com). The agents are programmed with several parameters such as their behavior and set of actions to be taken upon changes in the weather patterns. In addition, by using the specified Internet Protocol (IP) addresses, locations of a specific geographical location can be monitored in almost real-time. Such agents will be beneficial to many stakeholders since multi-agent architecture is able to observe the most current weather status and alert users from multiple sites around the world about potential hazardous conditions.

This work is supported with the grant program NSF HBCU-UP HR 0506096
and the University of the Virgin Islands.

PINK1: A Mitochondrial Ribosome Associated Kinase

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In mammals, mitochondria are responsible for providing over 90% of energy in the form of ATP, which is generated by the process of oxidative phosphorylation (OXPHOS). Our recent studies revealed that the mitochondrial translation machinery responsible for the synthesis of OXPHOS components is regulated by the phosphorylation of mitochondrial ribosomal proteins (MRPs). In addition, PTEN-induced putative kinase 1 (PINK1) was identified as one of the kinases responsible for phosphorylation of MRPs in the proteomics analysis of various mitochondrial fractions. PINK1 is a Ser/Thr kinase involved in phosphorylation of Parkin (E3 ubiquitin ligase) in order to eliminate damaged mitochondria through mitophagy. Mutations in PINK1 and Parkin result in autosomal recessive Parkinson's disease (PD), associated with oxidative stress and neuronal cell death. We hypothesized that PINK1 is a ribosome-associated kinase responsible for phosphorylation of MRPs and regulation of mitochondrial translation in health and disease. In this study, we investigated the association of PINK1 with mitochondrial ribosomes prepared at different detergent concentrations by Western blot analysis using PINK1 and MRP-specific antibodies. Western blot analysis of mitochondrial ribosome fractions confirmed the association of PINK1 with the mitochondrial ribosomal subunits. Mass spectrometry analysis will be performed to further confirm PINK1 association with the subunits.

This researCh was supported by NIH Grant 5P20RR016477 to the West Virginia IDeA Network for Biomedical Research Excellence and the NIH MARC Research Trainee Program (#5T34GM008422).

Determining Among-Site Prevalence of Haemogregarine Parasites In Caribbean Damselfish Species

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Changes in the composition of benthic habitats, especially the decrease in live coral cover, influences habitat availability for benthic stages of parasites and thus alters parasite-host dynamics. Haemogregarines are parasitic haemoprotozoans that parasitize on the erythrocytes (red blood cells), of vertebrates. Although parasitism of marine fish by haemogregarines is particularly common among marine fish, the mechanism of transmission to host fish and host-parasite dynamics are not fully understood. External fish parasites such as gnathiid isopods, may act as vectors of haemogregarines for reef fish. Gnathiids generally avoid live coral capable of ingesting them. This study aims to compare the prevalence of haemogregarine parasites in damselfish (Pomacentridae) based upon the premise that gnathiids inhabit locations with relatively low coral cover. Belt transect benthic surveys were conducted to determine the benthic habitat composition of two study sites. Preliminary field results indicate that Brewer's Bay has less live coral coverage at 9%, than does Fortuna Bay at 36%. Damselfish are caught at the study sites with modified cast nets and aquarium hand nets while snorkeling or SCUBA diving. Small samples of blood are collected with syringes from each fish to produce blood smear slides for parasite screening via 100x light microscopy. Multiple damselfish individuals have screened positive for haemogregarine-like structures within erythrocytes. Further screening is being conducted to compare haemogregarine prevalence among-site. This investigation will give insight into the importance of habitat quality on the health of reef fishes and increase understanding of the biocomplexity of marine reef ecosystems of the Caribbean.

This project was funded by the National Science Foundation (OCE-121615, P.C. Sikkel, PI) and the UVI NIH RISE program (#GM061325).

Correlation Between Human Dimensions and Impaired Water Quality for St. Croix, Virgin Islands

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Impaired marine near shore waters are associated with many terrestrial subwatersheds. These impairments, including turbidity, fecal coliform, and enterococcus bacteria, are brought into the marine environment via runoff from the land. These impairments may be correlated with land development, improper drainage, and unpaved roads. A comparative study examining demographic data from the Virgin Islands 2010 Census and EPA STORET station data on water quality for 2009 to 2011 was conducted in order to establish correlations between the human dimension of land development and poor water quality. The location of each station was mapped using ArcGIS 10.1. By comparing variables such as age, race, income, place of birth, number of housing units, and other related variables within each estate to the location of impaired marine near shore waters, common variables among subwatersheds with impaired near shore marine waters will be determined. Future research will involve finding correlations between human dimensions and impaired water quality for St. Thomas and St. John.

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This research was funded by the Water Resources Research Institute Fund # 205206.

An Assessment of Salt Pond Ecological Characteristics in High and Low Human Impact Areas on St. Thomas, USVI

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Salt ponds are coastal wetlands formed by the gradual closing of sheltered bays; they are surrounded by mangroves that provide habitat to nesting and foraging wetland birds. More importantly, salt ponds filter upland runoff, trapping sediment and contaminants thereby maintaining the water quality of the adjoining marine environment. Urbanization has led to an increase in runoff rich nutrients, sediment, and other non-point source contaminants entering salt ponds and the marine environment. Many ponds have been lost and altered through coastal development for resorts and condominiums, which could result in decreases in contaminants prevented from entering the marine environment by these coastal wetland filters. We are interested in examining the relationship between human development and ecological characteristics of salt ponds on St. Thomas, US Virgin Islands. Seven ponds were selected for sampling: three highly impacted ponds, one intermediately impacted pond and three ponds that receive little unnatural input. The water characteristics of each pond were recorded and water samples collected to measure the nutrient content within the ponds. In addition, pond characteristics were recorded, including shoreline vegetation, water color, depth and wildlife presence. Nutrients tested include nitrates, phosphates and sulfates and only show a difference in the ammonia levels of the various ponds. There were differences between impacted and non-impacted ponds in turbidity, total dissolve solids and dissolved oxygen levels but no difference in chlorophyll. Salinity and pH were highly correlated, and while the salinity of non-impacted ponds was lower than impacted ponds this may been more indicative of hydrology than water quality. Analysis of the collected water samples were expected to show higher nutrient levels in impacted ponds. The results of this study has determined a differences in high and low impact ponds the reason behind this difference will require further study of the ponds ecological properties.

This research was funded by HBCU-UP (Grant Number-1137472)
and the ECS Honors Fund.

The Search of Extra-Solar Planets Using the Etelman VI Robotic Telescope

Bonnie President
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University of the Virgin Islands

An extra-solar planet, or exo-planet, is a planet that orbits a star other than our Sun. The first extra-solar planets discovered were quite unlike those found in our own solar system, but recent studies are beginning to discover planets more similar to those nearby. Of particular interest, is the search for Earth-like planets in the so-called "habitable" zone, the orbital region around a star where liquid water may exist on the planet's surface. The first extra-solar planet was discovered by Polish astronomer Aleksander Wolszczan in 1990 using the Arecibo radio telescope and to date there are 911 confirmed extra-solar planets with many thousands more planet candidates. Research conducted was to test the hypothesis that the Etelman VI Robotic Telescope can detect and observe extra-solar planets. The 'transit' or 'eclipse' technique is favoured in the search for this class of exo-planets since it is least biased against their detection. The depth and shape of dips in the stellar light curve provide evidence for the presence of and, in some cases, details of the characteristics of a planet in orbit around the star. We present results of our Virgin Islands Robotic Telescope (VIRT) observing campaign on the known exo-planet system GJ1214b. Our results are presented as a test of the VIRT's ability to detect exo-planets using this technique.

This research was funded by HBCU-UP (Grant Number-1137472).

Study and Analysis of Simplified Cellular Automata in the Context of Conway's Game of Life

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Cellular automata have been used to design and create visual models and simulations of different phenomena in domains such as art, forest fires and social movement. One of the many applications of cellular automata is Conway's Game of Life. The game is represented by a collection of cells on a grid. An initial state shows where cells can be either dead or alive. A set of four rules allow the transition from state to state until all cells die or cells live forever. The objective of this research was to compare the behavior of cellular automata using simplified rules. For this study, a couple of Java implementations were used to analyze the behavior of various instances of the modified game and to establish baseline data for comparing the new simplified and the original game. Our main goal is to determine if specific states that are reachable in the Game of Life can also be reached with lesser number of rules. The first experiment uses three rules and collects data to characterize the behavior of the new automata. The data are then compared to the Game of Life's results. Preliminary results show that under specific conditions it is possible to simplify the behavior of the new automata producing lesser transitions to reach a given state from the initial state, hence showing a simplified behavior.

This research was funded by HBCU-UP (Grant Number-1137472).

Vertical Chlorophyll Profiles in Salt River Bay and Bioluminescent Mangrove Lagoon, St. Croix, US Virgin Islands

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Mangrove Lagoon is a shallow, semi-enclosed, man-made embayment created in the 1960's by a hotel project that is located within the Salt River Bay National Historic Park and Ecological Preserve. Mangrove Lagoon is notably bioluminescent year round and it is thought that *Pyrodinium bahamense* var *bahamense,* a phytoplanktonic dinoflagellate is the primary species responsible for the bioluminescent phenomenon. We hypothesized that Chlorophyll A is more concentrated in Bioluminescence Mangrove Lagoon than Salt River Bay. In order to investigate the vertical distribution of phytoplankton, Chlorophyll A concentrations were obtained in both Bioluminescence Mangrove Lagoon and Salt River Bay for comparison at different depths during the day and at night. Chlorophyll A is bound within living cells of algae, phytoplankton, and other plant matter and plays an important role as an apparatus responsible for photosynthesis. Data were collected, compared and analyzed at four different sites, namely, in the interior of Mangrove Lagoon, the entrance of Mangrove Lagoon and two other sites in Salt River Bay. Data were collected during the months of May, June and July in the morning between 9-11am and in the evening between 8-11pm. Chlorophyll A concentrations were measured at the water surface and every 0.5 m in depth. We observed that Chlorophyll A concentrations were highest in Mangrove Lagoon (1.49 µg/L) compared to the other three sites. We concluded that during the day, Chlorophyll A concentrations were highest near the bottom compared to the top meters. During the night, we have seen Chlorophyll A concentration spread throughout the top and bottom meters.

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and Department of Interior National Park Service.

Comparison of Nutrient Content in Salt River Bay and Bioluminescent Mangrove Lagoon, St.Croix

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In the 1960s, a hotel development located in Salt River Bay, US Virgin Islands created a man-made embayment, which today developed into the bioluminescent Mangrove Lagoon. Within Mangrove Lagoon, bioluminescent dinoflagellates emit light when the water is agitated, producing a vibrant glow. The primary factors influencing the abundance of these dinoflagellates are not yet fully understood. We observed that there was significant bioluminescence throughout Salt River Bay, however, the highest concentration was observed within Mangrove Lagoon. The main objective of this study was to examine the nutrient content in Salt River Bay and compare with Mangrove Lagoon to investigate if nutrient content influences the concentration of bioluminescent dinoflagellates. Four sample sites were selected for the collection of water samples for the analysis of nutrients. Water samples were obtained during the night between 9-11pm from the surface and bottom of the water column. The sample sites were located within Mangrove Lagoon, in the mouth of Mangrove Lagoon, and two in Salt River Bay, which is connected to open ocean. The nutrients tested for this study were Total Nitrogen (TN), Total Phosphorus (TP), Nitrates and Total Organic Carbon (TOC), all of which used EPA approved methodologies. The results of Pearson correlation analyses between Mangrove Lagoon and Salt River Bay did not reveal a significant difference (P-value < 0.05) for any of the nutrients tested.

This research was funded by NSF HBCU-UP Grant Award No. HRD – 0506096
and the Department of Interior National Park Service.

Influence of Papaya Seed Age on Viability

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Papaya (*Carica papaya*) has a gelatinous sarcotesta surrounding the seed that can reduce germination due to inhibition of oxygen to the seed. However, removal of the sarcotesta allows the seeds to dry quicker and more exposure to oxygen. The viability of the clean seeds, sarcotesta removed at harvest, and held under refrigerated storage wasn't known. The objective was to study the viability and germination of seven papaya lines with seeds from 2006 to 2012. Seeds were imbibed in vitro for one week and a tetrazolium test for seed viability applied. Seeds held in storage from 2006, 2008, 2010 and fresh harvested seed from 2012 were planted in replication under greenhouse condition. Germination was recorded over a 33 day cycle. There was great variability between lines for germination. The 2008 seed for all papaya lines had the poorest germination that ranged from 10% to 60%. Papaya seed loose viability over time under refrigerated storage.

This research was supported by USDA-NIFA-Hatch and USDA-NIFA-Insular Tropical Grant funds.

Sorrel Hybrids: Fruit Size Evaluation

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Sorrel (*Hibiscus sabdariffa*) also known as Roselle, is in the malvaceae family and popular in the Caribbean as a seasonal beverage. The objective of the research was to compare sorrel F1 and F4 hybrids as it relates to calyx length, width and spur size. The deep colored fleshy calyces were collected and evaluated from KxT F1 and TxK F1 and F4 lines that were field established in June. Overall the TxK hybrids had darker fruit then the KxT lines. Varieties TxK F1 and KxT F1 had the same fruit length which was significantly longer than the hybrid TxK F4 line. The calyx width among these hybrids was not statistically different. The spur length for the KxT F1 line was significantly longer than the TxK lines. Hybrid vigor was evident in the F1 lines for fruit length but is diluted by the F4 generation.

This research was supported by USDA-Hatch and USDA-NIFA-Insular Tropical Grant funds.

Initiation of Somatic Embryoids in Five Varieties of Sorrel (Hibiscus sabdariffa)

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Sorrel (*Hibiscus sabdariffa*) is a tropical crop grown for its colorful fleshy and delectable calyx. The ability to apply molecular breeding for plant improvement is inhibited by the lack of a protocol for somatic embryogenesis and regeneration. The purpose of this research was to evaluate the influence of 2,4-D concentration on the induction of somatic embryogenesis from cotyledon explants of sorrel. Seeds of six sorrel varieties (100, JAK, 128, KDN, 245, TTB) were surface disinfected and germinated in vitro. Cotyledons from two day old germinating seeds were sliced into 1.5 mm strips and placed in petri plates containing MS medium with 60, 120, 180 and 240µM 2,4-D. After eight weeks embryoids were observed emerging from the vascular bundle in the expanded cotyledon slices of five varieties. Successful embryoid formation improved as the 2,4-D concentration increased for the varieties 100, KDN,128, TTB and 245. 2,4-D can be used to promote somatic embyoid induction from young cotyledon tissue in vitro.

This research was supported by USDA-NIFA-Hatch and USDA-NIFA-Insular Tropical Grant funds.

Integrated Theoretical and Experimental Analysis of a Model Oligopeptide Library for Interpretation of FT-IR Structural Data

Keturah Bethel
Dr. Justin Shorb (mentor)
University of the Virgin Islands

To understand the mechanisms of protein structure, we will use Fourier Transform Infrared Spectroscopy (FT-IR) to study the absorption spectrum of peptides. Specifically we will be looking at the absorption of the amide I band which is primarily the C=O stretch from the peptide bond in proteins. Isotope labeling allows the amide I Band to be studied site-specifically. The amide I Band is being studied because of its strong absorption in the IR spectrum. In the literature, many different theoretical methods have been used to describe the changes in the amide-I band location and strength as its environment changes. Some of these methods involve the use of electric field vectors along the C=O bond vector, or torsional angles along the peptide backbone. These have been tested in various model systems from large proteins (14,000+ atoms) to small di- or tri-peptides. To this point, however, no model set of small peptides has been used to compare these theoretical models' accuracies in a similar data set. The goal of this project is to design a model set of di- and tri-peptides, take spectroscopic data in the laboratory in standard conditions, and then perform molecular dynamics simulations of these model oligopeptides to compare existing theoretical models. The library of model compounds used will be discussed and preliminary FT-IR data of these oligopeptides in various solvents will be shown.

This research was funded by HBCU-UP (Grant Number-1137472).

Screening of Ciguatera Toxins Found in the Invasive Indo-Pacific Lionfish (Pterois volitans) in the United States and British Virgin Islands

Khalin Nisbett Jamila Martin, Gejae Jeffers and Lorne Joseph
Bernard Castillo II, Ph. D. and Kynoch Reale-Munroe (mentors)
University of the Virgin Islands

In the early 1980s, the Indo-Pacific lionfish (*Pterois volitans/miles* complex) invasion began in the Atlantic Ocean. The non-native lionfish travelled up the eastern coast of the United States then further east to the Bahamas. By 2004, the lionfish began to travel south within the Caribbean and continue to travel toward South America. The lionfish population in the Caribbean have since expanded to alarming numbers, rapidly consuming native fish and have high reproductive rates. One strategy in controlling the increasing population of lionfish is to encourage human consumption of this fish. However, this poses a possible problem in the Caribbean as there is high prevalence of Ciguatera Fish Poisoning. In the Caribbean, there is the presence of a tropical dinoflagellate, *Gambierdiscus toxicus*. This dinoflagellate contains a gambiertoxin used for self-defence, which biomagnifies and biotransforms to ciguatoxin as it moves up the food chain. World-wide, over 400 species of fish have been found to accumulate the ciguatoxins in their tissues. Recently, the USFDA added the Lionfish to their list of species that may contain ciguatoxins. These toxins affect humans neurologically and gastrointestinally. For this study, 33 lionfish samples were collected from the United States and British Virgin Islands and were processed for ciguatera toxin extraction using the United States Food and Drug Administration (USFDA) established protocol. The lionfish were collected at depths ranging from 6 to 32 m. The lionfish samples were 133-361 mm in total length and 40 –708 g in weight. Lionfish flesh was grinded followed by four consecutive extractions. Acetone was used to extract organic compounds, hexane to defat (remove non polar compounds), and chloroform to extract slightly polar compounds. The extract was purified via solid phase extraction. No controls were necessary as the data were independent of each other. The extracted ciguatoxins were sent to USFDA for toxicity analyses. Previous analyses showed that 40% of lionfish samples were shown to contain ciguatoxins in harmful amounts. We continue our research to solidify these finding, find correlation between location and toxicity and correlation between liver analyses and muscle analyses. Our results would allow our local government agencies and other organizations to make better informed decisions regarding the use of lionfish as a potential food source.

This research was funded by Department of Interior National Park Service, the NSF HBCU-UP Grant Award No. HRD-0506096 and the ECS Honors Fund.

Examining Rainfall and Temperature Changes on St. Thomas

Kwame Simmons
Dr. David Morris and Dr. Avram Primack (mentors)
University of the Virgin Islands

This project examined weather on St. Thomas over time. To do this weather data collected by the National Climate Data Center from the past 60 years on St. Thomas was used as a baseline. By extracting unnecessary data, creating scatterplots and line graphs to interpret the data, and comparing them to one another the trends of the weather appeared. Comparing the precipitation and temperature data from different years gave an idea of how weather changed over recent decades. Examining the rainfall of Red Hook and the Cyril E King Airport during the years 1989, 1999, and 2009 showed very little change to their rainfall over the years, though the Cyril E. King tends to have more inches than Red Hook. In regards to temperature the sites are basically the same, though over the years summer has stayed around longer and longer. With this baseline data and the weather stations currently being set up around the island we will be able to compare how the weather has and is changing over time and perhaps even predict how it will change in the future.

This research was funded by HBCU-UP (Grant Number-1137472).

Modeling Population Dynamics of US Virgin Islands Corals Between Shallow and Mesophotic Depths Using Long-term Empirical Datasets

Lavida Brooks
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University of the Virgin Islands

Due to natural disasters, climate change and human disturbances, the coral reef population within the Caribbean is being drastically impacted. The actual dynamics of the coral population has not been thoroughly studied. Previous work has been done using age-related models to predict the rise or fall of a particular population of species. However, an age-related model is only appropriate for animals and plants that develop through consecutive life stages (Hughes, 1984). In corals for example, where growth rates may differ due to genetic or environmental differences, and where partial mortality and fragmentation can revert a coral to a smaller (i.e., younger) size class, a size-based model is more appropriate (Hughes, 1984).

While implementing the Leslie Size-Based Matrix Model from Hughes in 1984, our goal is to use our previously collected empirical data on *Porites astreoides*, *Siderastrea siderea* and *Montastraea annularis* of varying sizes and their growth and mortality rates derived from photographic analysis within the shallow (Blackpoint Bay and Coral Bay) and deep depths (College Shore and Seahorse Bay) within St. Thomas, Virgin Islands, and compare the population dynamics between the two depths. Generally, we expect to see that the similar species and sizes of corals should be found in both shallow sites and similarly for the deep sites.

This research was supported by the NIH MARC Research Trainee Program (#5T34GM008422).

Development of Water Quality Labs for General Chemistry at the University of the Virgin Islands

Lorne Joseph , Keturah Bethel, Clyde Joseph, and Micadel Hazell
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Historically, what has been the norm in Chemistry laboratory instruction focuses on skills and rote memorization. Literature has shown that this style of curriculum has low levels of engagement and low levels of retention of student learning. Laboratory instruction should enable students to think critically and analytically and that has not been the case. According to the research, a study conducted by Daniel Domin, four laboratory styles: expository, inquiry, discovery and problem-based are identified. General Chemistry Laboratory curriculums at the University of the Virgin Islands have been formatted in expository and discovery styles up until last year. These types of labs gave step-by-step instructions to students—those types are seen as the "cookbook recipe" methods. The other two that are more hands-on learning styles enable students to create their own procedures and be more involved with the process of learning their way around the lab. These two methods also foster creativity and an opportunity not only to retain what is learned but also to apply the knowledge gained. Research has shown that giving students the opportunity to generate their own procedures improves the chances of students thinking creatively and retaining information longer. For this project, a set of water quality tests were used as a foundation to design new laboratory exercises for general chemistry labs. The choice to incorporate water quality testing was decided based on the ubiquitous appeal water quality measurements have within our island territory. Laboratory exercises and their instructional design are discussed for measuring pH, Turbidity, and Salinity/Total Dissolved Solids.

This research was funded by NSF HBCU-UP (1137472) and supported by the NIH MBRS-RISE Grant# GM061325 through the Emerging Caribbean Scientist Program.

Assessing Change in Water Quality of Southwestern St. Thomas from 1978-present

Lynisha Farrell
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University of the Virgin Islands

In the Virgin Islands, seagrass beds and coral reefs are valuable marine ecosystems. To maintain healthy conditions these habitats must have the correct water quality. There are indications that water quality has declined in nearshore environments of the USVI in the last few decades and this is affecting coral reef health. From 1978 to 1981 scientists measured a baseline of water quality on southwestern coast of St. Thomas that can be compared to modern conditions to understand if water quality has declined and, if so, by what magnitude. In this study water turbidity was measured in the southwestern water bodies of Brewers, Midshore, Offshore, and Perseverance. There was a significant 236% increase in turbidity of Brewers Bay over time ($p < 0.05$), from 0.56 to 1.87 NTU. The Offshore area also showed an increasing trend in turbidity over time, from 0.43 to 0.84, but the change is not significant ($\alpha = 0.05$). The pristine standard of water quality in southwestern waters of St. Thomas has decreased over time. This could be the case for many water bodies near developed areas. Future research could observe the changes to coral reefs and seagrass with the deceasing water quality near developed areas.

This research was funded by NIH MBRS-RISE Grant Award No. GM061325, supported through UVI - Emerging Caribbean Scientists Program.

Perfluorocarbon Tracer Data Analysis Enhancement

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Harmless, odorless, perfluorocarbon gasses can be deployed and captured in order to model environmental airflow using an application called perfluorocarbon gas tracing (PFT). An understanding of numerous airflow related issues within complicated physical environments can be gained using Brookhaven National Laboratory's advancing PFT process. Applications of data from such understandings are directly beneficial towards homeland security, atmospheric research, and nuclear security issues. A demand for more efficient ways to translate, sort, and present PFT data has developed as this process evolves. This internship centered on creating a program that would interact with information from any one of three gas chromatographers' (GC) comma separated value (.csv) formatted data files, as well as .csv files output by machines used for capturing tracer gasses, and various additional external data files. This code is designed to distinguish between varying file states, and coordinate information amongst these data sources, providing the user with a number of calculations and graphical display capabilities. Currently, a functional interface for graphical analysis is being developed, in order to quickly and visually analyze data from thousands of samples in ways that have previously required time-consuming, manual efforts. This ongoing experience poses a creative and analytical challenge, while providing a valuable contribution to an engineering department at a National Laboratory.

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Office of Science.

Mathematical Modeling and Control of Co-transmitting Soil-transmitted Helminthes

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Soil Transmitted Helminths (STH) refer to a group of nematode worms causing human infection through the contact of parasite eggs or larvae which usually thrive in tropical or subtropical regions of the world. These worms usually enter the human body via direct or indirect transmission, sometimes even via skin penetration. Infection by such worms may result in impairment in physical, intellectual or cognitive development. Over the past few years the numbers for individuals being infected by such parasite has greatly increased, raising concerns worldwide. Definitely there is a need for a good understanding of the STH transmission dynamics that may help control the number of infection in order to reduce morbidity in the affected areas of the world.

Mathematical modeling of infectious diseases has proven significantly beneficial in increasing our understanding of the population biology of pathogens and the effects of interventions via the exploration of different infection- or disease related-parameters for their likely outcomes. The use of mathematical modeling for getting insights into STH infection dynamics and control therefore could be highly advantageous. The STH model used in this research is based on a basic model derived from the work of Anderson and Medley. In this, the age-structure of host population is taken into consideration as well as worm population and the different parameters of transmission and contact. All of which are modelled by a set of partial differential equations.

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Search for Near Earth Objects

Odelmo Joseph
Dr. David Morris (mentor)
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History demonstrates that extra-terrestrial objects have collided with earth before causing great disaster. Relatively recent examples include the Tunguska even of 1908 and the Chelyabinsk event of 2013. The Tunguska explosion knocked down an estimated 80 million trees over an area covering 2,150 square kilometers (830 sq. mi). In an attempt to better anticipate or prevent these collisions, the search for NEOs began. According to the George E. Brown NEO survey Act, NASA is to detect 90 percent of NEOs with diameter of 140 meters or greater by 2020. NEOs are any objects outside the Earth's atmosphere that orbit within our solar system. NEO's generally consist of comets and asteroids. Comets are composed of frozen gases, rock, and dust and are roughly the size of a small town. When a comet's orbit brings it close to the sun, it heats up, emitting dust and gases into a giant glowing nucleus. Along with comets, asteroids are the next potential hazards that pose a threat to colliding with earth. Individual asteroids are classified by their characteristic spectra, with the majority falling into three main groups: C-type, S-type, and M-type. These were named after and are generally identified with carbon-rich, stony, and metallic compositions, respectively. A NEO's brightness and variability reveals information concerning the location speed, and whether or not the NEO is rotating as it orbits. The Virgin Islands Robotic Telescope (VIRT) at the Etelman Observatory is planned to help detect and track NEOs. As a first step in the VIRT's NEO tracking program, the sensitivity of the telescope in tracking unknown objects must be determined. In this work we test whether the VIRT is capable of detecting a known NEO of magnitude M~12. We will observe a known asteroid to determine the VIRT's sensitivity to NEOs. We use the "blinking technique" to verify that objects detected are NEOs rather than artificial satellites of artifacts. At the end of the program, data from a known asteroid was taken and it was concluded that the VIRT is capable of finding and tracking NEOs of at least M<12 in reasonable exposure times (t <~30s). Future work now includes using this same technique to search for previously unknown NEOs. New NEOs will be tracked to determine relative velocity, true space velocity, and mass.

Acknowledgements: NASA EPSCoR grant NNX13A28A, UVI HBCU-UP #1137472, and the Emerging Caribbean Scientist (ECS) Program.

Updating the Analytical Chemistry Curriculum I

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Determination of the composition of Soda Ash using acid-base titrimetric analysis

The main goal of this project was to update the analytical chemistry curriculum and develop new experiments that could be used in the analytical chemistry curriculum. Various experiments were done to test the instrument that was used.

The first experiment involved the analysis of a mixture of sodium bicarbonate and sodium carbonate or Soda Ash, Na_2CO_3 and $NaHCO_3$. Soda Ash has significant economic importance because of its applications in manufacturing glass, chemicals, papers, detergents, and many other resources. This chemical has been used since ancient times. For instance, the ancient Egyptians made glass containers from soda ash (borosilicate glass) and the early Romans expanded its use as an ingredient in medicine and bread. Soda ash comes from Trona ore which is a dry mined to recover the ore (mineral) from seams below the surface. One of the largest known Trona deposits is found in Green River Basin which is located in southwestern Wyoming. The Green River facility converts Trona ore to soda ash this is done in a multistep purification process. This is done by crushing Trona which is then heated to remove unwanted materials. This process converts the ore to commercial grade soda ash. Water is finally added and the solution is filtered to remove all impurities. Lastly, this is then boiled to form crystals. The goal of this experiment was, by using the Microlab data acquisition system, was to validate the ability to accurately determine the percent composition of soda ash using titrimetry.

Using standardized 0.1160M HCl a measured sample of soda ash was titrated and monitored using a calibrated pH electrode. The titration curve demonstrated the expected results, with the pH of the soda ash solution at ~12.5, which decreased as acid was added. The two inflection points appeared as expected and at the expected pH. The first equivalence point indicates the protonation of carbonate ion represented by $CO_3^{-2} + H^+ \rightarrow HCO_3^-$ and the second equivalence point indicates the second protonation of bicarbonate, $HCO_3^- + H^+ \rightarrow H_2CO_3$.

Determination of Ka values for monoprotic and diprotic molecules

The purpose of this experiment was to determine the Ka values for a monoprotic and diprotic product. The Ka is equilibrium constant for the partial ionization of “weak acids” in water. In this case, the weak acid is p-Amino Benzoic Acid. The Ka value roughly looked about 10^{-6} For a monoprotic acid, the acid dissociation constant, K_a, is equal to the pH at the half-neutralization point. Titration of a known amount of weak acid using standardized base allows one to determine the volume required to completely titrate the acid. The pH at one-half this volume is equivalent to the pK_a. The same process was used to titrate a diprotic acid (tartaric acid), and using the same process, both pK_{a1} and pK_{a2} values were determined. Comparison of our results with literature values showed close agreement (+/- 0.5 pK units) for both experiments.

This research was funded by NSF HBCU-UP Grant Award No.1137472.

Evaluating Physiology and Behavior of Hair Sheep Ewes at Weaning

Serena Joseph , Whitney Preston, and Amy Jung
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Agricultural Experiment Station, University of the Virgin Islands

Weaning involves the process of transitioning the nutrient source of the offspring from a combination of milk from the dam and forage, to having the offspring rely totally on forage or concentrate feed for nutrition. The weaning process at St. Croix UVI Agriculture Experiment Station Sheep Research Facility involves placing the ewes and their lambs in a pen with no feed or water for up to 48 hrs. The objective of this study was to evaluate the impact of water restriction during the weaning process on the packed cell volume (PCV) of ewes and their behavior regarding water consumption immediately after the weaning process. St. Croix White (n=18) and Dorper x St. Croix White (n=16), ewes were used. Each ewe had at least one lamb during the process of weaning. Lambs were weaned at 63, 90 or 120 days of age as part of an ongoing study to evaluate weaning age impact on lamb and ewe productivity. The weaning procedure was the standard method used at the UVI-AES Sheep Research Facility, with the addition of sample collections. On Day 1 ewes and their lambs were placed in a pen with no feed or water where they stayed for 24 hr. Before being placed in the weaning pen ewes were weighed and had a jugular blood sample collected to determine PCV. On Day 2 the lambs were removed from the ewes and provided access to feed, forage and water. The ewes remained in the pen without water for another 24 hrs. On Day 3, prior to being released from the weaning pen, ewes were weighed and a second blood sample was collected and PCV was measured. As the ewes were released from the weaning pen their behavior was monitored to observe if they stopped at the water trough to drink or just continued walking into the pasture to graze and merge back with the flock. After conducting the experiment we concluded that there was no significant difference of the distribution of ewes that consumed water compared to the ewes that did not. 88% of St Croix White and 93% of Dorper x St Croix White ewes did not drink. There was a difference ($P < 0.01$) in the pre- and post-weaning weight of ewes in St Croix White and Dorper x St Croix White ewes (40.7± vs. 5.8 vs. 35.1± vs. 6.0 kg and 41.9 ± vs. 8.8 vs. 34.3± vs. 6.6 kg, respectively). There was no difference ($P > 0.01$) in pre- and post-weaning PCV in St Croix White and Dorper x St Croix White ewes (28.5± 4.4 vs. 29.0± 3.6 % and 28.0± 5.2 vs. 29±5.8 %, respectively). These data indicate that the 48-hr period of water deprivation during weaning has no significant impact on the behavior or physiology of hair sheep ewes under tropical conditions.

This research was funded by NIH MBRS-RISE Research Program Grant Award No.GM061325 and supported by the Emerging Caribbean Scientist Program.

Effect of Foliar Spray Application of Calcium and Phosphorus on Fruit Production of Zucchini (Cucurbita pepo)

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The UVI Aquaponics System is a food production technology which integrates tank fish culture components with hydroponic vegetable cultivation. The integration conserves land and water and recovers waste nutrients from fish into a valuable vegetable crop. The primary waste from fish metabolism is ammonia-nitrogen which is converted by biological nitrification processes into nitrate-nitrogen which is used by plants to grow stems and leaves. Previous research at UVI-AES has focused on the production of lettuce and other leafy vegetables. Research has been limited on production of fruiting plants which need phosphorus and calcium to promote fruit set and produces quality fruit.

The purpose of this study was to quantify zucchini production when foliar sprayed with different levels of calcium and phosphorus. To determine the effect of calcium on the zucchini production we look at both the marketable and nonmarketable production. In the calcium group, five set of plants were treated including a control group that was not treated. The application rates of 0.0 (control), 1.25, 2.50, 3.74 and 5.0 mg/l were applied weekly to the plant leaf surfaces. The plant that was sprayed with a 3.75 mg/l concentration of calcium was most effective and had a great production of zucchinis, 33.9/m^2 for the production period. The control group however produced a high amount of unmarketable zucchinis (28.5/m^2). The marketable yield mass of 7.5 kg/m^2 with the 3.75 concentration was most effective.

The same method was used to determine the effect of different levels of phosphorus on the zucchini plants. Five sets of plants were used for this experiment including a control group. The application rates of 0.0 (control), 0.5, 1.0, 1.5 and 2.0 mg/l where applied weekly. The plant that received the 1.00 mg/l concentration of phosphorus was most effective and had a great production of marketable zucchinis. It also yielded the highest mass (7.4 kg/m2). The plant that received 0.50 mg/l concentration of phosphorus was yielded the greatest number of unmarketable zucchinis.

Foliar application of both calcium and phosphorus was effective in elevation production number and mass for zucchini grown in an aquaponic system. Future research will evaluate combined nutrients to further enhance production.

This research was funded by UVI WRRI - 2013VI243B.

Influence of Extended Refrigeration on Pea Seed Viability

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Peas are a commercially grown vegetable that is nutritious in providing the human body with various minerals, vitamins and anti-oxidants. The purpose of this study was to evaluate the influence of refrigerated storage on snap peas (*Pisum savitum*) and snow peas (*Pisum macrocarpon*) seed viability after four years. A germination viability test was conducted using six varieties which were replicated in petri-dishes with each treatment containing 50 seeds. Results indicated that the four year refrigeration 4 years significantly reduced the seed viability of the snap pea varieties “Super Sugar Snap (23%)”, “Sugar Sprint (35%)”, and “Cascadia (24%)”. There was no change in the germination rate for the snow pea varieties “Little Sweetie” and “Oregon Giant”. The “Mammoth Melting Sugar” snow pea variety had an increased rate of germination by 15% indicating a possible after-ripening. Refrigerating seed for four years can be used to maintain seed viability for the selected snow peas varieties but not for the selected snap peas.

This research was supported by USDA-Hatch and USDA-NIFA-Insular Tropical Grant funds.

Detection of Ehrlichia in Ticks of Odecoileus virginianus (White-tailed deer) from the Virgin Islands National Park

Shanan Emmanuel and Tasha Corneille
Dr. Jennilee Robinson (mentor)
University of the Virgin Islands

Ticks are among the notorious hematophagous vectors known to carry deadly zoonoses. Research has shown that the deer in the US are host to two prominent species of ticks, *Ixodes scapularis* and *Amblyomma americanum*. These ticks are vectors of bacteria including Ehrlichia, Rickettsia, Anaplasma, and Lyme disease. These bacterial diseases threaten both wild and domestic animals, and are capable of being spread to humans.

The goal of this study was to identify what species of ticks are on the invasive *Odocoileus virginanus* (white-tailed deer) found in the Virgin Islands National Park (VINP) and whether these ticks are infected with potentially pathogenic Ehrlichia. We hypothesized that *Ixodes scapularis* and *Amblyomma americium* were present on the deer of the VINP and host Ehrlichia.

Ticks were collected from two deer found dead from the VINP and preserved in ethanol. Ticks (n=40) were chosen randomly and observed according to their distinguishing features to identify their species. All 40 ticks were triturated then heated overnight at 55 °C. DNA was extracted from the lysates using the Qiagen DNeasy Blood and Tissue Kit, then stored at -20 °C. Universal oligonucleotide primers that targeted ixodid 12S mitochondrial rDNA confirmed the recovery of PCR amplifiable DNA. Tick DNA extracts (n=18) were chosen at random, then screened for Ehrlichia with two rounds of PCR, a primary and nested round of amplification. DNA agarose gels (1.5%) were used for viewing PCR results.

The ticks ranged from larvae, nymph and adults (partially and fully engorged ticks. The 12S mitochondrial rDNA amplicons confirmed the recovery of amplifiable DNA for 40 (100%) of DNA extracts. Ticks were morphologically identified as either *Rhipicephalus microplus* (cattle tick) or *Anocentor nitens* (tropical horse tick). *Ixodes scapularis* or *Amblyomma americium* were not present on the two deer in the study. DNA agarose gels did not reveal amplified DNA following primary PCR for Ehrlichia. Nested PCR resulted in a band of the expected size, which indicated the presence of Ehlichia canis in at least one sample. It can be concluded based on the results, that the tick species *Ixodes scapularis* and *Amblyomma americanum* are not present on the USVI. However, there is a form of *Ehrlichia canis* present.

This research will expand the awareness of the citizens of the USVI on what species of ticks are present in the territory and the pathogens they may possess. It will also enable persons in authority to take action where further importation of the *Odocoileus virginianus* is concerned, as the deer may pose as a potentially fatal threat to native wildlife.

To further broaden on the investigation, preserved tick specimens will be exported for confirmation of species. Furthermore, screenings for other tick-borne pathogens like Rickettsia, Anaplasma and Lyme disease will be performed.

This research was funded by Grant Number: HBCU-1137427 and the
UVI NIH RISE Program (GM061325).

MyTrail: Trail Tracking and Map Creation without GPS Usage

Shelsa S. Marcel[1]
Dr. Jay Ligatti[2] and Dr. Larry Hall[2] (mentors)
[1]University of the Virgin Islands, [2]University of South Florida

This research focuses on an approach to track trails and create maps solely through the use of inertial sensors and distance measuring tools. GPS positioning and navigation is limited in its availability, coverage and security. This fact can have significant repercussions for our military, emergency response, business and private sectors. As a result, our approach works to contribute to solving the issue of GPS tracking limitations with specific application to the problem of bike trail tracking/ mapping. Our method uses ubiquitous sensing by employing a mobile phone application and sensors (accelerometer, speed/distance measurement, gyroscope, and compass) attached to a bicycle, a novelty in approaching this problem. This setup equips the user with the ability to track/map a trail by gathering data while riding the bicycle. The trail is later mapped by sending data to a computer which produces a map of the trail with the only potential GPS use being that of the provision of starting and ending coordinates. The sensors gather data on distance, direction and inclination. The result will be a precise map created without the limitations of the need for pre-marked routes and GPS navigation present in earlier approaches at solving this problem.

This research was funded by NIH MBRS-MARC Grant Award No. 5T34GM008422-20, supported through UVI-ECS (Emerging Caribbean Scientists) program.

Investigation in the Use of Infrared Spectroscopy to Determine Metal-Ligand Binding Constants

Suresh Sookraj
Dr. Stanley Latesky (mentor)
University of the Virgin Islands

The understanding of metal ligand binding constants is important for a number of reasons in relation to biochemical and chemical processes. In biochemistry, they are important in the understanding of the mechanism of binding metal ions to proteins and enzymes. For example, they aid in the transport of essential metal ions across cellular membranes and the removal of iron from the body. In nuclear chemistry, these studies are important to the understanding of the separation of radionuclides during the manufacturing and waste processing of nuclear materials. In the past, the customary approach in determining binding constants consisted of titration and gravimetric methods. This study, using iron, chromium, and copper (metals usually found in high concentrations in the preparation of radionuclides) sought to determine the validity of using infrared and ultraviolet-visible spectrophotometry to determine binding constants for a variety of metal-ligand complexes. First, we had to learn how to use two analytical instruments- the Varian Fourier-Transform Infrared Spectrometer (FTIR) and the Varian Ultraviolet-Visible Spectrometer (UV-Vis). We had to construct a library of FTIR spectra of common chemicals using three different sampling techniques- Attenuated Total Reflectance (ATR) of solids, liquid sampling and ATR sampling of liquid mixtures. With the instruments we determined the same binding constants using both FTIR and UV-Vis spectroscopy by obtaining spectra of various metal and ligand concentrations from solutions which we diluted ourselves. We then used software that allows us to perform spectral subtraction which lets us remove unwanted solvent and background spectra. After determining the constants with the instruments, literature research was done in order to find the actual metal-ligand binding constants value. Finally, using statistical analysis, we compared our determined constants with the researched constants and evaluated whether FTIR and UV-Vis can be utilized to determine metal-ligand constants.

This research was funded by HBCU-UP (Grant Number-1137472).

Recovery of High Quality DNA from Ixodid Ticks Collected off Odocoileus Virginianus (White-tailed Deer) in the Virgin Islands National Park

Tasha Corneille and Shanan Emmanuel
Dr. Jennilee Robinson (mentor)
University of the Virgin Islands

In recent years, there have been numerous tick-borne diseases reported in the continental U.S. In hearing this, one cannot help but to wonder whether or not the United States Virgin Islands are at risk in the spread of tick-borne diseases. The Virgin Islands National Park (VINP), is a popular site for tourist attraction and a home to White-tail deer (*Odecoileus virginianus*). They were once brought to the Virgin Islands for recreational purposes and are currently under investigation to see if they host ectoparasites that may carry pathogens. Considering how these deer can potentially lead to deadly diseases such as *Rickettsia*, *Anaplasma* and *Babesia,* deer that reside in the VINP national park are vehicles of these tick-borne diseases that could ultimately land on a passer-by.

To conduct this research project, ixodid ticks were identified to the genus-level based on their morphological type, life stage, and gender. DNA extraction was done on a series of 40 deer ticks using the Qiagen DNAeasy Blood and Tissue Kit. The efficiency of the Qiagen DNAeasy ticks were analyzed based on the concentration and purity of the tick DNA extractions using UV spectroscopy. Data from the spectroscope was measured from six ixodid deer ticks (1, 15, 25, 27, 30, 34). For ticks 1 and 25, the 230 wavelength expressed high contaminant levels. Also ticks 1, 25, 27, and 34 at the 325 wavelength reported values that indicated high particulate levels present in the sample. Furthermore, three ticks, (27, 30, and 34) had low DNA yield whereas ticks (1, 15 and 25) yielded concentrated DNA extractions. Overall, tick 15 showed no sign of large particles or other contaminates. Moreover this sample had high levels of tick DNA with a concentration of 203g/ml. To further acknowledge the quality of these tick DNA extractions, gel products were compared. As expected, tick 15 had conversely high quality DNA, as visualized by clean, bright bands on the gel electrophoresis results.

To understand the levels of low yield DNA present in DNA extractions, the Qiagen kit troubleshooting section stated that lower yields could be attributed to poor storage prior to DNA extraction and that DNA yields are dependent on the type, size, age and the storage of material. Despite the flaws present in the DNA extraction, the Qiagen DNeasy Blood and Tissue kit was effective at yielding high quality tick DNA.

This presentation was supported by the UVI HBCU-UP Program
(Grant Number-1137472).

Applying Gene Ontology Enrichment Analysis to Increase Understanding of Cellular Responses

Thalia Lake
Dr. Mark Craven (mentor)
University of Wisconsin- Madison

The cells of living organisms are controlled by complicated systems. "Cellular systems could be understood by using a measure of similarity to select sets of genes. After identifying these sets of similar genes one can understand what is going on in the cell. High-throughput experiments can be used to measure the behavior of many genes at once under different experimental conditions. Next, computational methods can be performed to identify clusters of genes with similar measured attributes. We can do this by performing Gene Ontology enrichment analysis to two datasets, one relevant to circadian rhythms and the other to HIV replication. Gene Ontology provides a structured vocabulary that describes cellular components, molecular function and biological processes. We found that there is some enrichment in each cluster and each cluster has different terms associated with them. We can use the knowledge gained by this research to potentially guide future biological discoveries that are relevant to improving human health.

This project was done as part of the Integrated Biological Sciences Summer Research Program (IBS-SRP). We acknowledge the support of the National Science Foundation (DBI 1063085), NSF grant IIS-1218880, by the NHGRI grant supporting the Genomic Sciences

Evaluating Papaya Fruit Quality

Tyrone Pascal
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The papaya (Carica papaya is a popular fruit that originated in the South America and the Caribbean. The size and fruit quality are key factors in the development of papaya varieties. The purpose of this research was to evaluate fruit quality through the measurement of fruit length, width, weight, soluble sugar content, flesh thickness, and flesh color. The varieties used in this experiment were Maradol, kY, TW, Tainung 5, UVI, and YN1. The hybrids used were FWxC, HYx5, Maradol x Yong Nong, and Tw x Tainung 5. The varieties and crosses were replicated across 3 blocks which received different treatments of fertilizer. Fruit data was collected for seven months from October 2012 to April 2013. Variances in TW were present in the fruits' weight, length, and width. In the UVI varieties, variances were present in fruit weight, length, width, and sugar content.

This research was supported by USDA-Hatch and USDA-NIFA-Insular Tropical Grant funds.

Abundance and Reproduction of the brown alga Dictyota in Brewers Bay, St. Thomas, VI

Zola N. Roper
Dr. Teresa Turner and Dr. Tyler Smith (mentors)
University of the Virgin Islands

Since the 1980's coral populations have decreased and algae populations have increased. The brown alga *Dictyota* has been the most abundant genus within the Caribbean. Therefore, we need to understand the biology of *Dictyota*. The main focus of this research is to observe reproductive patterns in the different species of *Dictyota* and also seasonal patterns of abundance along different areas in Brewers Bay on St. Thomas, U.S. Virgin Islands. Sampling of *Dictyota* spp. will be done every month starting from January 2014. A 20 m linear band transect was laid perpendicular to the shoreline, 1 m deep and 2 m deep. Then a 0.25 m^2 divided quadrat was placed every 2 m evenly spaced 10 times along the transect line. The quadrats were subdivided into 25 squares (each representing 4% of the quadrat), and percentage of *Dictyota* spp. combined was recorded. There was an average of 5.8% cover of *Dictyota* spp. found in the month of January and an average of 6.5% cover of *Dictyota* spp. found in the month of February. The largest percentage found was that of *Dictyota menstrualis*, but I also found *Dictyota pinnatifida* and *Dictyota pulchella*. There was no sign of reproductive presence found on the algae collected in January. In February, there was the presence of female gametophytes on *Dictyota menstrualis*.

This research was funded by HBCU-UP (Grant Number-1137472).

Judges

NAME	INSTITUTION	TITLE
Marra Austrie	Dept of Labor, DIV. OF Occupational Safety and Health	Industrial Hygienist Biomedical/Environmental Egr UVI 3-2 Engineering Alum
Akima Williams	Dept. of Planning and Natural Reseouces	Chemical Engineer UVI 3-2 Engineering Alum
Dexter Hypolite	V.I. WAPA	Electrical Engineer UVI 3-2 Engineering Alum
Michelle Peterson	Univ. of the Virgin Islands	Assoc Prof of Biology
Al Hassan I. Musah	Univ. of the Virgin Islands	Professor of Biology
Eric Douglas	Univ. of the Virgin Islands	Asst Prof of Process Tech Process Technology Director
Stuart Ketcham	Univ. of the Virgin Islands	Prof of BioChemistry
Kwame Garcia	Univ. of the Virgin Islands	State Director, Cooperative Extension Services
Robert Godfrey	Univ. of the Virgin Islands	Research Prof of Animal Sc Director, Agricultural Experiment Station
Nicholas Drayton	Univ. of the Virgin Islands	Project Assistant Director
Celil Ekici	Univ. of the Virgin Islands	Asst. Professor of Mathematics
Kofi Boateng	Univ. of the Virgin Islands	Assoc. Director of Cooperative Extension Services
Lawrence Lewis	V.I. Government Univ of the Virgin Islands	Former Commissioner of Agriculture Former Special Assistant to the V. Provost of Research & Public Service
Donald Bailey	Univ. of the Virgin Islands	Research Specialist III (AES)
Stuart Weiss	Univ. of the Virgin Islands	Research Specialist II (AES)
Kynoch Reale-Munroe	Univ. of the Virgin Islands	Bio/Natural Resources Pt Time Faculty, Science
William Coles	Dept. of Planning and Natural Resources	Chief Biologist, Fish and Wildlife
Leia LaPlace	Dept. of Planning and Natural Resources	Research Analyst, Comprehensive and Coastal Zone Planning
Jane Coles	Good Hope Country Day	Science Teacher
John Munro	Univ. of the Virgin Islands	Assoc. Prof of Computer Information Systems

Judges con't.

Don Cox	Univ. of Wisconsin-Madison	Emeritus Professor of Physics
Stafford Crossman	Univ. of the Virgin Islands	Ext Asst. Professor Assistant Director, Agriculture & Natural Resources
Harold Francis	St. Croix Educational Comp	Biology Teacher
Andre Francis	St. Croix Central High Univ. of the Virgin Islands	Chemistry Teacher Grad Stud, MMAT
Ann Marie Gibbs	St. Croix Educational Comp	Biology Teacher
Dawn Grey	Good Hope Country Day	Chemistry Teacher
Gemma Y. Bognot-Dijamco	St. Croix Educational Comp	Science Teacher (Bio/Chem)
Tanya Nichols	St. Croix Educational Comp Univ. of the Virgin Islands	Science Teacher (Chem) Pt Time Bio Instructor
Joann Lewis	St.Croix Educational Complex	Science Teacher(Bio/Phys/Chem)
Meria Marcel	St. Croix Educational Complex Univ of the Virgin Islands	Mathematics Teacher MMAT Grad Cohort I Pt Time Math Instructor
Christa Molloy	St. Croix Central High School	Assistant Principal (Former Math Teacher)
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Zina Dore	St. Joseph High School	Mathematics Teacher
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Dalma Williams	St. Croix Educational Comp	Science Teacher (Bio/Chem)
Jeffrey Whelan	St. Croix Educational Complex Univ. of the Virgin Islands	Mathematics Teacher Pt Time Math Instructor MMAT Grad, Cohort I
Cicely Ferguson	Arthur Richards Jr. High	Science Teacher
Cletus Emmanuel	Arthur Richards Jr. High Univ. of the Virgin Islands	Mathematics Teacher Pt Time math Instructor
Whitney George	Univ.of the Virgin Islands	Scientist, AES

Notes

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Judges

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