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ABSTRACTS of Posters Presented

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Division of Science and Mathematics (UVI)

Emerging Caribbean Scientists Program (UVI)

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Mission Statement and Goals

of the Emerging Caribbean Scientist Programs

Mission Statement:

The mission of the Emerging Caribbean Scientist program is to increase research training and promote excellence for students at the University of the Virgin Islands.

Goals:

- Increase the number of students majoring in Science, Technology, Engineering and/or Mathematics (STEM) disciplines
- Better prepare students in STEM disciplines for medical school, post baccalaureate study, teaching and science and technology industry
- Support faculty research, which will in turn support undergraduate student research, through providing funding opportunities for research at UVI and off island
- Provide funding for undergraduate student research
- Provide for role models for UVI students through the visiting scientists program
- Provide for enhanced curriculum through development and adoption of innovative instruction

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Red form of Echinometra lucunter shelter from sunlight more than other color forms

Presenter: Fitzherbert Harry

Faculty Mentor: Dr. Stephen Ratchford, University of the Virgin Islands

Abstract: Ultraviolet light is a growing concern in the world today due to the depletion of the ozone layer. Little research has been conducted on the effects of ultraviolet light on marine life. *Echinometra lucunter* (the rock-boring urchin) are found in the shallows, where they are exposed to sunlight. They come in three color forms: black, red and a mixed red/black form. We asked "Is there a difference in the sensitivity to uv light among the three color forms?" We conducted 50 m^2 transects and 30-min timed swims at several sites around St. Thomas during which we counted urchins of the 3 color forms exposed to sunlight versus the ones found under rocks. A greater percentage of the red urchins than black or mixed were found under rocks. Is this distribution caused by red urchins using rocks to shade them from the sun more than the black urchins do? We constructed four shallow wet-tables with flowing water and small shelters – two tables in sunlight and two in a shaded lab. We placed ten urchins haphazardly in each of four tables. One table in the sun and one in the shade got red urchins; the other two got black urchins. After three days, we recorded the number of urchins found under shelters. Both color forms were more likely to use the shelters in direct sun than in the shaded treatments. Although we have seen no difference between red and black urchins seeking shelter in the sunlight treatment to date, in the shaded treatment red urchins were more likely to be found under shelters than black urchins. The black pigment may provide more protection from damaging UV rays than the red pigment.

Affiliations: The student completed this work in the UVI Summer Undergraduate Research Experience (UVI-SURE) supported by NSF grant "Interdisciplinary Innovations", UVI NSF HBCU-UP Award No. 0506096

Location Proteomics: Using Shape Signatures for Classification

Presenter: Artisha Hector

Authors: Alexia Minots, Artisha Hector

Faculty Mentor: Dr. Robert Stolz , University of the Virgin Island

Abstract: The primary goal of "Location Proteomics" is to automate protein classification through the development of numerical features that can help to identify and differentiate between protein images. The images used are fluorescence microscope images of protein location patterns within cultured cells. These images were obtained from the Murphy Lab at Carnegie Mellon University.

It is believed that the proteins can be classified by their shape signatures and that proteins in the same class would have similar shape signatures. This work involves developing new sets of geometric features that can find dissimilarities between 2-d and 3-d images by creating shape signatures for each protein image. These signatures are derived from shape distributions and probability distributions derived from samples of geometric measures between random points on the images. After these distributions are obtained we employ different norms to quantify the dissimilarities. Before the images are analyzed they are converted to binary images and preprocessed to remove excess background noise and to define clear boundaries. After preprocessing, a shape distribution is found by the calculating the Euclidean distances between random points in the image and constructing a normalized histogram. The shape distributions of different images are compared using the L-2 norm.

Our study focuses on comparing our algorithm's performance using different geometric measures and norms.

Affiliations: This research was supported by an NSF grant "Interdisciplinary Innovations", UVI NSF HBCU-UP Award No. 0506096

Using ADCP Data to Determine Red Hind (Epinephelus guttatus) Fish Spawning at Hind Bank

Authors: Marra Austrie, Afiya Fredericks, & Jodi Hodge

Faculty Mentor: Dr. Nasseer Idrisi, University of the Virgin Islands

Abstract: The purpose of this project is to determine if the spawning period of fish at Hind Bank is at neap or spring tide. We will test the hypothesis that around the full moon Red Hind (*Epinephelus guttatus*) Fish spawn when currents bring eggs northeast on Hind Bank, followed by westerly currents that spread the eggs/larvae onto the bank. The Acoustic Doppler Current Profiler (ADCP) was used to measure the currents speed, direction, backscatter data (signal strength) and temperature at varying depths at the bank. The retrieved data was taken near full moon from December 2005 – February 2006 and was preprocessed in Nortek Storm Software, reformatted, and interpreted in MATLAB.

These students completed this work in the UVI Summer Undergraduate Research Experience (UVI-SURE) supported by NSF grant "Interdisciplinary Innovations", UVI NSF HBCU-UP Award No. 0506096

Presenter: Eddie Parish

Mentor: Dr. Teresa Turner, University of the Virgin Islands

Abstract: Since the mass die-off of the herbivore *Diadema antillarum,* the black long spined sea urchin, in the 1980's coral reefs in the Caribbean have undergone a major phase shift and in many cases reefs are now dominated by macroalgae. In recent years the sea urchins have grown greatly in numbers and may be significant enough to lead another phase change on reefs back to which corals would again be dominant. *D. antillarum* are known herbivores but only recently has a preference in diet been examined and results show that urchin grazing patterns depend largely on type of macroalgae present. Urchins were collected and tagged to identify each urchin. The urchins were then separated into either the control or experimental group, with each of those groups containing a high density group (5 urchins per.25 m^2) or a low density group (1 per 2 m^2). The control group was then placed on a rocky substrate with little algae present while the experimental group was placed on high densities of *Dictyota spp.*, *Caulerpa sertularioides*, or *Halimeda opuntia*. The movement of the urchins was then monitored every 2-3 hr and the distance traveled was recorded. The urchins were monitored at night. *D. antillarum* appear to move less on *Caulerpa sertularioides* (between 1.5-2 m per night) than on the any other substrate. Urchins foraged approximately the same range on *Halimeda opuntia* and *Dictyota spp.*, which was between 3.3-4.1 m per night. Urchins placed a rocky substrate moved between 3.1 and 3.7 m per night on average. The results suggest that urchin grazing patterns are drastically affected by the type of algae present. Urchins are believed to be the key to a return to high coral dominance; however, if urchins do not return in high enough numbers then perhaps the lack of competition will allow urchins to more particular in their diet, thus not removing species of algae most fiercely competing with coral. Urchins travel greater distances when placed on *Dictyota spp.* or *Halimeda opuntia* perhaps because they are not as palatable as other algae. Determining grazing patterns of *Diadema* based on the presence of algae may allow for a better assessment for the ability and likelihood of coral reefs to regain dominance in the Caribbean.

Efficient Acquisition of Fluorescence Microscopy Images

Presenter: Jennifa Mohammed

Faculty Mentors: Charles Jackson, Dr. Jelena Kovacevic, & Dr. Robert Murphy, Center for Bioimage Informatics, Carnegie Mellon University

Abstract: Sub cellular location patterns are revealed through the use of fluoresce microscopy. Fluorophores are added to a cell and this causes the fluorophores to bind to proteins. When an excitation light is shined on the cell, the fluorophores fluoresce and the sub cellular location pattern is revealed. However, often times, the excitation light damages the cell, which is known as phototoxicity and the fluorophores, which is referred to as photobleaching. We present three proposed algorithms for the efficient acquisition of fluorescence microscopy datasets. We evaluate these with a protein classification system based on subcellular location patterns. The goal of this project is to acquire the datasets more efficiently in terms of the speed at which we acquire images, as well as the amount of light that the specimen is exposed to, in order to speed up acquisition and reduce photobleaching. We compared downsampling, reduced resolution, and reduced exposure time. Our results found that downsampling is the most efficient of these methods, but that a combination of all three can yield even better results.

This work is partially supported by NSF grant "Interdisciplinary Innovations", UVI NSF HBCU-UP Award No. 0506096

No differences in DNA sequences from two color morphs of the mustard hill coral Porites astreoides

Presenter: Tryphena Cuffy

Faculty Mentor: Dr. Sandra L. Romano, University of the Virgin Islands

Abstract: Evolutionary biology is based on the process of speciation and the characterization of a species. This process helps with the clarifying species boundaries to aid in the development and understanding of our surroundings. Systematics of scleractinian reef corals (defined by morphological differences) have proven to be controversial. The genus *Porites* is found abundantly in the Caribbean and many Pacific islands. The genus is speciose, but for many of these species there is doubt as to whether they are in fact separate species. This is problematic due to inter- and intraspecific variation within the genus *Porites*. Much research has been done, but it has been difficult to establish a basis of distinction of species among the genus. *Porites astreoides*, a massive coral, is found as two morphs in the Caribbean – green and brown. The genetic similarity between the two morphs has proven to be elusive to scientists because of morphological evidence that supports the hypothesis that they are genetically similar as well as evidence that opposes it. By comparing DNA sequences, I determined the genetic similarity of the two *P. astreoides* morphs to test the hypothesis that the two morphs are a variation of one species and the alternative hypothesis that the two morphs are genetically different from each other. Samples were collected from colonies in St. Thomas, United States Virgin Islands. Genomic DNA, including nuclear and mitochondrial DNA, was extracted from samples of both green and brown morphs of *P. astreoides* for polymerase chain reaction (PCR) amplification of two mitochondrial gene regions. PCR products were cycle sequenced and electrophoresed on an automatic sequencer. Sequences were analyzed, aligned and edited using Sequencher®. There were no differences in nucleotide sequences between any of the samples. These results thus far do not support the hypothesis that the two different morphs are genetically distinct from each other. Continuing work on this project includes more samples of *P. astreoides* and analyses of nuclear DNA sequences to more comprehensively test the hypotheses that the two morphs of *Porites astreoides* are genetically distinct and that the species *Porites branneri* (distinct in morphology and bluish in color) is synonymous to *Porites astreoides*.

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Species diversity of fish and shrimp in gut streams is related to land development and human activities in St. Thomas, USVI.

Presenter: Duvané Hodge & Rifca Mathurin

Faculty Mentors: Dr. Donna Nemeth, University of the Virgin Islands & Renata Platenberg, Virgin Islands Division of Fish & Wildlife

Abstract: St. Thomas, Virgin Islands, is characterized by steeply-sloped hillsides that channel water flow after heavy rains in defined watersheds or guts. This creates freshwater stream habitats that typically consist of a series of pools that are connected by flowing water. Encroaching human development, with its potential negative inputs of sewage, sedimentation, and chemicals could further limit the ability of this variable habitat to support aquatic life. To determine whether human activity has an impact on the ecological community of the guts, we selected 3 St. Thomas guts that varied in degree of development, collected water quality data, identified the shrimp and fish species inhabiting them, and performed some tests. Overall, 5 species of shrimp and 4 species of fish were identified in the freshwater guts of St. Thomas. The individual guts varied in terms of which species were present. Over the course of the nine month period that we had been visiting and obtaining data from the various streams, we noticed a decrease in the overall species' population and diversity. To relate levels of development to water quality that could impact the habitability of the gut for different species, we measured temperature, pH, total dissolved solids, salinity and conductivity in several pools within each gut. Water samples were collected and tested for the presence of Nitrogen & Phosphorous. Phosphorous concentration was elevated in the area that we predicted had the most human disturbance. We observed a variation in the rainfall pattern during the spring, summer and fall months. While human development has great potential to influence water chemistry and hydrology of these gut habitats, and impact communities through the introduction of exotic species, natural seasonal variation in water flow is also likely to have a significant effect on the species assemblages present.

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Preparation and Fractionation of Cytotoxic Natural Products Extracts for High-Throughput Screening Application

Presenter: Digna Washington

Authors: Digna Washington,[1] Ben Winer,[2] Charles Zhu,[3] Kirk Gustafson,[3] & James McMahon[3]

Abstract: In the quest for new anticancer therapeutics, natural products represent a rich source of bioactive metabolites. A significant number of the new anticancer drugs in clinical trial were either derived from or natural product inspired compounds. The National Cancer Institute – Molecular Targeting Development Program screens extracts collected from a diverse range of organisms (eg. plants, fungi and marine organisms) for anticancer activity. Crude extracts were initially screened via a 60-cell line assay, which assessed the extracts ability to inhibit the growth of cancer cells. High-Throughput screens were used to guide the fractionation of the identified active extract. New fractionation methods were tested with the expectations that it is possible to isolate the pure anticancer active metabolite(s). Additionally, this process would be used to eliminate promiscuous cytotoxins.

[1]University of the Virgin Islands
[2]College of William and Mary
[3]Molecular Targeting Development Program, CCR, NCI

Identification of Metabolic Markers for Bleaching in the Coral Porites astreoides

Presenter: Semoya Phillips

Faculty Mentor: Dr. Tyler Smith, University of the Virgin Islands

Abstract: Coral reefs are an important marine habitat. Bleaching, loss of symbiotic zooxanthellae, is one of the largest threats to coral reefs worldwide and is often thermally induced. It occurs when ocean water temperatures exceed a specific threshold temperature. Coral bleaching is the loss of the photosynthetic symbiotic zooxanthellae from a coral polyp. Bleached corals may survive by consuming plankton; however they are often weaker and more susceptible to disease. This study is attempting to identify metabolic markers for bleaching in the coral *Porites astreoides* (mustard hill coral) by comparing healthy versus thermally stressed samples maintained in aquaria. Initially each of twenty colonies was placed in aquaria each with their own water flow. An ambient water treatment of 29.5 C and a heated water treatment of 30.9 C. Ten samples were taken at the beginning of the one week treatment period for exudate and whole tissue sampling. The remaining ten samples were placed under their respective treatments and they were also used for exudate and whole tissue sampling. Visual comparisons after the initiation of stress validated that the corals in the heated treatment were thermally stressed. Though one week was too short of a time period for bleaching to occur, the coral in the heated treatment formed mucus build ups or completely cocooned them with mucus. Using liquid chromatography mass spectrometry, small molecules collected from the surrounding environment and whole tissues are being compared from the different treatments. While some samples are continuing to be analyzed, to date five markers have been detected. These markers still need to be identified. Future work for this project includes testing the markers for time relevance, i.e. do these markers correspond to five days before bleaching occurs?.

The student worked in the UVI Summer Undergraduate Research Experience (UVI-SURE) supported by NSF grant "Interdisciplinary Innovations", UVI NSF HBCU-UP Award No. 0506096

Controlling a Virtual Environment During an Acrophobia Therapy

Presenter: Kailah Davis

Faculty Mentors: Dr. Boris Bracio & Payal Jalan
University of Alaska Fairbanks[1]

Abstract: There are millions of people who suffer greatly from phobias which include fear of flying, fear of heights and many more. The ultimate goal of our project is to create a virtual environment that can be used for virtual reality therapy, in our case acrophobia, better known as the fear of heights. Three sensors were incorporated during the therapy sessions. These sensors measured heart rate, skin temperature and blood pressure. With the use of sensor information that is sent to a computer workstation, we were able to create a formula based on the three sensors values to compute the patient's fear factor level. As the patient's sensor information increases the patient's fear factor increases, which results in a change in the virtual environment during a therapy session. Due to the fact that the virtual environment sceneries are contingent upon the patient's fear factor, as the patient's fear level intensifies, the virtual environment becomes more terrifying. The patient's therapy session will end when the patient's fear factor level reaches the maximum, which is one hundred. Computing a fear factor that controls the environment allows the virtual reality therapy to be more effective and successful. Two computer workstations were used to send sensor information in order for the fear factor to be computed. The sensor information was first sent to one workstation using Matlab, a high level computer language which is use for analysis and numerical computation. Once these information were stored in this workstation, the values were sent to another workstation. To effectively communicate between both computers, the computers were connected to each other through the parallel port. This allowed information to be sent from one workstation to another. Due to the fact that most computers have a female twenty-five pin D-SUB at the back of the computer, a male parallel port cable was used to connect both computers allowing the sensor information to be transferred from one computer to another. To send the sensor information to the parallel port a program in Matlab was created. Once this was done, the second computer would read the three values that were sent to the parallel port. To read these values on the second computer a program was created on a Linux machine using C++, a high level programming language. Successfully sending and receiving information through the parallel port allowed the sensor information to be transferred, allowing us to use the information to compute the patient's fear factor which was previously described. Currently, the prototype that has been designed is being improved upon and as a result little testing with actual patients has been done. The on going work deals with incorporating more sensors and creating different virtual environment sceneries that can treat different phobias.

This research was funded by the Arctic Region Super Computing Center at the University of Alaska Fairbanks and by NIH MARC program MARC 2 T34 GM008422 at the University of the Virgin Islands.

When does Sigma Preserve Addition

Presenter: Everard Bellot

Faculty Mentor: Dr. Douglas Iannucci, University of the Virgin Islands

Abstract: Sigma (which is represented by the Greek letterσ) is an arithmetic function which sums up the divisors of any natural number. Let m and n be natural numbers for which σ(m) and σ (n) denote the sum of the positive divisors of the natural numbers m and n respectively. It is well known that σ (mn) = σ (m) σ (n) as long as m and n are relatively prime, i.e. that have no common divisor. In this project we will try to find properties which m and n must have for which σ (m+n) = σ (m) + σ (n).

The student completed this work in the UVI Summer Undergraduate Research Experience (UVI-SURE) supported by UVI NSF HBCU-UP Award No. 0506096.

Influence of Cassava Starch on the Growth of Bacteria

Presenter: Victoria Henry

Faculty Mentor: Dr. Thomas W. Zimmerman, University of the Virgin Islands

Abstract: Cassava is a native annual crop grown in many tropical and subtropical regions that forms starch storing tuberous roots. Cassava starch is used for both human food and industrial purposes including the starch found in paper. Cassava starch can also be used as a thickening agent. The purpose of this research was to evaluate the use of cassava starch as a thickening agent in supporting gelled bacteria media. Cassava starch was added at the levels of 0, 20, 40 g/L to Luria Bertani (LB) medium solidified with 4 g/L Gelrite. Both *Escherichia coli* strain DH5 and *Agrobacterium tumefaciens* strain EHA 105 were the sources of bacteria streaked on the treatment media plates. *E. coli* produced large colonies within 48 hours while *A. tumefaciens* required 72 hrs to differentiate. Bacteria media containing cassava starch resulted in *E. col*i and *A. tumefaciens* growing as well as or better then LB medium with agar.

The student completed this work in the UVI Summer Undergraduate Research Experience (UVI-SURE) supported by UVI NSF HBCU-UP Award No. 0506096.

Pineapple Micropropagation

Presenters: Tanicia Corke

Faculty Mentor: Dr. Thomas Zimmerman, University of the Virgin Islands

Abstract: Columbus reported pineapples being grown and eaten here on his arrival to the Caribbean. Pineapples originated in the tropical American region and has been distributed and grown throughout the world's tropical area. Pineapple has potential to become a major crop in the Virgin Islands for both home owners and small farmers. However, there is a limited supply of pineapple material for planting. The objective of this study was to evaluate the use of Benzyladenine (BA) and Kinetin (Kin) for micropropagation of three new pineapple varieties. The pineapples varieties were 'Cabezona', 'Kew' and 'Golden Super Sweet'. Cuttings, 2 cm in length, of each variety were grown in Murashige and Skoog (MS) liquid medium or MS with both BA and Kin at a concentration of 2 mg/L. After 35 days the proliferating clumps of shoots were separated, counted and transferred to gelled MS medium without plant growth regulators. The BA & Kin medium resulted in significantly more plants than the control. BA and Kin can be used to efficiently micropropagate these pineapple varieties.

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Discovering Associations between Environmental Factors and Coral Stress

Presenter: Sharice Richardson

Faculty Mentor: Dr. Marc Boumedine

Abstract: Corals are colonial organisms that are composed of thousands of individual animals called polyps. Most reef-building corals are found in warm, clean, tropical shallow waters and have a symbiotic relationship with photosynthetic algae, called zooxanthellae, that lives within their tissues. Due to unfavorable environmental stresses related to changes such as the sea temperature, light intensity and salinity this symbiotic relationship may be interrupted. The lost of the zooxanthellae is known as coral bleaching. The purpose of this research is to detect relationships or associations between environmental variables and coral stress due to environmental changes prior to coral bleaching. Association Rules are the most popular representation for patterns in data mining. In this research, the Apriori association rules algorithm uncovers hidden patterns among the NOAA station datasets. These patterns are described in the form of rules. The relevance of each rule is analyzed and the rules with the greatest confidence describe the strongest patterns in the datasets.

A sequence mining approach for predicting normal and abnormal environmental induced coral reefs bleaching events

Presenter: Trevis Baker

Faculty Mentor: Dr. Marc Boumedine, University of the Virgin Islands

Abstract: In this preliminary work explore the usage of sequence mining techniques to derive normal or abnormal environmental conditions prior, during and after coral reef bleaching. Sequences of events are derived to identify frequent and infrequent environmental patterns. These patterns are then used to determine which environmental conditions are more likely to induce coral bleaching, or be most favorable to coral reef recovery. After presenting the sequence mining algorithm, examples of event sequences will be analyzed. The viability of this approach is finally discussed on NOAA CREWS data sets.

Fine Tuning the Multi-Layer Perceptron and the J48 Algorithms to Predict Coral Reef Health

Presenters: Javier Navarro & Keridon Williams

Faculty Mentor: Dr. Marc Boumedine, University of the Virgin Islands

Data mining algorithms are studied to predict coral reef health based on environmental stressors such as water salinity, sea temperature, light intensity etc. One important aspect of data mining algorithms is to fine tune the learning parameters that will permit to increase prediction accuracy rates. This research focuses on learning parameters of two predictive algorithm families: artificial neural networks and decision trees. In specific, we will be comparing the multi-layer perceptron and the C5.4 algorithm to determine which combination of learning parameters in each case gives the highest percentage of correctly classified instances and therefore allow us to infer the best predictions. Experiments use NOAA CREWS 2005 data sets. This research is currently in progress.