Sixteenth Annual

Summer Student Research Symposium

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CULTURALLY DIVERSE
VIRGIN ISLANDS

ABSTRACT BOOK

August 3rd, 2018
10:00am to 12:00pm
Sports & Fitness Center
University of the Virgin Islands

16th Annual Summer
Student Research Symposium
Abstract Book

Friday, August 3rd, 2018
Sports & Fitness Center
St. Thomas Campus
University of the Virgin Islands

Event Organized by

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

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Amino Complex Binding

Ahmad Abdul-Samad, Kiwanee Smith, and Emely Henriquez
Mentor(s): Dr. Stanley Latesky
University of the Virgin Islands

Amino acids are organic compounds containing amine and carboxyl groups and are found in and around the human body (in certain foods and animals). Over time, your body can produce some of them and supplement the rest, but what if something goes wrong? We are testing to see how transition metal solutions can bind to two biochemical compounds and how they could possibly react in the human body. We started by creating a TRIS HCl (hydroxymethyl) aminomethane buffer of varying pH, the amino acid solutions, and the metal solutions to test by varying pH first, then by concentration in the spectrometer. When testing by pH, we took small beakers and measured specific amounts of each solution into the beaker, which would hopefully give some sort of noticeable chemical change/reaction. After this was finished, we took specific amounts of each metal and buffer and slowly added the amino acid after each measurement in the spectrometer to look at varying concentrations of the compounds. As a result, the graphs of some of the absorbances are very funny due to precipitation in some solutions. Also, there had been a definite change in absorbance levels for every solution tested. At the time of writing this abstract, we are still finding out where certain metals are binding and what would be their effect on the human body after binding them together. Hopefully in the future, researchers can come forward and continue the research that we've done and make greater discoveries.

The Blood Traveler: Apicomplexan Blood Parasite of Dusky Damselfish

Antonae Anthony, Shakilah Liburd, Makeda Mills and D'Shaunique Walters
Mentor(s): Dr. Jennilee Robinson
University of the Virgin Islands

Apicomplexa are intracellular protozoan parasites that infect a wide array of host animals including birds, reptiles, fish, invertebrates, **humans**, and other mammals. Apicomplexa are responsible for severe human diseases such as cryptosporidiosis, toxoplasmosis and malaria, but little is known about other natural apicomplexan infections. In the Caribbean, some of the most abundant coral reef fish, *Stegastes adustus*, (dusky damselfish) are infected with Apicomplexa parasites in their red blood cells. To characterize the host range, life cycle, and route of transmission of these parasites, our goal is to develop methods to isolate and detect them in infected fish blood samples. **We hypothesize that the number of apicomplexan infections in the dusky damselfish will be distinct from the previous years due to the recent hurricanes**. To test our hypothesis, we captured 10-15 dusky damselfish from their natural reef habitat at seven different sites, collected blood, and released them. At each site, a 25m line transect was used to record the density of all six *Stegastes* species, as well as *Stegastes adustus* individuals. We developed several detection and isolation methods which include screening of Giemsa-stained thin blood smears by microscopy, and a polymerase chain reaction (PCR) assay specific to the 18S rDNA of the fish parasite. By microscopy, we detected a 14% (10 of 71) rate of infection compared to 2016 and 2017 with a 24% (24 of 100) rate of infection. Moreover, three of the seven sites had no infected fish. This was a decrease in the amount of infection. Therefore, further research will include attempts to isolate infected cells using a Percoll density-step gradient, and Western blot analysis using antibodies specific for Toxoplasma surface antigens in order to further classify this parasite. The significance of the research is to have a positive impact on future mitigation of severe human diseases through the application of this natural apicomplexan infection to provide clues for new treatments or preventive measures.

Short term Fidelity by Symbiotic Crustaceans to Host Anemone Varies by Species

Brad Arrington
Mentor(s): Dr. Stephen Ratchford
University of the Virgin Islands

The corkscrew anemone (*Bartholomea annulata*) is host to many species of symbiotic crustaceans including: *Ancylomenes pedersoni, Alpheus armatus, Periclimenes yucatanicus,* and *Stenorhyncus seticornis*. The purpose of this research was to determine if these symbiotic crustaceans remain at their host anemones or move to different anemones over a period of days. In summer 2018 we counted the number of each type of crustacean at 50 anemones at an offshore reef and in the nearshore shallows of Brewers Bay, USVI. We assumed that if the crustaceans were loyal to their anemones then the same number of crustaceans would be seen on each anemone day to day. We quantified this loyalty by calculating an R^2 value. R^2 is a statistical value (0-1) to denote how well data fit a linear model, in this case comparing crustacean number at anemones day to day. The higher the R^2 value, the higher is the crustacean's fidelity. Among *A. pedersoni*, the R^2 values for the offshore site over the 7 -day period ranged from 0.838 – 0.919, indicating that the *A. pedersoni* have high fidelity; then the R^2 value significantly dropped to 0.246 following a storm event. Other species had lower fidelity. The crustaceans at the inshore site also showed high fidelity with R^2 values ranging from 0.634 – 0.935. Fewer *A. pedersoni* were found at the offshore site at night than during the day, indicating that the cleaner shrimp may be moving around to other anemones at night. The next steps include determining why the crustaceans may move.

Quick, Catch!…Preparing For LVC O3 with the VIRT and Zadko

Jonisha Aubain[1]
Mentor(s): Dr. Bruce Gendre[2]
[1] University of the Virgin Islands, [2]University of Western Australia

To prepare for the LIGO Virgo Collaboration 3rd observation run (LVC O3), techniques for doing more efficient observations of large sky areas where a gravitational wave source is located are investigated. One major way of performing more efficient observations is to reduce the region of the sky where gravitational wave sources are least likely to be formed. A search algorithm code was tested using data from GW170817 to find possible improvements to the current method of gravitational wave search. Six parameters that affect efficiency and their possible improvements were discovered. When applied we expect a significant reduction of imaging time compared to a blind search.

Revitalizing The U.S. Virgin Island Climate Monitor

Treston Benjamin
Mentor(s): Dr. Brice Orange and Dr. David Chesney
University of The Virgin Islands

Since the tragic passing of the category 5 hurricanes Irma and Maria, the Virgin Islands lost their small network of weather stations which studied and collected data on the micro climates around the islands. Without these stations, the Virgin Islands cannot join the Federal Drought Monitoring program, which allows for participants to receive federal financial aid in time of droughts. These stations are crucial in joining this program because there has to be some form of baseline in rain rates and monitoring to know when a drought is actually passing from when it is not. This project is putting up new, more technologically advance, stations to aid and replace the previous ones. These new Davis Vantage Pro II stations will allow the Virgin Islands to follow and hopefully predict these micro weather changes, and ultimately help the Virgin Island to get on this Federal financial program to ease residents financial in the time of droughts.

Water Quality and BleachWatch

Shamoy Bideau and Nicholas Durgadeen
Mentor(s): Caroline Pott, Austin Stovall, and Lisa Terry
University of the Virgin Islands and St. Croix East End Marine Park

Water quality is a factor that has effects on all marine organisms. Water quality encompasses the physical, biological, and chemical parameters of a water source. Five sites within the St. Croix East End Marine Park were tested for eight (8) different parameters: coliform bacteria, dissolved oxygen, biochemical oxygen demand, nitrate, pH, phosphate, salinity and Temperature. The five sites were ranked by averaging daily total scores. Solitude East had the best overall water quality, while Coakley Bay had the lowest average daily total score.

Coral reefs play an important role in marine environments, but are threatened by poor water quality. Hard coral cover on reefs have been severely threatened and due to their rapid depletion, are being significantly replaced by macroalgae. Surveys consisted of observations on reefs at four (4) bays within the St. Croix East End Marine Park. Notes and observations included percent coral cover, coral species identification, other surrounding benthic structures, impacts (bleaching, paling or diseased) and mortality. Fifteen quadrats surveys were conducted at each of the four sites chosen. Turner Hole had the highest percentage of hard coral cover, but the least species diversity of all sites. Macroalgae was a constant observation throughout all sites. Bleaching was even observed at Cheney Bay.

"An Interrupted Song": The Effects of Anthrophony on the Red-Eyed Coqui

Jahnyah Brooks
Mentor(s): Dr. Renata Platenberg and Jessica Nagel
University of the Virgin Islands

Frogs are vertebrates that use sound to communicate for breeding and territorial defense. While vocalizing, there are other sounds in the environment that can influence frog behavior, such as wind blowing, crickets chirping, or cars driving by. We want to know if sounds produced by humans, specifically those of cars, have any influence on frog calling activity, which could affect breeding success. If frogs are disturbed by cars enough to reduce calling activity, this may decrease their ability to attract females, and breeding success may decrease. We tested the hypothesis that the sound of cars does not influence frog calling activity by recording frogs in two locations with moderate traffic, using an SM3BAT bioacoustics recorder set to capture sound within the audible frequency range of frogs. We recorded for three consecutive nights at both sites to ensure a large enough sample size. Using the bioacoustics analysis software Kaleidoscope, we counted the number of frog vocalizations ("chirps") in four-second intervals within a ten-minute window before, during, and after the passing of a car. The number of chirps decreased as the car approached and passed the location of the recorder for both sites and across all three nights. These results showed a significant influence of car sounds on frog calling activity (ANOVA, $p<0.001$). This means that something that occurs so frequently, such as cars driving by, has the potential to influence the activities of wildlife. On more busy roads, the sounds of cars can potentially cause a shift in the species behavior. With more interruptions it might mean less time for reproduction, which can translate to potential population decreases and loss of fitness. By showing that cars do have an influence on frog activity, we can start a dialogue about the extent of our influences on their activities.

Differences between Speech and Speaker Recognition:
Visualizing Voice as Signal

Elisha Brumant
Mentor(s): Dr. Marc Boumedine
University of the Virgin Islands

Speech recognition is a multi-person applicational use that converts voice into words. The text usually is associated with a command and is then interpreted and executed by machine. The speech recognition aims at understanding and comprehending what was spoken. Voice or recognition however identifies the unique speaker's voice based on accent and behavioral patterns, and then uses it for command security access to some devices or systems. My primary goal is to understand differences between speech and voice recognition. My long-term goal is to research and develop an algorithm that allows me to control my laptop using my voice. In order for my computer to recognize my voice, I had to gather voice signals of my voice to be able to train the system. I used a standard recording application to record voices in different context (with and without noises) and convert them in into the WAV format. I used a Python script to visualize voice signals which showed the difference between my voice and voice signals from other individuals. One of the problems along the way, was differentiating between the speaker's voice and noise in the background.

Multiple Genotypes of *Halophilia stipulacea* Found Around St.Thomas

Michael Caracciolo and Kwame Forbes
Mentor(s): Dr. Alice Stanford and Dr. Marc Boumedine
University of the Virgin Islands

Halophila stipulacea, a species of seagrass native to the Indian Ocean, has been rapidly invading the Caribbean. *Halophila stipulacea's* ability to displace the local marine flora makes it a potential threat to the biodiversity of invaded regions. Published literature on *H. stipulacea* is limited, and its effect in the Caribbean has not been thoroughly documented. Information that is known about the species, however, is that it seems to reproduce asexually within the Caribbean. It should be noted that in its native region *H. stipulacea* is a high-volume seeder, but in the Caribbean, this is not the case, as no published literature shows findings of seeding. Our main research question was finding out how many genotypes are present within the area. Since we are fairly certain of asexual reproduction, we hypothesized unique genotypes would be low. To shed light on this, DNA sampling was used to determine the nature of the seagrass. We analyzed the samples using Genclone software, to determine the samples' relation to one another. Of the 64 individual that were sampled on the beaches of St. Thomas, St. John and Water Island, 15 had unique genotypes. The remaining 49 were shown to be clones. Now that we know that there are different individuals within the population, our next step is finding out why there are different genotypes and how they got here. One reason could be because of mutation/ mutations, and another could be that the species has been introduced to the beaches numerous times, but more findings would be needed to support either claim.

Phenolic Content in Virgin Islands Plants

Angel Cedeño, Anthony Jolly, Michael Doliotis and Selena Parilla
Mentor(s): Dr. Bernard Castillo II
University of the Virgin Islands

Phenols are a type of antioxidant that specifically consists of a hydroxyl group bonded to an aromatic hydrocarbon. Phenolic compounds are present in different sources of food like, plants, fruits, vegetables, etc. Phenolic compounds have various health benefits such as anti-inflammatory and anti-allergenic properties. Other health benefits include the reduction in the occurrences of sudden diseases like Alzheimer's disease, and boosts metabolism. The main purpose of this study was to determine the Total Phenolic Content (TPC) of plants found in the Virgin Islands, which are used in food and local drinks. The plants used for this study were Bay Leaf (*Laurus nobilis*), Common Thyme (*Thymus vulgaris*), Moringa (*Moringa oleifera*), Mint (Mentha spicata), and Lemon Grass (*Cymbopogon citrates*). We hypothesized that there would be a significant difference in the TPC between each plant. We determined the TPC in each plant by Folin-Ciocalteu's method, using a UV-Vis Spectrophotometer to measure the absorbance at 765 nm. Total phenolic contents were reported as mg per grams of Gallic Acid Equivalent (GAE) per grams of dry weight (mg/g GAE/g DW). Out of all our plants, Common Thyme had the highest TPC (55.463 ± 4.792 mg/g GAE/g DW) while Lemon Grass had the lowest TPC (8.564 ± 1.212 mg/g GAE/g DW). A one-way ANOVA test showed significant difference between the mean TPC each plant ($p = 8.0 \times 10^{-8}$). A Tukey *post hoc* test revealed that there was no statistically significant difference between Mint and Bay Leaf ($p = 0.878$), Bay Leaf and Moringa ($p = 0.053$) and Lemon Grass and Moringa ($p = 0.310$), while every other treatment showed a statistically significant difference between each group ($p < 0.05$). For future research, we want to continue investigating total phenolic contents in local crops such as okra, spinach, etc. We also want to test how synergism in Virgin Island plants affects the TPC levels.

Investigation of three Venturi sizes on the Total Gas Pressure (TGP) in an Aquaculture System

Marc-Anthony Colon
Mentor(s): Donald Bailey
Agricultural Experiment Station, University of the Virgin Islands

A trial was conducted comparing the Nitrogen (N2) gas percentage in a volume of 3.61 m3 of water with the usage of three various size Mazzei Venturi Injectors. Three systems were constructed per manufacture's recommendation. The Total Gas Pressure (TGP) percentage and Dissolved Oxygen (DO) percentage were recorded to calculate the total Nitrogen (N2) gas percentage to determine if the water is supersaturated with Nitrogen gas. The data was collected over a four-hour time period with ten-minute intervals. The Total Gas Pressure was steady throughout the time period with an average standard deviation (STDEV) of 0.79%. The control has an average TGP of 103.56% with a STDEV of 1.50%. The 12.7mm system has an average TGP of 102.32% with a STDEV of 0.47%. The 19.05mm system has an average TGP of 101.96% with a STDEV of 0.35%. The 38.01mm system has an average TGP of 104.48% with a STDEV of 0.82%. The calculated N2 percentages were high enough to cause supersaturation of Nitrogen gas but were not influenced by the Venturi Injectors.

Keywords: Dissolved Oxygen, Total Gas Pressure, Supersaturation, Nitrogen.

Random Sampling of Nodes in Polynomial Interpolation

Nikkoiya Cromwell, Tione Grant and Darryle Cyrille
Mentor(s): Dr. Andrew Gard
University of the Virgin Islands

Polynomial interpolation is a method used to approximate unknown functions based on small numbers of data points. One advantage of polynomial interpolation is that error can be computed explicitly. In many cases, the most important part of this error function is a polynomial $w_n(x)$ entirely by the x-values of the sample points. This raises the question of how large $w_n(x)$ can be expected to be. We numerically evaluate the average size of the maximum value of this function, getting surprisingly small results.

The Effects of Rounding Errors on Polynomial Interpolants

Darryle Cyrille, Nikkoiya Cromwell, and Tione Grant
Mentor(s): Dr. Andrew Gard
University of the Virgin Islands

Polynomial interpolation is the construction of polynomials that pass through given sets of data points. In the real world, measurements and rounding errors are bound to happen. How large of an impact do such errors have on polynomial interpolants? Through experimentation, I found that the overall effect (measured using a definite integral) of vertically shifting an interpolation node depends only on the distribution of x-values of the nodes and never on the y-values. This fact can also be demonstrated algebraically.

Phenolic Content and Antioxidant Capacity in Virgin Islands Plants

Michael Doliotis, Selena Parrilla, Angel Cedeño and Anthony Jolly
Mentor(s): Dr. Bernard Castillo
University of the Virgin Islands

Antioxidants are found in a variety of plant based food sources, like berries, nuts, beans, and vegetables. These compounds counteract the formation of free radicals by reducing the damage done to our cells caused by oxidation. When exposed to harmful environmental stressors over time such as pollution, herbicides, and radiation, cells begin to break down, which can set off a chain reaction leading to oxidative stress. Eating foods high in antioxidants can prevent diseases resulting from oxidative stress, and replenish our bodily cell functions. Hydrophilic antioxidants play a major role in this capacity, like ascorbic acid, which has been used to study other subsets of antioxidants. One of these subsets are compounds that contain polyphenols. Phenols are a type of antioxidant with an aromatic ring attached to a hydroxyl group. They have a wide range of health benefits, such as greatly reducing the risk of certain cancers, cardiovascular diseases, and neurodegenerative disorders. Berries and other variety of citrus fruits have been found to contain polyphenols. In previous studies, phenols have contributed to overall total antioxidant activity, and there has been a correlation between water-soluble antioxidants and phenols found in algae. In this study, we selected five different plants in the Virgin Islands, namely, Lemon Grass (*Cymbopogon citrates*), Moringa (*Moringa oleifera*), Mint (*Mentha spicata*), Bay Leaf (*Laurus nobilis*) and Common Thyme (*Thymus vulgaris*). Our main objective of this study was to determine if there is a correlation between Hydrophilic Antioxidant Activity (HAA) and the Total Phenolic Content (TPC). We hypothesized that there would be a correlation between HAA and TPC. The ABTS/H_2O_2/HRP decoloration method was used to determine HAA, and Folin-Ciocalteu's method was used to assess TPC. Values were reported as µmol Trolox Equivalent (TE) per gram Dry Weight for HAA and mg per g Gallic Acid Equivalent (GAE) per gram Dry Weight for TPC. According to results, Common Thyme and Lemon Grass had the highest and lowest mean HAA (179.98 ± 9.86, 15.07 ± 5.64) and TPC (55.46 ± 4.79, 8.56 ± 1.21) values, respectively. A one-way ANOVA showed no significant difference between HAA and TPC (*p = 0.164*). Pearson correlation analysis showed strong evidence of positive correlation between HAA and TPC (*r = 0.935*). Lastly, linear regression analysis showed a linear relationship between HAA and TPC ($R^2 =0.874$). From this study, we found that there was a correlation between HAA and TPC for the selected Virgin Islands plants. For future work, we would like to study correlation in other local herbs, vegetables, and fruits such as cilantro, spinach, and sour sop.

Visual Identification of Asteroids and Other Dangerous Space Debris from DECam Data

Lennycia Finley[1]
Mentor(s): Dr. Antonino Cucchiara[2]
[1]Ivanna Eudora Kean High School
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During my studies here at the University of the Virgin Islands Professor Cucchiara and I have been working on analyzing different images of space in order to identify transients objects. We have been searching for different stars, galaxies, asteroids, and comets. Our goals were to find many objects in space that may be dangerous for our planet earth, satellites and future spaceships for space exploration. We use different applications on the computer to analyze the pictures. We looked at images from the Blanco Telescope in Chile and the Dark Energy Camera. The dark energy camera also known as the DECam has 62 tiles and each tile has 60 slides. I wrote a couple of essays on near earth object , asteroids, dark energy camera, dark energy survey, telescopes, and galaxies. I analyzed about 30 tiles during my studies. After downloading the pictures on to the computer, we opened the DS9 visualization software and scaled them to a level we can easily see objects that moved across the images. Over ten images taken in sequence as we search for near earth objects (NEOs). To keep track of the different near earth objects (NEOs) we see in space , we created a log. The log consistsofthedate,time,thename,anddifferentobjectswesaw (asteroids,galaxies,etc.) While looking at the parts of the sky we saw many galaxies over the other NEOs. Galaxies are very beautiful. I am currently applying scaling parameters to a galaxy in order to make true color images of them. In conclusion, this research was very interesting and educational. I loved doing this.

Cluster Analysis on Hurricane Data

Samuel Gittens Jr. and Belize Saunders
Mentor(s): Dr. Marc Boumedine and Dr. Roy Watlington
University of The Virgin Islands

A hurricane is a higher form of a tropical cyclone with sustained winds of 74 miles/hour and pressures below 980 millibars. When a tropical cyclone reaches hurricane status, the low pressure is called the eye. Warm water fuels the hurricane by turning into heat in the abundance of rain that circles around the which is the eye wall. The released heat lowers the barometric pressure in which strengthens the hurricane from the center. The objective of this research is to look for similarities between these storms. We used an unsupervised algorithm clustering called K-means that will hurricanes according to the pressure and wind speed. We expect the hurricanes to be clustered according to the Saffir-Simpson Hurricane Wind scale Category 1-5 and match with the classification of the hurricanes. This data can be used to determine the severity of hurricanes, gauge how the storms have been changing over time, as well as look at the frequency of the intensity of storms. We clustered 84 number hurricanes with the K means method.

Comparing Uniform and Chebyshev Interpolants for Extrapolation

Tione Grant, Darryle Cyrille, and Nikkoiya Cromwell
Mentor(s): Dr. Andrew Gard
College of Science and Mathematics, University of the Virgin Islands

We compared interpolating polynomials created with uniform and Chebyshev points, examining their behaviors outside their sampling intervals for several representative test functions. While interpolants based on Chebyshev points are often thought to extrapolate more poorly than those based on uniform distributions, I found that Chebyshev interpolants yield smaller percent errors over a greater percentage of the interval's length, suggesting that Chebyshev points are better for extrapolation than uniformly distributed ones.

Mathematical Learning and Language of Instruction in the Virgin Islands

Yarilynn Guadalupe
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What effect does the language of instruction have on students when learning new mathematical concepts? For example, will Crucian speakers in the U.S. Virgin Islands develop a better understanding of mathematical concepts when these are presented in Crucian rather than in standard academic English? Although the use of Creole and other non-standard language varieties in educational environments is often criticized (Torres and Torres 2012), linguistic research in education often shows positive outcomes in students' learning when they are taught in their native language variety (Wigglesworth et al. 2013). In this study, participants watched video tutorials presenting mathematical topics in academic English and their home language variety (either Standard English or Crucian creole), after which they were assessed on their level of proficiency with the mathematical idea. They were also assessed qualitatively on their perspectives and attitudes towards the use of Crucian as an educational setting, as well as their perceived effect of language on their understanding. Our research does indeed suggest that Crucian speakers may develop a better understanding of mathematical concepts when learning in their home language variety. Research is scheduled to continue into the fall in order to increase sample size and to verify and expand upon these preliminary findings.

Our Falling Sky: Tracking Space Junk

Harmonie Hanley[1]
Mentor(s): David Coward[2] and Dr. John Kennewell[2]
[1]University of the Virgin Islands, [2]University of Western Australia

The amount of debris in space is steadily increasing. Currently, there are thousands of trackable objects and millions that are not identified that are all moving at very high speeds. This causes many hazards in space making it difficult to perform various space operations. Using python, photometry, and python signal processing, we have tracked Australia's first communication satellite, Aussat 1 and determined how this satellite is rotating. We have found that the satellite has a rotational period of 1.94 seconds. In the future we hope to use this technique to take a closer look into how this period evolves with time and repeat this analysis for other satellites.

Simulating Magnetic Reconnection Propulsion

Peter Jean-Baptiste
Mentor(s): Dr. Brice Orange and Dr. Dave Chesny
University of the Virgin Islands

The purpose of this project is to reduce the amount of time that human passengers will have to spend on voyages through space because the harmful energies, rays, and zero-gravity conditions are not meant to be endured by human bodies. The project was designed to simulate an increase the thrust and speed of a space craft by using magnetic reconnection propulsion which will decrease overall mission times and the times of round trips that astronauts have when visiting celestial bodies and therefore make space travel safer. We used NASA's General Mission Analysis Tool in order to chart celestial bodies' paths and create trips from Earth to the other planet. We were able to see that the reduced travel time is indeed possible and, in contrast to regular propulsion methods, uses less kilograms of fuel. This means that we were correct in trying to see if space travel could be made safer in this scenario.

Local Cyberspace Should be Safe!

Lorenzo LaPlace
Mentor(s): Timothy Kentopp, MCSE, MSIA
University of the Virgin Islands

Many Internet users are needlessly exposed on the Internet. Their devices may not have full port filtering/stealth enabled or available, such as mobile devices that have no built-in firewall. Many people often wonder how they get hacked online. This research was conducted to bring attention to the problem of hackers and their avenues of attack. To begin this research, I performed system resets using best practices to establish a known baseline. Tests using several devices across varying networks in St. Croix were performed. The objective of this research was to assess the level of user exposure given the known state of recommended measures: stateful firewall (FW), subnetting, and Network Address Translation (NAT). A variety of network scanning tools were utilized such as nmap and GRC ShieldsUp. We attempted to understand the level of security many locals may experience using the Internet. Results were exceptional indicating broad security exposures. While many users have a moderate level of protection on their network, they are still vulnerable to probing by hackers.   Research on this should continue with public service recommendations. We should also develop solutions to some of these network risks.

Experimenting with Object Classification

Kaleb Liburd and Kenique Liburd
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Object recognition is the area of artificial intelligence (AI) concerned with the abilities of computers to recognize various entities. This is an important computational feature in on-going development. Our ultimate goal is to optimize object classification techniques to accurately identify bottles underwater (and elsewhere). Our techniques may be used alongside underwater ROVs to improve accuracy in identifying bottles, other harmful waste products, different species of corals or anything else for that matter. These abilities may prove useful in providing assistance to marine biologists. For example, it may help with identifying or tracking different animal species or, on a slightly different spectrum, help in finding harmful trash in our reefs.

We began experimentation with the Haar algorithm which is available in OpenCV-Python. Many different methods of training and image preprocessing were attempted. One of these methods was an attempt to cause the Haar algorithm to focus on just the general shape of bottles and be able to identify them by this. We decided to preprocess the images to a point where only the objects' outlines remained. After many different training and testing trials, we came to the conclusion that the Haar algorithm and Haar-like features may not be the best suited for the problem. In the future, we plan to look at other promising classification algorithms to experiment with, using various techniques. We want to modify or adapt the ones that show the most promising results in order to further increase the classifications' accuracies. If needed, we will create our own algorithms in an attempt to tackle our very specific problem.

Tracking Spawns By Use Of A Brownian Bridge Random Walk Program

Brandon Manners
Mentor(s): Dr. Robert Stolz
Emerging Caribbean Scientists (ECS) Program, University of the Virgin Islands

The *Mycteroperca venenosa*, better known as the yellow-fin grouper makes up a valuable part of the commercial fishery throughout the Caribbean. Research has shown that due to overfishing of the species they are now at risk of extinction. A grouper spawning aggregate was discovered at the edge of an underwater shelf a few kilometers south of St. Thomas, U.S. Virgin Islands, and two protected areas were established, the Hind Bank and Grammanik Bank, to prevent fishing around the spawning aggregate during mating season. A program was developed that utilizes data, collected by way of Acoustic Telemetry, to probabilistically produce the specific location of the spawning aggregate by generating multiple Brownian Bridge random walks of the groupers' movement between each successive observations of the groupers. The simulations will then be used to improve the efficiency of the Hind and Grammanik Banks by adjusting their current size and location to one that will be providing sufficient protection to the groupers' spawn while still allowing fishermen to make a living without harming the reproductive rate of the spawns.

Large Amounts of Detached Algae Increases Juvenile Fish Abundance Over Halophila and Sand

Matthew Mullins
Mentor(s): Dr. Stephen Ratchford
University of the Virgin Islands

Brewer's Bay has been impacted by an invasive seagrass (*Halophila stipulacea*) as well as two category five hurricanes. The hurricanes uprooted much of the native seagrasses, and *H. stipulacea* is spreading across the sandy-bottomed bay. From a recent study, the invasive seagrass has lowered fish diversity. This summer we noticed large volumes of detached algae over the shallow *Halophila* and sandy bottom. In order to measure the abundance and diversity of juvenile fish we compared the density of fish in the seagrass and the sand habitats to habitats impacted by the algae. Transects (30x2 meter) were laid at 13 nearshore locations to determine the amount of juvenile fish. Compared to the sand only, the algae that drifted above the sand quadrupled the abundance of juvenile fish and increased the diversity slightly. The algae that drifted over the *H. stipulacea* doubled the abundance of juvenile fish, but the diversity remained the same. The large amount of detached algae this summer has increased the abundance and diversity of juvenile fish living in it compared to normal habitats. The detached algae appears to be providing additional structural complexity, additional protection, and possibly a food source for juvenile fish allowing for a higher abundance of juvenile fish in these areas. Our next steps are to determine if there is detached algae and if it has an impact on other bays around St. Thomas and even other islands.

Using Eye-Tracking Technology to Objectively Measure the Development of Chemistry Students' Problem-Solving Abilities and Perceptions of Self-Regulation Skills

Khadijah O'Neill and Christopher Rosario
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The purpose of this study is to analyze how students approach chemistry word problems and to understand their perceptions of self-regulation. Self-regulated learning (SRL) is composite psychosocial learning variables. It includes a measure of cognitive, metacognitive, behavioral, motivational, and emotional aspects of learning (Panadero, 2017; Zimmerman & Schunk, 2011). The psychosocial variable measured in the eye-tracking distance learning research study is cognitive strategy. Eye-tracking technology allows researchers to measure and analyse fixation and gaze data, both indicating focus and attention, in increments of seconds. Eye-tracking allows researchers to collect fixation and gaze plot data to understand students' cognitive behavior while they answer nomenclature word problems before and after participating in a blended learning environment or traditional lecture-based environment. Ten students wore eye-tracking glasses and answered six chemistry nomenclature word problems at the beginning of the nomenclature chemistry lesson and at the end of the lesson. The glasses provided fixation and gaze data in the appropriate area of interest. Students in the blended learning environment scored higher on the post-test than students in the traditional lecture-based environment. Eye-tracking fixation data in appropriate areas of interest reveal the amount of cognitive effort students exerted as they attempted to solve chemistry nomenclature word problems. Data suggests that higher fixation in appropriate areas of interest increases students' performance on chemistry nomenclature problem solving tasks. These findings are useful to informing the design of future distance learning chemistry courses and can aid chemistry faculty in directing students' attention to certain areas of the periodic table while solving chemistry nomenclature problems.

The Untold Story of a Circle

Kiandre Rogers
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It has been known for a while that the ratio of the distances from 2 fixed points in a plane is a circle. What had not been explored was the question of whether a given circle can be generated from 2 fixed points and a known fixed ratio. Our hypothesis-Can Algebra be use to prove the ratio of the distances from two fixed point = constant is a circle? Using basic algebra, translation of axes and rotation of axes, we were able to prove that the constant ratio of the distances from 2 fixed points in 2-D is circle. Furthermore, given any circle, they are infinite sets of pairs of points that can be used to define the circle. These infinite pairs of points in themselves define a circle. We shall also investigate how these new ideas, especially the results from the rotation and the translation of axes to calculate the distances between objects with elliptical paths around the sun. We found out that the traditional definition of a circle isn't the only possible way in which a circle can be viewed. Our approach led to a number of interesting and otherwise unknown facts about circles. The whole project began out of the curiosity of finding out the locus of points with a constant ratio from 2 fixed points in space. The full meaning of our work wouldn't be known until we add the elliptical aspects and application to it. As at now, we are happy with filling in the unknown gaps described above.

Medicaid Claims for Prescribed Opioid Medications in the USVI for 2016 & 2017

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Opioids are the most effective and widely used drugs in the treatment of severe pain. They act through G protein-coupled receptors. Four families of endogenous ligands (opioid peptides) are known: (Benzomorphans, Diphenylheptanes, Phenanthrenes, and Phenylpiperidines). This study aims to determine the distribution of types of opioids submitted as Medicaid Claims in the USVI for the years 2016 and 2017. Data on opioid prescription claims were obtained from the Medical Assistance Program within the Department of Human Services for the years 2016 and 2017. The top 10 Opioids prescribed under the MAP program for both years: Hydrocodone Bitartrate-Acetaminophen, Oxycodone HCL-Acetaminophen, Buprenorphine Hydrochloride, Acetaminophen-Codeine Phosphate, Tramadol HCL, Oxycodone HCL, Tramadol HCL/Acetaminophen, Hydrocodone Polistirex-Chlorpheniramine Polistirex, Fentanyl Transdermal System, Suboxone . However, the frequency varied between the two years of data examined. As a result, Opioids prescribed under the MAP program showed a significant drop in claims from 2016 to 2017. Future studies can look at the reasons behind the sudden drop in claims.

Microplastic Pollution in West End Beaches, St. Croix

Deon St. Jules
Mentor(s): Professor Marcia Taylor
University of the Virgin Islands

Microplastics are harmful to not only marine life, but human life as well. These small fragmented pieces of plastics, classified in this study as <5mm in total length, have been found in drinking water and seafood. This research quantified the microplastic load on three West End beaches on St. Croix, USVI. This study emulated the methodology of a previous study done in the East End Marine Park, allowing for the comparison of results. Sand samples were collected along transects at each site. Remote sensing imagery data, retrieved from Google Earth, was used to divide transects into ten equally spaced sample points, with the distance between sample points determined by the length of the beach. A quadrat was placed at each sample point where a liter and a half of sand was collected. Four microplastic items were found at Dorsch Beach, nine at Rainbow Beach, and 15 at Ham's Bay. The results support the initial hypothesis that the average number of microplastics per beach was greater at West End beaches than beaches sampled in the East End Marine Park.

Locating Hazardous Asteroids with Python Coding and the Virgin Island Robotic Telescope

Kaheem Walters
Mentor(s): Dr. Antonino Cucchiara
University of the Virgin Islands

The topic of my research project is to track asteroids and determine if the path they are on will lead to a collision with Earth. In the event of discovering an asteroid that will crash into Earth, the information can be passed on to professionals to establish a plan that will hopefully save the planet and its inhabitants. To do this, I am writing a python programming code with the help of my mentor, Dr. Antonino Cucchiara. To write a python code capable of doing so, I will import and use python packages such as the Pyephem package, Numpy package, Astropy package and Matplotlib package. To run and test the code created, I will use a list of minor planets (asteroids) that have already been identified, catalogued, and posted on the Minor Planet Center website. Out of the18,000 minor planets within the list, the objects we are interested in are those of specific altitude and magnitude, and the time at which they will be visible from the Etelman Observatory here in the U.S. Virgin Islands. Once the python programming code is complete and proven to work, the code will allow us to determine every night what objects will be visible with the Virgin Island Robotic Telescope and determine the exact position and ultimately provide stringent constraints on the orbital properties of these objects, including their future trajectories.

Parallel Computing of High-Value Zero-Sum Combinations

Leon Wheeler
Mentor(s): Dr. Christopher Plyley
University of the Virgin Islands

This research investigates the subsets of the finite cyclic group, $G = \{1, 2, ..., n-1, n\}$, to streamline a series of computations, that will find the lowest size of choices of $nChoosek$ combinations – where every subset A in G of size k has an index of one. This threshold is called $T_1(n)$. An index of one implies that A's sum-set can add to n. To prevent miscalculations, A does not include the empty set. The main goals are to use a program to find $T_1(n)$ in as little time as possible and try to calculate $T_1(100)$ and achieve as close to perfect linear speedup as possible for all values of n. Israel Dennie's recent update to his program, RNTBA, uses a logic table and a cache array to test each subset, A, of G instead of the direct computation of the sum-sets. The runtimes show a plateau effect, making them appear to have a perfect speedup; however, the efficiency changes erratically, at $n > 35$, and the runtimes vary from the relatively quick runtimes of prime numbers in minutes to the extensive tests of all others.

Body Self-Perception, Depression, and Obesity in a Sample of USVI Youth

Azriel A. Williams
Mentor(s): Dr. Janis Valmond
University of the Virgin Islands

The purpose of this secondary data analysis is to examine the association between body self-perception, depression and obesity in a representative sample of USVI adolescents, using data from 124 11th grade students participating in the School Physical Activity and Nutrition Survey (SPAN) conducted among public school students on the East End of St. Thomas, USVI during May-June 2015. Body self-perception is considered a part of self-concept and is defined as the mental image one has of oneself; depression is characterized as a mood disorder, lasting at least two weeks to two months; obesity in adolescents (kg/m2) is determined using height (meters) and weight (kilograms) and age and gender-specific growth charts. Data analysis included frequencies, the chi-square test for independence, and logistic regression in SPSS 25. Sixty percent (60%) of study participants were female; 23.8%, were classified as obese; and 6.5% for males and 16.9% for females perceived themselves as obese. After analyzing the data using chi-square test, it was shown that there was little to no association between depression and obesity. The logistic regression test reported that gender and perceived female obesity were significantly associated with obesity. This study revealed that the females in this sample were more likely to be obese than the males and that there was no significant association between depression and obesity.

Summer Participants

Summer Sophomore Research Institute (SSRI)	Summer Undergraduate Research Experience (SURE)	Mathematics Behind the Science (MBS) Program	Sophomore Boost Program
Antonae Anthony Elisha Brumant Michael Caracciolo Michael Doliotis Yarilynn Guadalupe Emely Henriquez Anthony Jolly Kiwanee Smith **NSF INCLUDES SEAS Your Tomorrow Internship** Samuel Gittens Jr. Shamoy Bideau Nicolas Durgadeen Belize Saunders	Ahmad Abdul-Samad Brad Arrington Jahnyah Brooks Angel Cedeno Marc-Anthony Colon Nikkoiya Cromwell Darryle Cyrille Jasiem Everington Kwame Forbes Tione Grant Josette John Lorenzo LaPlace Kaleb Liburd Kenique Liburd Shakilah Liburd Brandon Manners Makeda Mills Matthew Mullins Khadijah O'Neill Selena Parrilla Kiandre Rogers Christopher Rosario Jair Smith Christian Soto Deon St. Jules Donus Thomas D'Shaunique Walters Leon Wheeler Azriel Williams	Aisha Aaron Jalan David CamilaDuran SorayaFerreras Ma'Kenya Henderson Shamyah Joseph Juchara Margetson Carissa Moses D'Andre O'Neal Alliel Phillips Shamir Smith **NASA Undergraduate Research Program** Megan Grant Peter Jean-Baptiste Treston Benjamin Jonisha Aubain Harmonie Hanley **DoD Apprenticeship Program** Kaheem Walters Lennycia Finley	Alice Barker Makayla Carino Jacquelyn Deport Khadeem DeSilvia Nicolas Durgadeen Jahlea Escobar Kenisha Florence Samuel Gittens Jr. Warren Graham Maurice Hansby Joshua Hassel Ray Mathurin Jenee' Roberts **EARTH Program** Deslyn Bartlett

Summer Program Descriptions:

- Math Behind the Science (MBS) Program - A residential, summer bridge program designed to enhance the mathematics readiness of college-bound STEM students by preparing them to enter the introductory calculus course and provide an enriching experience for transition to college life.
- Summer Sophomore Research Institute (SSRI) - A summer research program that allows current UVI students to work with faculty on a research project and participate in workshops to learn basic research methods and techniques.
- Summer Undergraduate Research Experience (SURE) - A program that provides research experience for mature undergraduates to work closely with UVI faculty on challenging scientific research projects across a variety of STEM disciplines.
- Sophomore Boost - During the program, students participate in an immersive experience that involves training in creativity, skill building, growth mindset and a mentored teamwork project.
- DoD Summer Apprenticeship—Program integrates student in astronomical research at UVI
- NASA Summer Research Experience—Provides funding for undergraduate students to engage a mentored summer research experience
- SEAS Your Tomorrow Program - Summer internship program pairs students with project partners from local and federal government agencies and non-profit organizations active in ocean science and conservation.
- EARTH Program—Service learning internship at the Gifft Hill School, St. John in partnership with Iowa State U.

Mentors

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Verleen McSween (STX coordinator)

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Alice Stanford	Timothy Kentopp
Christopher Plyley	Marcia Taylor
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Stephen Ratchford	Janis Valmond
Donald Bailey	David Morris
Antonino Cucchiara	Greg Guannel
Kristin Wilson-Grimes	Angelicque Tucker Blackmon
Sennai Habtes	Teresa Turner
Edwin Cruz-Rivera	David Minner

Math Behind the Science Program

Avon Benjamin

Brandon Rhymer

Aimee Sanchez

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Sophomore Boost

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Timothy Faley	Victoria Henry
Nicolas Drayton	Michael Henry
Michael Smith	Olasee Davis
	Migdalia Roach

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