Eleventh Annual

Summer Student Research Symposium

July 26th, 2013
St. Thomas Campus
College of Science & Mathematics
University of the Virgin Islands

11th Annual Summer

Student Research Symposium

Friday, July 26th, 2013
University of the Virgin Islands
St. Thomas Campus, U.S. Virgin Islands
Administration and Conference Center

Event Organized by
Emerging Caribbean Scientists Program
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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.

2013 Participants

Mathematics Behind the Science	Summer Sophomore Research Institute	Summer Undergraduate Research Experience
Aliyah Joseph	Ariane Ramsundar	Abigail Rene
Anisa Otto	Ayanna Hogan	Andy Breton Peralta
Cashaun Fraser	Bonnie President	Anthonio Forbes
Danelly Samuel	Jahnelle Rivera	Denny Smith
Danielle Lewis	Jarvon Stout	Gejae Jeffers
Davindra Ramsundar	Joshua Hazell	Jamall Marsh
Duane Thompson	Kwame Simmons	Jamila Martin
Eliakin Del Rosario	Odelmo Joseph	JoAnn Thomas-Lewis
Jakesha Descartes	Osei Wallace	Khalin Nisbett
Kai Vincent Richardson	Shanan Emmanuel	Leo Jobsis
Kaleb Liburd		Luverne Lavinier
Meritzer Lawrence		Nicholas Cromwell Jr.
Micaiah Williams		Recaldo Rogers
Patrick Leonard		Sena Hussein
Peron Trotman		
Samantha Nystrom		
Sharone Richards		

Summer Program Descriptions:

- Math Behind the Science (MBS) Program - This residential, summer bridge program is designed to enhance the mathematics readiness of college-bound STEM students by preparing them to enter the introductory calculus course and provide a foundation for success.
- Summer Sophomore Research Institute (SSRI) - This summer research program 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) - By participating in this program, students that are selected as SURE Fellows work closely with UVI faculty on challenging scientific research projects across a variety of STEM disciplines.

Summer 2013 Research Symposium Presenters

Molecular Characterization of Haemogregarine Parasites in Caribbean Reef Fish

Akacia Halliday
Jennilee Beth Robinson, PhD. and Amber McCammon, MS (mentors)
St. Thomas, University of the Virgin Islands

Haemogregarines are Apicomplexan protozoans that live within the cytoplasm of blood cells. These parasites have been reported in the blood of fish since 1901 and have been found in fish all over the world. In the Caribbean. There has only been one known species of haemogregarines reported, although we hypothesize that there may be more than one species present in Caribbean fish. In this study we evaluate whether the haemogregarines present in fish are all of the same species.

Blood samples were taken from numerous fish species captured on local reefs either by snorkeling, diving, or the assistance of a local fisherman. Blood was removed from the spinal cord vein of anesthetized fish using a diabetic syringe. Afterwards, live fish were returned to the reef or fisherman. Fish blood was used to create blood smears on microscope slides and the remaining blood was mixed 50:50 with 95% ethanol for preservation. The blood smears were visualized with Wriight's stain and screened for the presence of haemogregarines using a 100X compound light microscope objective with oil immersion. Once infection was confirmed by microscopy, DNA was extracted from the remaining fish blood using the Qiagen DNeasy Blood and Tissue Kit. PCR targeting overlapping fragments (1.3 kb and 1.65 kb each) of haemogregarine 18S rDNA was used to amplify regions of the gene from present within the fish blood DNA extract. Sequencing of PCR-amplified DNA cloned on a plasmid in *Escherichia coli* will be done to identify the species of haemogregarine present.

We expect to recover a mixture of clonal plasmids for sequencing where the plasmid inserts are from either haemogregarine DNA or other 18S rDNA from the fish blood DNA extract (including fish rDNA genes or rDNA genes of other eukaryotic pathogens found in fish blood). Other researchers report difficulty with the specificity of haemogregarine primers within the high background of host rDNA. Therefore, we will sequence several clones from our library, and use haemogregarine 18S rDNA sequences to improve the specificity of our PCR assay. This research will allow us to design an improved, specific molecular assay for the detection of haemogregarine DNA. Such an assay is rapid for diagnosis of fish infection compared to microscopy and is also useful for future studies of the pathogenesis and transmission mechanisms of haemogregarine infection.

This study was conducted as Directed Independent Research at the University of the Virgin Islands.

Design and Implementation of Autonomous Weather Monitoring Agents Using The Java Agent Development Environment

Andy Breton and Jamall Marsh
Dr. Marc Boumedine (mentor)
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 by NSF HBCU-UP grant #1137472 and the University of the Virgin Islands.

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

Anthonio Forbes[1]
Amber McCammon[1,2] and Dr. Paul Sikkel[2] (mentors)
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Keywords: Caribbean, Habitat, Haemogregarine, Parasite, Pomacentridae

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). Support was provided in part by NIH MBRS-RISE grant #GM061325.

Correlation Between Human Dimensions and Impaired Water Quality

Anthonios Doliotis and Kenisha Pascal
Dr. Wayne Archibald, Dr. Kala Fleming, and Dr. Avram Primack (mentors)
University of the Virgin Islands

Impaired marine near shore waters are associated with many terrestrial subwatersheds in the Virgin Islands. 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. In order to establish correlations between the human dimension of land development and poor water quality, a comparative study examining demographic data from the Virgin Islands 2010 Census and EPA STORET station data on water quality for 2009 to 2011 is being conducted. The location of each station was plotted using ArcGIS. 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.

This research was funded by the Water Resources Research Institute.

Rainfall Patterns on St. Thomas

Ariane Ramsundar
Dr. David Morris and Dr. Avram Primack (mentors)
University of the Virgin Islands

The spatial variability of rainfall on St. Thomas was examined for the years around 1972-2013 using data from the National Climate Data Center (NCDC) and data that we gathered from new weather stations that we put out on different sites such as Botany Bay and Estate Mandahl. The distribution of rainfall showed some dependence on location. NCDC weather stations located in Charlotte Amalie Cyril E. King Airport and Fort Mylner showed ratios of 1.3:1 for monthly and annual accumulations. Data from our recent stations shows that windward sites tended to show higher rainfall at Botany Bay. Using these sites I was able to compare the precipitation data over the time periods. The data showed continuous change overtime between the areas of the island respectively to their precipitation patterns. With the historical data and future data from the weather stations being currently installed at different sites we were able to analyze how the weather has change and will be changing in the near future. This will be useful for future research into climate change. Further research and the new weather stations will provide tools for examining the effectiveness of environmental protection strategies.

This research was funded by the NSF HBCU-UP grant (#-1137472).

An assessment of salt pond ecological characteristics in high and low human impact areas on St. Thomas, USVI

Ayanna Hogan
Dr. Renata Platenberg (mentor)
St. Thomas, University of the Virgin Islands

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 on St. Thomas 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 are awaiting lab analysis. There were differences between impacted and non-impacted ponds in turbidity, total dissolved 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, which may be more indicative of hydrology than water quality. Further analysis of the collected water samples are expected to show higher nutrient levels in impacted ponds. The results of this study has determined that there is a difference in water characteristics between high and low impact ponds and the reason behind this difference will require further study of the ponds' ecological properties.

This research was funded by the Emerging Caribbean Scientists Honors Fund and NSF HBCU-UP grant #-1137472.

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

Bonnie President
Dr. David Morris (mentor)
Etelman Observatory, St. Thomas, 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. 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 6a 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 the NSF HBCU-UP grant (#-1137472).

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

Denny Smith
Dr. Marc Boumedine (mentor)
University of the Virgin Islands, Marine Science Center, St.Thomas Campus

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 are 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 the NSF HBCU-UP grant (#-1137472).

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

Gejae Jeffers,[1] Jamila Martin,[1] Michelle Zimberlin,[2] and James Pinckney, Ph. D.[2]

Mentors: Bernard Castillo II, Ph.D.[1] and Kynoch Reale-Munroe[1] (mentors)

[1]University of the Virgin Islands
[2]University of South Carolina

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. In order to investigate the vertical distribution of phytoplankton, chlorophyll a concentrations were obtained in both Mangrove Lagoon and in 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 middle of Mangrove Lagoon, the mouth of Mangrove Lagoon and two 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 mg/L) compared to the other three sites. We also observed that during the day, chlorophyll a concentrations were highest near the bottom compared to the top meter. During the night, we have seen chlorophyll a concentration spread throughout the top and bottom meter.

This research was funded by NSF HBCU-UP Grant Award No. #- 1137472 and Department of Interior National Park Service.

Developing feeding preference methods: Starvation affects feeding preferences of long-spined black Sea Urchins *Diadema antillarum*

Jahnelle Rivera and Jarvon Stout
Dr. Teresa Turner (mentor)
University of the Virgin Islands, St. Thomas USVI

Sea urchins are important herbivores that eat macroalgae. In the 1980's there was a massive die off of sea urchin *Diadema antillarum* throughout the Caribbean. This die off led to an increase in macroalgae which led to a decrease in coral cover. This is because the algae overgrow the corals. To determine the effects of sea urchins and algae and how to increase urchin numbers, feeding preferences of urchins need to be known. Thus, we developed methods of testing feeding preferences in a sea water system. We conducted four cafeteria style experiments. For each experiment we collected approximately 20 urchins, and placed each in individual containers. We used algae abundant on the reef in Brewers Bay St. Thomas, U.S. Virgin Islands. We tested the red alga *Acanthophora spicifera* and the brown alga *Dictyota dichotoma* and found *Acanthophora* was preferred (t-test, $p<0.01$).This may explain high *Dictyota* cover on Caribbean reefs. Our experiments also showed that starvation changes food preferences. In the experiment without starvation of urchins the red alga *Acanthophora* was eaten more than the brown alga *Sargassum polyceratium* (t-test, $p < 0.01$), but with 5 days starvation *Sargassum* was preferred. These results may have been influenced by many factors, such as stress on the urchins, loss of algae during the experiment, variation in algal chemistry, urchin size, and previous diet.

This research was founded by Grant Number : HBCU-1137472.

Comparative Study of Nutrient Content in Salt River Bay and Bioluminescent Mangrove Lagoon, St. Croix, US Virgin Islands

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

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 –200804 and the Department of Interior National Park Service.

Methods to Explore Mechanisms of Parasite Resistance by Invasive Lionfish, *Pterois volitans* and *P. miles*

JoAnn Thomas-Lewis
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St. Thomas, University of the Virgin Islands

Natural predators for fish usually consist of other fishes as well as endo/ecto parasites. Invasive lionfish in the Caribbean, *Pterois volitans* and *Pterois miles (*Scorpaenidae*)*, have no natural predators. Preliminary data from an experiment conducted at Coral World suggested lionfish are resistant to ectoparasites. Ectoparasite loads were compared between individual blue tangs, *Acanthurus coeruleus,* (Acanthuridae) and *P. volitans* placed in a *Monogenea* (Platyhelminthes) -infested aquarium. *A. coeruleus* was heavily populated with monogeneans vs. the lionfish which in a single case had one monogenean on its body. Another ongoing survey has suggested higher parasite numbers on native Pacific lionfish than Caribbean lionfish. This led to the research question: Why is the Caribbean lionfish resistant to these ectoparasites? We hypothesized that the basis of the lionfish resistance is their immune response to ectoparasite attachment. An overview of teleost immunity, as well as, potential methods for investigating *P. volitans'* responses to ecoparasites will be presented. For example, other studies have identified an increased production of the proinflammatory cytokine IL-1 in parasitized fish skin. Therefore, IL-1 expression levels could be detected in punch biopsies of fish tissue with an attached ectoparasite by indirect immunofluorescence assay (IFA) or via quantitative PCR for the IL-1 gene.

This research was funded by the NSF HBCU-UP grant (#-1137472).

Ultraclean and Chloroform Yield High Quality DNA From White Mangroves (*Laguncularia racemosa*)

Joshua Hazel and Abigail Rene
Alice M. Stanford, Ph.D. (mentor)
College of Science and Mathematics, University of the Virgin Islands

Mangroves are an important part of our coastal ecosystem. They help protect coastal areas from tsunami and hurricane damage and serve as habitats for juvenile fish, insects, and small crustaceans. Knowledge of mangrove population diversity would help us determine what activities threaten the population and what conservation and restorative measures would be most effective. To determine the diversity of the mangrove population, DNA samples must be extracted and amplified. Mangroves are specially adapted to harsh environments such as marshy anoxic anaerobic soil and fluctuating salinity of the water bodies in which they grow; they synthesize high amounts of polysaccharides, polyphenols, and other secondary metabolites such as alkaloids and flavonoids which impede DNA extraction (Sunil Kumar Sahu et. al, 2012). This study investigated white mangroves (*Laguncularia racemosa*) from the U.S Virgin Islands and Jamaica using three protocols: a standard CTAB protocol, a modified CTAB (Xin and Chen, 2012), Master Pure ™ Plant DNA purification kit, and UltraClean to determine which protocol would yield the purest DNA sample. Extracted samples were subjected to further cleanup using sodium acetate, proteinase K, and RNase H (ribonuclease H). The extracted DNA was analyzed using a UV spectrophotometer under dilution factors of either 50 or 20. In terms of quality RNase H and chloroform yielded the purest DNA with A260/A280 ratios of 1.86 and 1.77 respectively. Quantitatively, UltraClean and the modified CTAB and yielded DNA concentrations of 116.25 ng/uL and 79 ng/uL respectively. These results indicate that despite the chemicals that impede DNA extraction, high quality genomic DNA can be obtained and used for further genetic studies.

Funding for this research was provided by the National Science Foundation (NSF) HBCU-UP grant #-1137472.

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

Khalin E. Nisbett , Gejae Jeffers, Lorne Joseph and Jamila Martin
Bernard Castillo II, PhD 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. 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 samles 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. The extracted ciguatoxins were sent to USFDA for toxicity 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. #-1137472, and the ECS Honors Fund.

Examining Rainfall and Temperature Changes on St. Thomas

Kwame Simmons
Dr. David Morris (mentor)
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 the NSF HBCU-UP grant (#-1137472).

Determining Host Range and Prevalence of Intracellular Parasites in Caribbean Pomacentrids

Kyle Jerris[1]
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Keywords: Caribbean, Haemogregarine, Intracellular, Parasite, Pomacentridae

Protozoan intracellular blood parasites called haemogregarines, prey on the eurethyrocytes of fish and other wild life. A number of marine fish families have been shown to be infected by haemogregarines in the Indo Pacific and in the tropical western Atlantic and Puerto Rico. This study aims to confirm the hosts of haemogregarine blood parasites among damselfish (Pomacentridae) in the eastern Caribbean. A minimum of 10 individuals are sampled from at least 5 species of damselfish. Potential host fishes are collected as needed by snorkelers or SCUBA divers using hand nets and modified cast nets. Live fish are housed in open-sea water flow wet tables at the MacLean Marine Science Center. After removal from holding tanks, fish are anaesthetized with clove oil, measured (fork, total and standard length) and thin films are prepared from blood taken from the caudal vein using small gauge needles (2-3 films per fish). Additional blood is placed in microcentrifuge tubes and frozen for subsequent genetic analysis. Slides are air dried, fixed with methanol, and stained with phosphate-buffered Giemsa solution prior to microscopy screening. Haemogregorine-like structures have been observed in samples from multiple species. However, further screening must be conducted to compare haemogregorine prevalence among-species. The objectives of this work is to establish which Pomacentrid species carry haemogregarine loads and thus determine overall prevalence of infection, and to identify individual samples with heavy parasitemias for future imaging and genetic analysis.

Support was provided by the College of Science and Mathematics at the University of the Virgin Islands.

Erosion in the Magens Bay Area

Leo Jobsis
Dr. David Morris and Dr. Avram Primack (mentors)
University of the Virgin Islands

This multi-part project seeks to establish weather stations around the island of St. Thomas, then find sites for and build NRCS regulation erosion stations on the island, and then compare data from the erosion stations to rainfall and other possible weather factors in erosion. Many of the previously operational weather stations around the island are now defunct, and there is little erosion data on the island of St. Thomas. Due to problems with equipment and site-finding, the erosion project was refocused to the immediate area surrounding Magens Bay, using in-lab regulated tests on 12”x6”x4” soil samples extracted from the field by hand, including a standardized erosion test, a soil water uptake test, a clay content test, and, of course, simple observation. Soil samples on the North side of the bay were found to contain much more clay than samples from the south side of the bay, suggesting that the soils had been moved less, and so less erosion was taking place. Organic content had a much larger presence on the slopes and forested areas than on the beach and grassy areas. Research is ongoing, and more research needs to be done.

This research was funded by the NSF HBCU-UP grant (#-1137472).

Association of STEM success and Mathematics preparedness

Luverne Lavinier-Phillip
Dr. Kostantinos Alexandridis (mentor)
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Globally colleges and universities are having difficulties producing graduates in STEM. Information from the Digest of Education Statistics show that while Business, Social Sciences and Education degrees conferred in 2009-2010 reached several hundred thousand while , the numbers conferred in STEM courses still linger between thousand and ten thousands The University of the Virgin Islands (UVI) is no exception. Of the number of bachelor degrees bestowed upon recipients in 2010-2011, while 49.7% were in the business field, Science(biology and biomedical, Chemistry and physics), Technology, Engineering and Mathematics combined pooled a mere 17.4%. Research evidence suggests that there are several factors influencing the rate at which stem majors graduate; one of these deciding factors being level of preparedness. Reviews of several papers indicate that some students entering are ill prepared to undertake traditional college courses. This evidence has forced 90% of colleges to institute what are known as placement tests. This study sets out to validate the extent to which the measured level of readiness is likely to impact achievement in STEM. To understand the level of impact that readiness or its lack thereof has on achievement in STEM courses; quantitative data from SATs and UVI placement are statistically analyzed in association with achievement in the first Science course at the university, Science 100. The statistical data analysis allows us to validate whether this proposition holds true particularly for the University of the Virgin Islands. It will also allow evidence-based inferences for programs to be implemented or reinforced, teaching and learning experiences, and mentoring and advising of students, more specifically freshmen evaluated for maximum effectiveness. Finally outcome of this research enables us to investigate additional or supplemental factors at play in the attrition and low achievement of STEM majors and as a result measures taken to improve retention and achievement.

This research was funded by the NSF HBCU-UP grant (#-1137472) and viEPSCoR (0814417).

Follow-up Observation of Gamma-Ray Bursts Detected by NASA Orbiting Observatories

Nicholas Cromwell
Dr. David Morris (mentor)
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Today's technological advances have allowed for new discoveries that our ancestors would have never thought it existed. A perfect example of this is gamma-ray bursts. Gamma-ray bursts (GRBs) were first detected in the late 1960s by U.S. nuclear test detection satellites, which were designed to sense gamma radiation pulses emitted by nuclear weapons while in space. These bursts are one of the most distant and brightest objects that can be detected within our universe and are also believed to be one of our few insights into understanding more about the structure and evolution of our universe. NASA operates several satellites built to detect the activity of GRBs; the importance of this study is to use the Etelman telescope to make follow-up observations of these GRBs after they have been identified by NASA satellites. We began by examining the capabilities of the telescope to determine the precision of the telescope and to further understand the telescope's capabilities and by preparing the telescope's automated response software, which allows it to respond to any automated triggers. In addition, we worked on getting the computers at Etelman to communicate with the computers at the Goddard Space Flight Center. We plan to test and verify this communication system and to examine some already well-known GRBs to determine how well we are able to identify these objects and to catch some new GRBs as they take place.

This research was funded by the NSF HBCU-UP grant (#-1137472).

The Search of Near Earth Objects Using The Etelman VI Robotic Telescope

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The objective of this study was to search for known and unknown NEOs. History proves that foreign space objects collided with earth before causing great disaster. 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 202. NEOs are any objects outside the earth's atmosphere that orbit within our galaxy. NEO's generally consist of comets and asteroids. On each night of observing "darks" and "flats" would be first taken with the telescope. Darks and flats are needed to clean up the pictures taken and make the data more interpretable. For any known asteroids an ephemeris was made to keep track of the asteroid. Frames were taken of the known area with hope that the asteroid was there. Once an object is detected through the blinking of frames, the brightness and light flux is measured to fully confirm that it is an asteroid. Theories have been thought of and formulated about riding asteroids to mars or other neighboring planets. The search for NEO's may prove to be beneficial and lifesaving. While only known asteroids were examined during the summer, future work is in progress to continue analyzing the night's sky in search of unknown asteroids.

This research was funded by the NSF HBCU-UP grant (#-1137472).

Updating the Analytical Chemistry Curriculum II

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Rainwater is free from impurities except for those that are picked by rain from the atmosphere and from physical contact with materials. Wind- blown dust (Here in the VI, "Sahara Dust" is a known problem), decomposing organic matter, fecal droppings from birds and animals on the catchment areas can be sources of contaminations of rainwater, leading to health risks from the consumption of contaminated water from storage tanks. Clean catchments and storage tanks supported by good hygiene can offer drinking-water with low health risk, whereas a poorly designed catchment and storage system can affect the human population greatly by having high health risks. Pathogens such as Cryptosporidium, Giardia, Campylobacter, Vibrio, Salmonella, Shigella, E. Coli and Pseudomonas have been detected in rainwater. These bacteria are representative of different pathogens that can be found in rainwater, however, rainwater usually carriers a lower rate of these pathogens than can be found in other water sources. Due to atmospheric CO_2 rainwater is slightly more acidic than stream water. Acidic rainwater can dissolve heavy metal salts (e.g. those containing Zn, Cu, Al, and Pb) and other impurities from materials of the catchment and storage tank. In most cases, chemical concentrations in rainwater are within acceptable limits; however, elevated levels of zinc and lead have been reported.

Ligands are ionic or neutral Lewis bases (electron pair donors) that can bind to a central metal atom or ion (Lewis Acid). Ligands act as Lewis bases (electron pair donor), and the central atom acts as a Lewis acid (electron pair acceptor). Ligands have at least one donor atom with an electron pair used to form covalent bonds with the central atom. In this case the ligand we used is 1,10-phenanthroline.

In this study, we will be develop an experiment for use in the analytical curriculum in which we will be able to simultaneously determine the binding constants for a series of M-L complexes and determine the metal ion concentration for a series of metal ions unknown water samples. We then will use the developed method to test cistern water for the presence of Fe and Cu. For our initial studies, the two metal ions that were used for this experiment Cu^{2+} and Fe^{2+}. The Fe complex is octahedral and has a maximum absorbance at 550nm. The Cu complex is distorted tetrahedral and has a maximum absorbance at 725nm and this can be seen using a UV-Vis spectrometer. The concentration of the metal-ligand complexes can be determined spectrophotometrically by measuring the absorbance spectra of a series of standards. The absorbance of is directly proportional to concentration and is modeled using Beers Law (A = abC, where a is the absorptivity constant, b is the cell path length, and C is the concentration). The program HYPSPEC was used to determine the binding constants, K_D for each complex. Each spectra was saved to an EXCEL .txt file, formatted, and then loaded into HYPSPEC. After data analysis, K_D values were determined based on a preset degree of convergence (typically 0.10 %). No more than 100 analysis cycles were required for convergence of the data.

This research was funded by the NSF HBCU-UP grant (#-1137472).

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, $\mathbf{Na_2CO_3}$ **and** $\mathbf{NaHCO_3}$. 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 $\mathbf{CO_3^{-2} + H^+ \rightarrow HCO_3^-}$ and the second equivalence point indicates the second protonation of bicarbonate,
$\mathbf{HCO_3^- + H^+ \rightarrow H_2CO_3}$**.**

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 $\mathbf{10^{-6}}$. 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 the NSF HBCU-UP grant (#-1137472).

Identification of Monogeneans on Caribbean fish using 18S-5.8S rDNA

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Monogeneans are ectoparasitic flatworms that attach to the gills or skin of freshwater and marine fish. The two families of fish that were the focus of this study were the Ostraciidae and the Acanthuridae, which may be parasitized by Monogenea of the genus *Neobenedinia* in the Caribbean. Fish were caught off the western coast of St. Thomas in a local fisherman's traps and placed on ice. Monogeneans were removed from these fish by soaking in freshwater (the result of the thawed ice). Fish were then returned to the fisherman. The water from ancanthruriids and ostraciids was separately filtered through a plankton mesh to collect any ectoparasites. Ectoparasites were placed in a petri dish by washing the filter mesh with fresh water. Next, the parasites were identified by stereomicroscope, separated into individual tubes, and submerged in 95% ethanol for preservation. DNA extraction was performed on triturated monogeneans using the Qiagen DNeasy Blood and Tissue kits. Universal PCR primers targeting the 18S and 5.8s of eukaryotic rDNA was used to copy this genomic region. Agarose gel electrophoresis was used to confirm copies of DNA were amplified from the monogenean DNA extracts in the PCR assay. PCR amplified DNA will be cloned on a plasmid in *Escherichia coli.* DNA sequence data will be useful to determine if *Neobenedenia* spp. are *N. mellini* or a separate species (Candidatus N. paraguensis).

This research was conducted as Directed Independent Research at the University of the Virgin Islands.

Detection of Coliform and Entercoccus in Brewer's Bay

Students of BIO 301: Microbiology for the Health Sciences
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Factors that may influence the number of pathogens in marine water include temperature, rainfall, animals and human waste, as well as run-off from the roads and hills. When these agents are present in beach waters they pose a risk to human health. Water quality can be measured via indicator organisms, such as the coliforms and enterococcus bacteria. These species are from human or animal origin. They also survive as long as, or longer than other pathogens in marine water. Their increased density can indicate the severity of fecal contamination, a source of various human pathogens including bacteria, eukaryotic parasites and viruses. The UVI Microbiology for the Health Sciences (BIO301) summer session class of 2013, measured the concentration of fecal indicator bacteria from three areas on Brewers Bay Beach. We hypothesized these bacteria can be washed downhill into the bay by heavy rainfall. We measured the concentration of enterococci, total coliform, and fecal coliform for three consecutive Mondays in July. Additional samples were collected at UVI's Center for Marine and Environmental Science building grounds near the bay, and two sites east of the bay along the roadside gut that flows into Brewer's Bay when rainfall is heavy. Marine samples (10 ml) were collected using sterile 15ml tubes and diluted to 100 ml using dH2O in sterile bottles. Enterolert or Colilert reagents were mixed samples and incubated overnight in Quanti-Tray 2000 plates. We were able to detect enterococcus, total and fecal coliform in Brewer's Bay water, as well as in the gut leading to the bay. Indicator bacterial concentrations were also compared to daily rainfall amounts.

Support was provided by the College of Science and Mathematics at the University of the Virgin Islands.

Molecular Detection of Tick-Borne Diseases in USVI White-Tailed Deer

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The white-tailed deer, *(Odocoileus virginianus)* provides food and recreation for some, but it can also be a potential threat. *O. virginianus* is the keystone host of the adult lone star tick *(Amblyoma americanum)* and the black-legged tick *(Ixodes scapularis)*, two notorious vectors of deadly zoonoses in the continental US. These zoonoses include Lyme disease, ehrlichiosis, anaplasmosis and babesiosis. Deer ticks also often contain additional endosymbiotic Rickettsiales (Proteobacteria). *O. virginianus* were imported to the USVI for sporting purposes before the establishment of the Virgin Islands National Park (VINP) in 1956. In a 2011 survey, USDA-APHIS identified the tropical horse tick (*Anocentor nitens*) on 4 deer from 3 sites within the VINP.

The aim of this study was to identify the ticks of VI *O. virginianus* and screen them for the presence of zoonotic pathogens. We hypothesized that **white-tailed deer in the VI host additional species of ticks beyond *A. nitens* and these ticks host zoonotic pathogens and endosymbiotic bacteria**.

Ticks were collected from deer (n=2) found dead at two sites in the VINP and preserved in ethanol. Stereoscopic examination of the tick samples revealed *O. virginianus* are heavily infested with morphologically similar larval, nymph, and adult ixodid ticks. This was exciting because US continental *O.virginianus* host mainly adult-stage ticks. Using an identification key we confirmed that none of the ticks were *Amblyomma* or *Ixodes.* Voucher specimens were preserved for species-level identification.

PCR, an assay that can detect and copy specific DNA sequences, enabled screening of tick DNA extracts for known zoonotic pathogens. Some adult and nymphs (n = 40) were individually triturated and incubated overnight in a lysis solution. DNA was extracted using the Qiagen DNeasy Blood and Tissue Kit and stored at -20˚C. Specific PCR assays screened extracts for zoonoses including *Rickettsia*, *Ehrlichia*, *Anaplasma,* and *Babesia.* Another PCR assay employed universal oligonucleotide primers targeting ixodid 12S mitochondrial rDNA to confirm recovery of amplifiable DNA in the tick extracts. The DNA sequence of 12S rDNA amplicons will confirm the tick species. DNA agarose (1.5%) gels were used to view the PCR results. All extracts screened so far by 12S mt rDNA primers indicated DNA was recovered by our extraction procedure. *Rickettsia*-like DNA was detected by citrate synthase PCR in 24 (60%) of the ticks. So far, 15% of these 24 ticks have been tested negative for *Rickettsia*. PCR screening for other species of pathogens is still in progress. Identity of PCR-amplified DNA will be confirmed by sequencing.

Support was provided by the College of Science and Mathematics at the University of the Virgin Islands and the NSF HBCU-UP grant (#-1137472).

Variation in Fish Assemblages Among Sites at Cockspur Island and Tybee Island, Savannah, GA

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Estuaries and surf zones are important habitats for fish. Determining what fish assemblages inhabit estuaries and surf zones of sandy beaches can help government organizations make better management and conservation decisions. The purpose of the present study was to determine the fish assemblages among sites at Cockspur Island and Tybee Island in Savannah, GA. Six sites, including two estuarine sites at Cockspur Island and four surf zone sites at Tybee Island, were sampled once a month from March to June 2013 using a seine net during an ebbing spring tide. A total of 61 fishes at "Cockspur Bay" and 13 fishes at "Cockspur Northeast" were collected. A total of 19 fishes were collected at "Tybee Jetty," 20 fishes at "Tybee 3rd Street," 61 fishes at "Tybee Pier," and only 10 fishes at "Tybee Creek." Tybee Pier was the most diverse site based on the Shannon-Weiner Diversity Index (0.84) with a high number of gulf kingfish *Menticirrhus littoralis* (n=24) followed by Cockspur Bay (0.82) with a high number of spot *Leiostomus xanthurus* (n=20). The diversity in sites were lower for: Cockspur NE (0.47) with a high number of spot (n=8), Tybee 3rd Street (0.37) with a high number of gulf kingfish (n=24) and Florida pompano *Trachinotus carolinus* (n=14); Tybee Creek (0.35) with a high number of spot (n=7); and Tybee Jetty (0.32) with a high number of Florida pompano (n=15). The major finding of this study was that there was a difference in fish assemblages at Cockspur Island and among sites at Tybee Island, GA, thus rejecting the null hypothesis. For example, there was a higher diversity of fish species at Cockspur Bay (13 species) and Tybee Pier (10 species) compared to Tybee Jetty (n=4), Tybee 3rd St. (n=3), and Tybee Creek (n=3). One reason for the high diversity at Tybee Pier might be the fact that the area contains a pier with barnacles, which may provide food for fishes.

This research was funded by NSF OCE (Grant Number-1156525).

ACKNOWLEDGEMENTS

Sponsors:

- ◊ National Institutes of Health, Minority Biomedical Research Support Research Initiative for Scientific Enhancement (MBRS RISE) Program - A New Vision
- ◊ National Science Foundation, Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) - Comprehensive Approach to Retention and Persistence
- ◊ NSF Virgin Islands Experimental Program to Stimulate Competitive Research (viEPSCoR)
- ◊ Emerging Caribbean Scientists (ECS) Honors Fund
- ◊ Jones Holloway Bryan Fund

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Summer Research Mentors:

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Teresa Turner	Jennilee Robinson	Kostas Alexandridis
Stanley Latesky	Avram Primack	Amber McCammon

Math Behind the Science Instructors & Staff:

Andre Douglas	Avon Benjamin	Linda Wymer
Akima George	Odari Thomas	Julie Cruz
Teresa Turner	Marc Boumedine	Jacques Gumbs

A special thank you to

Tanisha Mills
Celia Prince
Stevie Henry
Maggie Rios

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