2020

University of the Virgin Islands

Virtual Fall Student Research Symposium

PROGRAM BOOK

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Organized by the Emerging Caribbean Scientists (ECS) Program.
For more information, contact us at ecs@uvi.edu

The 21st Annual UVI
Fall Student Research Symposium

(ONLINE ONLY)

Videos of student presentations are available on the ECS YouTube channel. Click the following link:
https://www.youtube.com/channel/UCs70lDwGTVrHxa8stAChU8A

Live Q&A Sessions hosted via Zoom will take place on Sunday, September 27th, 2020 from 1:00-2:00pm
Registration is required to get access to the Q&A. The deadline is Fri. Sept. 25th by 5pm. To sign up, click the link below:
https://tinyurl.com/SymposiumGuest

Event Organized by:

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Racial Disparities in Prostate Cancer Research

Brittney Anderson
Mentor(s): Dr. Zanna Beharry
Co-Author: Brianna Cromwell

University of the Virgin Islands

Q&A Session 3: Biology & Chemistry (1:05-1:10pm)

Prostate cancer affects men of all racial backgrounds; however, it is men of African descent who face the highest risk of diagnosis and mortality. Despite this, black men remain underrepresented in prostate cancer research which introduces the apparent anomaly that the men mostly affected by prostate cancer are the least represented. To test this theory a total of 393 prostate cancer clinical trials were reviewed; only 198 studies racially identified its participants. Thirty-three prostate cancer cell lines were scrutinized for quantitative data on the availability of samples from men of African ancestry. Additionally, several literary articles were evaluated to re-enforce our theory regarding the lack of utilization and availability of black resources. The 198 clinical trials were performed on 77,028 racially identified patients, but only 8,408 (11%) were of African ancestry. Of the 33 prostate cell lines available, 20 were acquired from Caucasian men, 2 from Black men and the remaining 11 samples were unspecified. Most of the literature for prostate cancer in black men focused on the disparities rather than actual research involving black patients. A collective analysis was made from results which suggested that although prostate cancer is predominant in black men they are constantly being underrepresented in research. To better improve prostate cancer treatment for all males it is essential that future studies focus on diversifying all samples and studies. This will provide the best measures to properly counteract the evident racial disparities in prostate cancer research.

Thank you to NSF HBCU-UP ACE Implementation Project: The UVI Growth Model for providing our funding.

Pilot Study of Taking the English Proficiency Exam during Research and Applied Writing (ENG 201)

Laurie Armstrong
Mentor(s): Dr. Aletha Baumann

University of the Virgin Islands

Q&A Session 2: Education & Social Science (1:05-1:10pm)

The mechanism by which UVI determines students' writing skills, a graduation requirement, is the English Proficiency Exam (EPE), which is the writing of an argumentative essay in response to a prompt. It has been the University policy that students are not allowed to take the EPE until they pass ENG 201 or are certified ready by the advisors. A pilot study was conducted in spring 2017 that allowed students enrolled in ENG 201 to take the EPE. The purpose of this pilot study was to suggest a policy change based on a comparison of the performance of students taking the EPE while enrolled in ENG 201 versus after completion of ENG 201. Of the 102 participants, 32% took the EPE during ENG 201 and 69% took it after successfully completing ENG 201. Scores can range from 0 to 12, with 8 considered a passing grade. There was an overall pass rate of 75%. A regression analysis was performed to determine if the EPE score could be predicted from when it was taken and on which campus it was taken. The regression equation and single predictors were not significant. This finding would support the plan to continue to offer the EPE during ENG 201.10 UVI institutional and aspirational peers that provided information about English proficiency, none measured writing proficiency by a university-wide exam. If they used a writing exam, it was degree-specific. Most peers used completion of writing-intensive courses or portfolios. UVI should investigate the use of these options.
Keywords: English proficiency exam, UVI students

Funding provided by UVI NIH RISE grant award #2R25GM061325.

Parental Choice of Preferred Early Childcare [B-5] Facility in the US Virgin Islands: Opportunities and Limitations

Ariana Athanase
Mentor(s): Dr. Noreen Michael

University of the Virgin Islands

Q&A Session 2: Education & Social Science (1:10-1:15pm)

Early childhood development consists of the physical, socio-emotional, cognitive and motor developmental skills of children between the ages of 0 to 5. It is important to focus on the early developmental stage of a child's life because it is essential for primary school success [K-3] and later schooling, as well as adulthood. The US Virgin Islands have three early childhood education programs- Head Start, Early Head Start and Private/Parochial childcare facilities. Education from such facilities carries an essential role in their future development thus posing the question, "Are there factors that limit parental choice of preferred childcare facilities for their children, ages 0 to 5, in the US Virgin Islands?" The factors that limit parental choice of preferred childcare facilities consist of the following: proximity, finances, government benefits/subsidies, and a lack of public knowledge. Through a mixed-method design, using GIS mapping creates the visuals required to identify the accurate proximal distance between public housing and childcare facilities. A secondary data analysis from the Caribbean Exploratory Research Center and Department of Human Services provides the data necessary to distinguish the capacities and facilities located across the territory. Surveys and interviews with parents provide quantitative data for collection along with identifying the theme of the research. Acknowledging the factors- both positive and negative- that affect parental choice of preferred childcare facilities for their children will have the benefit of creating an environment of improvement for the various early childcare programs in the US Virgin Islands.

Funding provided by NIH RISE - Building Students' Identities as Scientists- 2R25GM061325-15.

One Year Biological and Chemical Water Quality Assessment at the UVI Albert A. Sheen Campus Drinking Fountains

Anelia A Austrie
Mentor(s): Dr. Bernard Castillo
Co-Authors: Kynoch Reale-Munroe, Naomi Douglas, Deon St. Jules & Stephanie Bullock

University of the Virgin Islands, Albert A. Sheen Campus, St. Croix

Q&A Session 3: Biology & Chemistry (1:10-1:15pm)

All life depends on water but less than 1% is fresh water. Drinking contaminated water can cause many health issues, some examples include, gastrointestinal problems, and even death. The United States Safe Drinking Water Act passed in 1974 – to protect public health by regulating the nation's public drinking water supply because of poor water quality that was endangering public health. The US Environment Protection Agency (EPA) has established protective drinking water standards for more than 90 contaminants. These standards are known as Maximum Contaminant Level (MCL), which, indicates the highest level of contaminant accepted in water. Contaminants are classified as physical, chemical, and biological. At the University of the Virgin Islands Albert A. Sheen (AAS) campus majority of students do not drink from the on-campus water fountains, however, previous studies showed that the basic water quality parameters tested were similar compared to commercial water. In this project, water quality was tested from six drinking fountains on the AAS campus for a period of one year. The objective in this project was to analyze data collected throughout Summer 2019-Spring 2020. The HACH test kits and the spectrophotometer were used to test all water quality parameters from all six water fountains. Locations included, Residence Hall (RHC), Melvin's Evan's Center (EVC), and Northwest Wing (NWW). Our results showed that Arsenic (0 ppb) and Total Coliform were absent. Copper (0.34 ± 0.072 mg/L), Lead (0.01 ± 0.006 mg/L) and Phosphorus (4.48 ± 2.002 mg/L) were highest at the NWW. Nitrate (13.83 ± 8.845 mg/L) and Chlorine (0.07± 0 mg/L) were highest at EVC. There were significant differences for Copper ($p = 0 .016$), Nitrate ($p =0. 026$) and Phosphorus ($p = 0.028$) in all EVC samples. There were no statistically significant differences ($p > 0.05$) found for all other parameters in all locations. Nitrate levels were above the EPA standards in EVC only. Copper, Arsenic, all non-metal contaminants, and total coliform were below EPA limits. Based on the results of our study, it is safe to conclude that the water at the AAS campus is safe for consumption based on the parameters which were tested.

This research was funded by NSF HBCU-UP ACE Grant Award No. 1623126.

Cleaner Shrimp have Preferred Client Fish Species for Cleaning

Janae A. Bruce
Mentor(s): Stephen Ratchford, PhD

University of the Virgin Islands

Q&A Session 1: Marine & Environmental Science (1:05-1:10pm)

Cleaner shrimp, such as *Periclimenes yucatanicus* and *Ancylomenes pedersoni*, are marine organisms that are known to clean ectoparasites off the client fish that visit the shrimps' anemone residence. Researchers that have studied these shrimps focus more on their cleaning behaviors and successful fish cleanings while dismissing unsuccessful cleanings. This dismissal seems to imply that all clients are cleaned on every visit with no preference, an idea our preliminary observations suggests is not true for all areas. We wanted to know whether cleaner shrimp had preferred clients, that is, clients that they clean a greater percentage of the time when they visit. To determine this, we placed underwater cameras near different corkscrew anemones inhabited by cleaner shrimp. From the video we were able to gather data related to each client's visit such as the fish's species, whether the fish got cleaned or not, and how long the visit lasted. Afterwards, we summarized that data to determine which client species was visiting most often and which had the highest percentage of cleans. Overall, we watched over 240 hours of video from the underwater cameras and saw great variation in the types of clients that visited the anemones. Fish such as damselfish, rock hinds, and angels that did not visit very often had a high percentage of cleans. Conversely, the fish that visited most often, such as butterfly fish, parrots and grunts, had a lower percentage of cleanings. We concluded that the rarer the fish, the more likely it was to get cleaned. One of the reasons why non-preferred client fish might visit so often is because they want to get cleaned so they come back repeatedly in an effort to be cleaned. Also, clients that visit rarely may have a different set of parasites that provide the shrimp a varied diet.
Keywords: Cleaner Shrimp, Anemone

Research funding provided by NSF HBCU-UP ACE Implementation Project: The UVI Growth Model (Grant No: 1623126).

Quantifying the Spread of SCTLD in the United States Virgin Islands

Alanica A. Canonier and Carissa S. Moses
Mentor(s): Dr. Robert Stolz and Dr. Marilyn Brandt

University of the Virgin Islands

Q&A Session 1: Marine & Environmental Science (1:10-1:15pm)

Coral Reefs are essential to the ecosystem of the U.S. Virgin Islands. The Stony Coral Tissue Loss Disease (SCTLD) is a disease that kills the tissue of corals, leaving behind white lesions. SCTLD was initially found in the U.S. Virgin Islands in January 2019, and ever since, it has affected the coral reefs located on St. Thomas and St. John. In this study, we investigate the quantifiable spread of SCTLD throughout several reef sites in the U.S. Virgin Islands from December 2018 to June 2020. We plan to use the diffusion advection equation to model how SCTLD spreads through the region mathematically. To create this model, we started with an initial estimate of the diffusivity constant. We then developed a code using MATLAB to simulate how the disease's range expands from a closely infected reef site and the initially infected reef site. For each month, the average minimal distance between the closest infected reef sites and newly infected reef sites was measured. We determined a 95% confidence interval for the average distance the disease traveled per month. We also created a model of the relationship of the distance the disease traveled from the initial outbreak versus time. The diffusivity estimates and the ocean current will be used in the second part of this study, which will use the diffusion advection equation to build a connectivity graph of the reefs. By quantifying the spread of SCTLD, plans for the restoration of the affected coral reefs can be devised using connectivity graphs.

Acknowledgements: NIH MARC at UVI: A Holistic Approach (Grant Award No. 5T34GM008422-26); NSF HBCU-UP ACE Implementation Project: The UVI Growth Model (Grant Award No. 1623126)

Blood Pressure and Perceived Racial Discrimination may be a Predictor of Episodic Memory Among Older Black Caribbean Adults

Alexanne Carr
Mentor(s): Dr. Aletha Baumann
Co-Authors: Dr. Karin Schon and Michael Rosario

University of the Virgin Islands

Q&A Session 2: Education & Social Science (1:15-1:20pm)

Elevated blood pressure and perceived racial discrimination in older African Americans can be a source of poor cognition. This study investigated the impact of blood pressure and perceived racial discrimination on episodic memory in people of African descent residing most of their lives on St. Croix, USVI, aged 50-80 years. We predict lower episodic memory performance with higher blood pressure and greater perceived racial discrimination. This study is part of more extensive research headed by Dr. Karin Schon of Boston University School of Medicine funded by the Alzheimer Association. Perceived racial discrimination is measured using the “Index of Racial Related Stress” scale. The mean arterial pressure will be the measure of blood pressure. Episodic memory is the ability to recall personal experiences from a specific time and location. It is assessed with the National Alzheimer’s Coordinating Center UDS Neuropsychological Battery’s “Craft Story 21 Recall” and “Category Fluency,” separately the “Mnemonic Similarity Task,” and the “Rey Auditory Verbal Learning Test.” In-person recruitment and data collection on three participants were complete before the Institutional Review Boards at both universities suspended face-to-face research in March of 2020 due to COVID-19. We are in the process of re-envisioning in -person data collection to virtual data collection. Blood pressure will be self-reported, and a revised measure of episodic memory instituted; however, the measure of perceived racial discrimination will remain the same. Recruitment of participants will commence upon approval of the Institutional Review Boards.

Research is funded by the Alzheimer’s Association and UVI NIH RISE grant award no. 2R25GM061325.

Depression and Prevalence of Types of Intimate Partner Violence against Women in St. Croix and St. Thomas

Ashley Challenger
Mentor(s): Dr. Aletha Baumann

University of the Virgin Islands

Q&A Session 2: Education & Social Science (1:20-1:25pm)

This study examines data collected by the Caribbean Exploratory Research Center for an NIH-funded grant from 1,059 Black women aged 18-55 who attended St. Thomas or St. Croix public health clinics between 2009 and 2011. The three aims of this study were to determine the (1) prevalence of Intimate Partner Abuse (IPA), in St. Thomas versus St. Croix; (2) relationship between IPA and depression; and (3) relationship between type of IPA and depression. Three categories of intimate partner abuse (emotional, physical, and physical combined with sexual) were determined from the Severity of Violence Against Women Scales and the Women's Experiences with Battering Scale. The Center for Epidemiological Studies' Depression Scale was used to measure depression. 46% of women reported having been abused by an intimate partner, with no significant difference between the two islands. There was a weak significant relationship between depression and experience of IPA indicating that women who experienced IPA were more likely to be depressed (54%) than those who were not abused (42%). Depression and type of IPA showed a weak significant direct relationship. Depression was found in 54% of women who were both physically and sexually abused, 46% who were only physically abused, and 31% who were emotionally abused. There was no significant difference in the prevalence of IPV or depression by island. This study further demonstrated the wide-spread IPA experience of women residing in the United States Virgin Islands and now shows the high rate of depression in women in the Territory.

Funding provided by UVI NIH RISE grant award #2R25GM061325.

A Good ‘tude Makes the Futures Mood: Integrating Research to Improve Attitudes Towards Science

Esonica Charles
Mentor(s): Bernard Castillo II, Ph.D.
Co-Author: Kynoch Reale-Munroe

University of the Virgin Islands

Q&A Session 2: Education & Social Science (1:25-1:30pm)

There is no one way to learn, but instead learning is a multidimensional spectrum of integrating information to create new long-lasting connections. “Research and teaching are used to reinforce learning processes, such as, imparting knowledge and creating knowledge as complementary activities.” In CHE Lab 151 & 152 from Fall 2018 to Spring 2020 applied research was integrated into the curriculum and the research topic was water quality. So, what is applied research? Applied research is research dedicated to answering a specific question. This is used to practically solve problems and create hypotheses for more information on that specific topic. Our hypothesis was, “If applied research is introduced to the curriculum, then students should show a more positive attitude towards science.” To answer our hypothesis, we asked students registered in the courses to anonymously answer an S-STEM survey. The reason behind using S-STEM surveys is because this survey is used to collect data on students’ attitudes towards STEM fields. We administered the survey during the semester before and after the students conducted research, creating pre and post survey entries. Results were collected then analyzed using SPSS Analytics, specifically using the Whitney-Mann Test. There was a total of 87 students who participated, 62 students in CHE 151 and 25 students in CHE 152. Our results showed that there was a significant difference in CHE 151 for the question “I will need science for my future work ($P = 0.017$).” However, there was no significant difference in students’ responses in CHE 152 and when CHE 151 and 152 responses were combined. To conclude, only students in CHE 151 were impacted, no impact was made on students in CHE 152 ($P > 0.05$) and as of right now there is no clear trend to what changes in attitudes could be proved in this experiment.

This research was funded by NSF HBCU-UP ACE Implementation Project: The UVI Growth Model Award No. 1623126.

Meta-analysis of Gene Expression Data

Naomi Douglas
Mentor(s): Dr. Lavida Rogers

University of the Virgin Islands

Q&A Session 3: Biology & Chemistry (1:15-1:20pm)

Tuberculosis (TB) is a lung disease caused by *Mycobacterium tuberculosis.* This disease is one of the top 10 causes of death and the leading cause from a single infectious agent. The bacterium is spread via airflow from person to person. It's dispersed into the air when the infected person(s) cough, sneeze, or simply speaks and can settle in the lungs; not long moving through the blood to other parts of the body, such as the kidney, spine, and brain. According to the World Health Organization, over 95% of cases and deaths are in developing countries. Due to the statistics, we want to know how does disease state, age, gender, and ethnicity affect gene expression for TB infections? To answer this question, the objectives were to understand how disease state, age, gender, and ethnicity affect gene expression responses to tuberculosis through expression data, and to reuse public data to answer new questions. The methods were to use data curation using Gene Expression Omnibus (GEO) to collect information on data samples. Data preprocessing by downloading raw expression data and preprocessing it. Data analysis to identify genetic variation in the data by performing an ANOVA. Finally, pathway and gene enrichment analysis to find differentially expressed genes (DEGs) associated with certain biological processes or molecular functions. I compared all pairwise interactions between factors such as: study, age, sex, disease status, and race. I found 1,790 DEGs by disease factor. Of the 1,790 genes: 2 genes ("AHCYL1" "ANGEL2") had disease and age interactions, 34 genes had disease and race interactions, and I found no genes that had disease and sex interactions. Reproduction and cell killing were among the biological processes identified by the finding of DEGs. In the future, we can provide biomarkers or new targets for vaccines or treatment of TB given age, race, or sex of the person once the expression profile is examined.

Funding provided by NIH MARC at UVI: A Holistic Approach grant award #5T34GM008422-26.

Algorithm Optimization for Fast Transient Identification in the Deeper Wider Faster Data

Michael Dow, Jr.
Mentor(s): Dr. Antonino Cucchiara

National Aeronautics and Space Administration (NASA)

Q&A Session 5: Physics & Astronomy (1:05-1:10pm)

Fast transients are astronomical objects whose brightness drastically increase and decrease over a short period of time, from a few minutes to fractions of a second. These events are particularly difficult to study because of their fleeting nature. The Deeper Wider Faster Survey is designed to discover these elusive objects and allow us to collect a large sample to study. Our goal is to develop a Python-based algorithm to be run on a supercomputer that will be able to run in real time with the DWF observations, build light curves that display these brightness spikes versus time, and quickly identify those objects that resemble fast transients of interest. We developed a Python-based code that allows us to model different light curves with mathematical equations and extract useful parameters for subsequent classification. The next steps include the creation of a large sample of light curves, their accurate modeling, and the collections of the fitting parameters that best describe these objects. This work will allow more powerful, dedicated facilities focus on these objects once they are identified, hoping to further our understanding.

Funding provided by MIRO Grant # NNX15AP95A.

Effects of Saharan dust on the Growth of Juvenile and Adult Corals

Nicholas C. Durgadeen
Mentor(s): Dr. Robin Smith

The Nature Conservancy

Q&A Session 1: Marine & Environmental Science (1:15-1:20pm)

During the month of June 2020, the US Virgin Islands experienced the largest Saharan dust plume it's had in decades. This brought about questions on the effects that this natural phenomenon may have on the health of coral ecosystem. The significance of Saharan dust has been researched extensively with regards to the weather patterns, and some propose that it may have a negative impact on coral reefs, affecting growth rates in both adult and juvenile corals. To evaluate this possibility, micro-fragments from colonies of the hermatypic coral, Orbicella faveolata and Diploria labyrinthiformis, were incubated in two separate tanks. One tank was, dosed with, .2grams of Saharan dust, the quantity estimated to be the amount that natural coral populations of St. Croix experienced during the height of the Saharan dust event. These estimates were performed using data from Earthschool.net, which provided the amount of dust per unit area. The second tank was absent of dust and acted as the experimental control. Interestingly, the results did not support the hypothesis that dust may impact growth in adult corals. The results of this study disproved the first part of my hypothesis but was consistent with the part that believed the poly's budding process would be stunted. The corals incubated with the Sahara dust weighed .146 grams more than the corals that were not in the water mixed with Saharan dust. One possible explanation for these results could be due to the mineral content of the Saharan dust. One of the most prominent minerals found within Saharan dust is iron (Fe), and there is recent evidence demonstrating its importance in coral-algae symbiosis which ultimately plays a role in coral calcification.

Acknowledgements: NSF SEAS Island Alliance, National Science Foundation INCLUDES Program, Award# 1930991 and The Nature Conservancy .

Analyzing Student's Attitudes Towards STEM in STX

Melissa Ferreras
Mentor(s): Dr. Chris Plyley

University of the Virgin Islands

Q&A Session 2: Education & Social Science (1:30-1:35pm)

There is a consensus in the United States that educational entities are falling short in producing the next generation of STEM talent for the workforce. Further, racial and ethnic minorities are underrepresented in STEM occupations, and many students at the high school level are diverting from STEM fields because they aren't comfortable or they don't believe they can succeed in math and science. In order to increase the amount of students that go into STEM careers, community-based STEM research projects have been implemented with the hopes of improving both student attitudes and student knowledge in STEM fields and careers, by showing students that STEM careers and STEM research involve more than just the math and science they know from school. In St. Croix, USVI, the Department of Education implements an intensive summer STEM research program where students are paired with a teacher to research various STEM projects. This research analyzes the results of three years (2018, 2019, and 2020) of student STEM attitude and STEM interest surveys. Surprisingly, the results show that many students suffered a significant decrease in their attitudes towards STEM after the research projects. Further analysis highlights the importance of the individual teacher and the project design in student experience. A general of current student attitudes and interests towards STEM in STX is also discussed.

This research is proudly funded by the NSF HBCU-UP ACE Implementation Project: The UVI Growth Model Award No. 1623126.

Challenging Experiences Centered Around a Hurricane for Undergraduate Students at the University of the Virgin Islands

Angelisa Freeman
Mentor(s): Dr. Michele Guannel

University of the Virgin Islands

Q&A Session 2: Education & Social Science (1:35-1:40pm)

This research project investigated the challenging experiences before, during, and after a hurricane. This study includes 26 Caribbean hurricane essays written by undergraduate students in the SCI 100 course at the University of the Virgin Islands. The study used a phenomenological approach to analyse data for common themes, or codes. These codes were utilized as a starting place in which 13 common themes that were coded in the essays. These themes were then analyzed and the most cited challenging experiences before, during and after were identified. The lack of knowledge about hurricanes was the most cited challenging experience before a hurricane. Lack of knowledge about the hurricane includes no knowledge and underestimating the destructive potential. The emotional state and damages were the most cited challenging experience encountered during a hurricane. Everyone possessed different emotional dispositions and endured various levels of damages. Emotional loss and physical loss were the most cited challenging experience after a hurricane. Loss that is, emotional and physical loss, was the most challenging of all experiences. Many lost possessions and lives due to the hurricane. Some recommendations include building shelters and homes to withstand major hurricanes, implement hurricane drills and having alternative communication techniques to ensure people are better prepared. Everyone should have an emergency plan for each household and adequate counselling services for persons with post-traumatic stress disorder. A hurricane is a potential danger to all thus, is it important to be prepared.

Research supported by the ECS Honors Fund and VI-EPSCoR

Detection, Assessment, and Mitigation of Public Network Exposures in the USVI

Javier Galiber
Mentor(s): Timothy Kentopp

University of the Virgin Islands

Q&A Session 4: Math, Engineering & Computer Science (1:05-1:10pm)

Initial research of a public network in the USVI revealed that tens of thousands of consumer and business systems exhibited needless system exposures. Most users are unaware that smartphones and tablets have no firewalls to protect them on Wi-Fi and the Internet. The latest Internet Protocol version (IPv6) includes security enhancements the previous version (IPv4) lacks. It may be possible to reduce network exposure by configuring selected devices on the same network to use different IP versions. Two locations were used to investigate the extent of public network exposures with open source tools. After initial results, three different trials were devised to test if devices using different IP versions would be less accessible. A device was configured with only IPv6, a second device with only IPv4, and a third device with both. An unexpected outcome of the public network assessment revealed three times the number of systems on business Internet were exposed than on residential Internet. In local trials to enhance security, results validated proof of concept as only devices configured alike could interact with each other. It was discovered default settings in network equipment provided by the ISP allowed unrestricted access to the home network gateway. Therefore, hackers could gain access to a local Wi-Fi, leaving mobile devices without firewalls at greater risk of compromise. While security can be enhanced using different IP versions, this promising method cannot be tested yet for most service providers in the USVI. Some tests were conducted after the conclusion of the summer research to see what other providers support IPv6. From the results, AT&T mobile Internet service was able to support IPv6. This granted access to the internet, however, the sites that are accessible through this type of AT&T service using this method is limited. More research is needed to investigate exposures likely caused by unchanged service router defaults in our territory, and to test the extent of IPv6 network access here in the US Virgin Islands.

Funding Source: NSF HBCU-UP ACE grant award #1623126.

Design & Manufacturing of Low-cost Hardware to Benefit Precipitation Monitoring

Ne'Kye George
Mentor(s): Dr. Marshall Parsons and Dr. N. Brice Orange
Co-Author: Ulric Baptiste

Etelman Observatory, University of the Virgin Islands

Q&A Session 4: Math, Engineering & Computer Science (1:10-1:15pm)

The University of the Virgin Islands' Etelman Observatory is home to several innovative technologies that support research in the fields of climatology and ground-based astronomy. For this project, we increased the technology readiness level of a long-range (LORA) and line-of-sight (LOS) radio communicator system designed to benefit the Etelman Observatory's Virgin Islands Robotic Telescope (VIRT), and the USVI Climate Monitor Program (USVI-CM). The process behind creating this technology, and our project was separated into three groups. The first was power management, output, and internal structure, which includes wiring, battery, nodes, etc. The second was its design and manufacturing, which takes into account durability and deterioration over the lifetime of the entire system. Third was following up on the software interface and programming aspect. Our project built upon the first-generation designs behind these specific technology sub-groups, and improved the interface between components and external entities (solar, antenna, rain sensor, etc.), and detailed the on-board power budget to optimize solar-power requirements. When manufactured, these units will be strategically placed in multiple locations throughout the United States Virgin Islands (USVI) to provide advanced warning of rain events to the Etelman Observatory, and initiate autonomous shutdown procedures for VIRT. In the future, we plan to branch the basic design of this technology to simultaneously benefit the USVI-CM.

Funding provided by NASA-MIRO grant NNX15AP95A.

Preparing Students and Communities for Natural Hazards in the U.S. Virgin Islands

Bethany Good
Mentor(s): Dr. Michele Guannel and Dr. Christopher Plyley

University of the Virgin Islands

Q&A Session 2: Education & Social Science (1:40-1:45pm)

After Hurricanes Irma and Maria severely impacted the U.S. Virgin Islands in 2017, it became evident afterwards that people were unprepared for the magnitudes of such disasters. This study is focused around STEM education research in the Science 100 class on the St. Thomas campus of UVI, a course that focus on natural disasters and ecosystems of the Caribbean. The objective of the study is to answer the question of how well students are prepared for a natural hazard to occur. The foundation of the research uses survey data and students' hurricane experiences. The study includes analysis of students' answers to pre- and post-surveys related to Disaster Preparedness and Safety, including sources students use to learn about natural hazards that may impact the USVI. To analyze the results of the 53 students who completed both the pre- and post-surveys, a paired t-test was performed for True and False questions and a McNemar Chi-Square test to determine significance in the natural hazard sources cited by students. Results indicated there was an overall significant ($p < 0.001$) increase in correct answers related to disaster safety, and a significant increase in the number of students who cited disaster response organizations ($p < 0.00001$) as sources of information about natural hazards in the VI, after the semester concluded. In addition, 26 hurricane essays, analyzed for emergent themes, revealed elements of survival preparedness, structural preparedness, and organizations, which were important to VI students who experienced Hurricanes Irma and Maria. This suggests that during the semester, students gained important knowledge to become better prepared in the event of natural disasters, as well as a recognition that their lived experiences of hurricanes increased their awareness of the need to be prepared.

Funding provided by the NSF HBCU-UP ACE Implementation Project: The UVI Growth Model 1623126 and supported by VI-EPSCoR.

Is Lindbergh Bay Eroding Since the Airport Expansion on St Thomas

Tione Grant
Mentor(s): Dr. Greg Guannel and Ariel Stolz

Caribbean Green Technology Center, University of the Virgin Islands

Q&A Session 1: Marine & Environmental Science (1:20-1:25pm)

Waves are an important factor in determining beach geography, so recognizing their formation and propagation patterns is essential to understanding their effects on nearshore areas and building inferences on events such as coastal erosion. It has been speculated that the Lindbergh Bay area is experiencing significant erosion due to the airport expansion project from the early 1900s. The goal of this project is to use modeling and propagation analysis to investigate wave behavior around the dredging site and theorize on the bay's erosion. Data profiles replicating the surrounding dredging site were modeled within Matlab, and different variations of wave components were inputted to mimic wave behaviors over these seafloors. The profiles were then manipulated and interpolated to remove the dredged hole and the exact wave variations were rerun over the new seafloors. After running different waves variations over both profiles, it was clear that filling the hole would reduce the bay's erosion, especially when it came to larger waves. And when the possibility of increase water levels was observed, the erosion levels were lower when the hole was filled. Future work seeks to examine the area using 2-dimensional modeling and implementation of SWAN modeling analysis to help build a greater understanding for the waves effect on the Lindbergh Bay area.

Funder Acknowledgment: Funding for this project was provided by the NSF HBCU-UP ACE Implementation Project: UVI Growth Model 1623126.

Genetics of the Invasive Seagrass- *Halophila stipulacea*

Emely Henriquez Pilier
Mentor(s): Dr. Alice Stanford
Co-Authors: Shantae Lewis and D'Shaunique Walters

University of the Virgin Islands

Q&A Session 1: Marine & Environmental Science (1:25-1:30pm)

The invasion of a seagrass may cause changes in local marine ecosystems and species. *Halophila stipulacea* originated in the Indian Ocean, then migrated towards the Caribbean and propagated throughout the region. Our research tested the genetic structure and clonal variation of the invasive seagrass and we wanted to know what could genotypes tell us about the invasion of *Halophila stipulacea* within the U.S. Virgin Islands. We also wanted to test if there were any differences in extraction quality between the various years of the research. We believed that once *H. stipulacea* invasion occurred, the rate of expansion was not related to genotype and believed there would be no difference in extraction quality throughout the years. To know the various genotypes, PCR and 2bRAD DNA sequencing was used, then genclone was used to analyze the data. So far, based on percent shared heterozygous loci, the majority of the distinct genotypes identified resulted from somatic mutation. An ANOVA was then done of three different years of the research (2016, 2017, and summer 2020) and their extraction quantities. It was found that 2017 had the best extraction quantity, while 2016 and summer 2020 showed similar but not significantly different extraction quantities. This showed that even though old leaves were used, the extraction quality was acceptable, and the extractions could be used for genotyping. Altogether, the results show that the invasion of *Halophila stipulacea* can be related to genotypes.

Acknowledgements:
NIH MARC at UVI: A Holistic Approach grant award #5T34GM008422-26

Searching for Radio Transient Sources

Marya Hussein
Mentor(s): Dr. Dario Carbone

University of the Virgin Islands

Q&A Session 5: Physics & Astronomy (1:10-1:15pm)

Radio transients are sources that are only visible for a limited amount of time (seconds to years) in the radio band. The analyzed images were taken by the radio interferometer LOFAR, which is composed of multiple antennas that work together as a single instrument.

I searched for transients in two different fields (two different parts of the sky) and then built light curves for the sources I detected. The reason I built light curves was to be able to decide whether those sources were transients or not.

Finally, since none of the sources was a transient, I was able to set an upper limit to the surface density of radio transients from my analysis. The transient surface density of transients is lower than 0.003 deg^(-2) for sources brighter than 0.2 Jy.

Project supported by the Research and Engineering Apprenticeship Program (REAP).

Training Acoustic Analysis Software to Identify Frogs Using Machine Learning

Sarai Hutchinson
Mentor(s): Dr. Renata Platenberg

University of the Virgin Islands

Q&A Session 1: Marine & Environmental Science (1:30-1:35pm)

Frogs are important to ecosystems as they control insect populations and are a food source for other animals. They are also important indicators of ecosystem function. They communicate through loud sounds that we can locate and monitor, and the use of bioacoustics, where recorders are placed to capture these sounds, is helpful in collecting large volumes of data. However, processing these acoustic files is tedious and incorporating automation into acoustic studies is important. The goal of this research project is to develop an automated classifier to identify different sounds within acoustic recordings and determine if frogs can be accurately identified using these classifiers. The hypothesis is that there is no difference in machine learning versus manual identification of frogs. The analysis software, Kaleidoscope, was used to sort the vocalizations according to acoustic patterns that were then used to create identification classifiers for four frog species. The classifier output was then tested against manually processed reference data. The classifiers did not identify each species consistently within the reference recordings because of the high variation within the vocalizations of each species. While the classifiers did aid in identifying frog species in this set of recordings, not all frog vocalizations were detected when compared against the reference data, resulting in an underestimation of the frogs present within the recordings. However, despite this, these findings mean that the workload for processing large volumes of data can be reduced through automation. Identifying sounds quicker and easier is the foundation for many other forms of analysis and can answer many more questions about frog ecology and environmental quality. Frog vocalizations are not the only things that can be recorded. Different species of animals and other types of sounds can also be located and monitored to maintain biodiversity.

Keywords: Machine learning; Frog vocalizations; Accuracy; Kaleidoscope

Funder Acknowledgement: Funding for this project was provided by the ECS Honors Fund.

The Biological Implications of Age and Gender on Lung Carcinomas: A Meta-Analysis

Anthony Jolly
Mentor(s): Dr. Lavida Rogers

University of the Virgin Islands

Q&A Session 3: Biology & Chemistry (1:20-1:25pm)

Lung cancer (LC) is one of the most prevalent forms of cancer found worldwide, killing over 1.6 million people each year. LC can affect the pleura membranes in the lungs by causing a buildup of fluid or block major airways, both inducing shortness of breath and difficulty breathing. The prevalence and survival of individuals with lung cancer over a 5-year period vary between 4 - 17% depending on the individual's stage of the disease and region. Survival can be influenced by both biological and socioeconomic factors (race, gender, genetics, age), as well as lifestyle choices (smoking history and diet).

This meta-analysis study aims to investigate gene expression profiles of both control individuals (n= 229) and those with LC (n=705) in order to identify biomarkers for the disease. We used publicly available datasets curated from the Gene Expression Omnibus (GEO) Database from the National Center for Biotechnology (NCBI) that reported individual's age, gender, disease stage, and smoking history. Based on our inclusion criteria, we curated 6 lung cancer microarray expression datasets (total of 934 samples). The expression datasets were preprocessed and pooled together to assess genetic variation in LC. We performed an ANOVA to identify genes differentially expressed by disease state. These genes were further explored for factorial effects (age, sex). We expect to see a higher gene expression profile in males with LC compared to females and a higher disease stage among smokers compared to non-smokers.

Funding provided by UVI NIH RISE grant award #5R25GM061325-16.

Finite Element Modeling of the Electroporation Phenomenon Using Microfluidic Devices

Deidre Lee
Mentor(s): Jeffery D. Zahn, Ph.D.
Co-Authors: Christopher Kidchob and Upasana Ghosh

Rutgers University

Q&A Session 4: Math, Engineering & Computer Science (1:15-1:20pm)

Electroporation is a non-viral technique in which an electric pulse is applied to cells which generates a membrane potential difference, and induces temporal pores in the cell membrane, allowing access for molecular delivery into the intracellular space. However, the task of obtaining efficient delivery without compromising cell viability is crucial when using this technique. A microfluidic platform is a unique way to electroporate flowing cells in an automated and controlled manner while increasing cell viability. Computational models are crucial in the design process, as they can identify a microfluidic and electrical design for optimal results. My role in this ongoing project is to model a microfluidic platform that performs electroporation on blood cell types using COMSOL Multiphysics.

This work was supported by the NSF REU in Cellular Bioengineering: From Biomaterials to Stem Cells (NSF EEC 1763005).

Structure-Based Virtual Screening Methods to Determine the Inhibitory Potential of Compounds Isolated from Caribbean Plants against Main Protease of Sars-Cov-2

Juchara Margetson
Mentor(s): Dr. Neelam Buxani
Co-author: Arya Duncan

University of the Virgin Islands

Q&A Session 3: Biology & Chemistry (1:25-1:30pm)

The outbreak of the novel coronavirus disease COVID-19, caused by the SARS-CoV-2 virus, has spread rapidly worldwide and has become the current health concern to the entire world. The heart of the COVID-19 outbreak was in December 2019 in Wuhan, China. It has over 3,096,626 confirmed cases, and 906,092 confirmed deaths reported by the World Health Organization. Since SARS-CoV-2 is a newly discovered pathogen, no specific drugs have been identified or are currently available. An economical and efficient therapeutic strategy for developing antiviral drugs is drug designing using molecular docking. In this study, four native Caribbean plants (Aloe Vera, Moringa, Lemongrass, Lignum vitae) were selected to compile a list of compounds to be virtually screened and identified as potential antiviral agents for COVID-19. One hundred twenty-five compounds were observed *via* a docking study. Docking studies were performed using the Glide software of Schrodinger (Schrodinger software suite, Maestro 2020-2). Out of 125 compounds, 13 showed significant inhibitory potential against SARS-CoV-2 main protease's (PDB code: 6LZE) active site. Based on the glide docking score (GDS) (in XP mode) and binding energy, the compound rutin (GDS: -11.962) was the best compound to be a potential inhibitor of SARS-CoV-2. ADME studies were also performed to evaluate the drug-likeness of these compounds. This research will help get new medicines from native Caribbean plants against COVID-19 and help fight the pandemic.

Acknowledgments: NIH MARC at UVI: A Holistic Approach grant # 5T34GM008422-26

Determining Energy Resolution from Inorganic Sources

Kervin Mathurin
Mentor(s): Dr. Georgia De Nolfo and Dr. David Morris

NASA Goddard Space Flight Center

Q&A Session 5: Physics & Astronomy (1:15-1:20pm)

The development of the University of the Virgin Islands own CubeSat (UVI-GREAT) continues to make great progress. In the near future this 3U CubeSat will be able to aid in the detection and localization of short duration Gamma-ray Bursts. On the journey to the completion of this project my task was to focus on the energy resolution of various inorganic sources. One of the well-known sources that I started with is Cesium-137. To begin my task, I created an algorithm that found the peaks from oscilloscope data. Once this was perfected a histogram of those peaks were created and fitted with a Gaussian curve. The next steps in finding the energy resolution would be to determine the Full Width at Half the Maximum (FWHM) of the curve center at the histogram peak(s).

Acknowledgement: NASA Goddard Space Flight Center, NASA MIRO

Kale Leaf Growth and Water Content

Dazonte Mathurin-Phaire
Mentor(s): Dr. Thomas Zimmerman

University of the Virgin Islands

Q&A Session 1: Marine & Environmental Science (1:35-1:40pm)

Kale, *Brassica oleracea*, is a health food grown during the cool season in temperate climates; however, the U.S. Virgin Islands (USVI) lacks a cool season, hence the need to evaluate how kale grows. The objective was to determine what kale variety to plant and when to harvest the leaves by studying the rate of leaf growth and water content in fifteen kale varieties. The null hypotheses was that all kale leaves grow at the same rate and have the same percentage water. Kale was planted in a completely randomized block design of three blocks and fifteen replications per variety and block. Kale leaf length was initiated on 2 cm kale leaves that were measured for three weeks. Mature leaves were weighed with and without the midrib and dried 48 hrs at 40^{o}C. The 15 kale varieties were classified into four distinct leaf types: green and red curly, dinosaur, and 'Red Russian'. The results indicated kale leaf development is a linear curve with two distinct groups, and it has logarithmic followed by slow growth. Kale leaves can be harvested 21 days after planting. Dinosaur leaf kale varieties produced significantly more marketable leaves than other leaf types and are best to grow in the USVI. The kale's midribs significantly increase the fresh weight of leaves, with the larger the leaf, the greater the midrib weight; however, there was no significant difference between the percentage water content with or without the midrib. Kale production is possible even during the USVI's warmest dry season, with the deep green dinosaur types the most productive. Kale leaves can also be dried to extend the shelf life.

Funding provided by UVI NIH RIE - Building Students' Identities as Scientists grant award #2R25GM061325 and USDA-NIFA-Hatch.

Spatiotemporal Variation in Fish Cleaning at Corkscrew Anemone Stations

Matthew Mullins
Mentor(s): Dr. Stephen Ratchford

University of the Virgin Islands, St. Thomas, USVI 00802

Q&A Session 1: Marine & Environmental Science (1:40-1:45pm)

Marine cleaners are ecologically important to many coral reef ecosystems, but little is known about the spatiotemporal variation of fish cleaning by common Caribbean cleaner shrimps, *Ancylomenes pedersoni* and *Periclimenes yucatanicus* that inhabit the corkscrew anemone *Bartholomea annulata*. We compared the fish visitation rates and rate of successful cleaning using over 140 hrs. of video collected from an inshore area (2-3m depth) and an offshore area (7-8m depth) in St. Thomas, USVI, over a 10 week period. Despite both areas having approximately the same density of anemones and being populated by a similar number of cleaner shrimps, the inshore anemones had a visitation rate over 4x that of the offshore area. Almost all visits to the offshore area resulted in cleanings, while the success rate inshore was below 40%. Client fish species varied by area. Weekly average visits/hr varied 4-fold at the inshore site and almost 9-fold at the offshore. Approximately 29% of anemones with shrimp were not visited at the inshore area, while 49% of anemones with shrimp were not visited offshore. Factors that lead to spatiotemporal variation in fish cleaning need further exploration.

Funding provided by National Science Foundation Grant No. 0346483 and supported by VI-EPSCoR.

Object Detection for Physical Security

Christopher Murphy and Shamir Smith
Mentor(s): Dr. Yen-Hung Hu
Co-Authors: Jaemond Reyes and Kenique Liburd

University of the Virgin Islands, Norfolk State University

Q&A Session 4: Math, Engineering & Computer Science (1:20-1:25pm)

Cyberattacks are not only limited to attacks on software, but include physical assaults against personnel and hardware as well. In order to provide physical security, one promising and low cost method is the use of open source real-time object detection. As of 2020, accurate real-time object detection is possible, and can be used to identify potential physical threats to valuable properties. The purpose of this research is to use open-source software and datasets to adapt pre-trained object detection models in order to detect anomalies such as shadows, and weapons such as guns and knives. By using a pre-trained model, we can adapt transfer learning to adjust the model to detect shadows, guns, and knives. New data in the form of video and images will be given to the model with the objective of helping the algorithm recognize physical threats. Some tools we will use are open-source software such as Linux, Python3, OpenCV, and CNN deep learning algorithms. By successfully training a model to detect potentially threatening items, it will be possible to process, identify and protect against physical threats in an efficient and low cost manner, and provide an example of the practicality of world-wide adoption of open-source software and deep learning models as physical security assets.

Funding provided by the Department of Energy National Nuclear Security Administration DE-NA0002686 and CECOR.

Automatic Signal Detection and Analysis

Joel Mwambungu
Mentor(s): Dr. David Morris, Dr. Dragan Nikolic, and Amalaye Oyake

Jet Propulsion Laboratory (JPL); University of the Virgin Islands

Q&A Session 5: Physics & Astronomy (1:20-1:25pm)

Gamma ray bursts are very energetic short-lived bursts of light. They are produced by one of two ways, the collapse of a supermassive star or the coalescence of 2 compact objects. These bursts are short lived and can last up to either a few milliseconds or a few minutes. CubeSats are a class of research spacecraft called nanosatellites. CubeSats are built to standard dimensions of 10 cm x 10 cm x 10 cm. The purpose of this project is to develop a framework for the rapid detection and classification of Gamma ray burst signals to be used by a cube-sat satellite which will be built by the UVI physics department and eventually launched into space. This framework was developed in a three-step process. The first step was the analysis and manipulation of spectrometer signal data into a format that can be read via computer software. The second step was to read the signal data into a small program and create algorithms to identify the different peaks present on these signals. In addition, information such as the height and time of the peaks was also produced using algorithms. And the third step was to generate custom signals using scientific equipment and modify pre-existing algorithms to accurately detect and analyze output signals.

This research was partially funded by the University of the Virgin Islands Physics department grant #80NSSC17M0048 and JPL Research Support Agreement (1646971).

Journey into Detecting Transient Sources

Joshua Parris
Mentor(s): Dr. Dario Carbone

University of the Virgin Islands

Q&A Session 5: Physics & Astronomy (1:25-1:30pm)

Radio waves are a part of the Electromagnetic Spectrum. What determines the type of Electromagnetic radiation created is how fast a wave wiggles on the Electromagnetic Spectrum. Radio waves are the lowest waves in terms of frequency with Gamma Rays being the highest. Radio Astronomy was discovered by Karl Jansky. He discovered radio waves coming from the Milk Way. Astronomers map the position of objects in the sky using celestial coordinate systems along the Celestial Sphere. Radio transients are sources that are only visible during a certain period and are detectable by radio telescopes Transient Sources are sources that are short lived. In this project we analyzed a series of observations of the same field taken by the Low Frequency Array (LOFAR). Radio telescopes are interments that explore the Universe in radio waves. The Main goal of this project is to constrain the rate of transient sources if they are any found. For our methods we focused on four radio sources in that field. We used the computer program DS9 for the parameters of these images. We built a light curve using the computer programming language called Python to determine whether these sources were transient or not. Based on our results there were no transient sources found, but we were able to out constraints to the radio transient rate. Continued research will be required to find transient sources and constrain the rate if any sources are found in different frames.

Simulations through Geomega & GEANT4

Jordina Pierre
Mentor(s): Dr. Georgia DeNolfo and Dr. David Morris
Co-Author: Grant Mitchell

University of the Virgin Islands, NASA Goddard Space Flight Center

Q&A Session 5: Physics & Astronomy (1:30-1:35pm)

This project aims to develop a detailed radiation simulation that will inform design parameters for the UVI-Gamma-Ray Experiment for Astrophysical Transients (UVI-GREAT) mission. This gamma-ray detecting instrument will focus on detecting sources like Gamma-Ray Bursts and other cosmological sources of gamma-rays from a high-altitude (100,000 ft) balloon flight aboard the High-Altitude Student Platform (HASP).

A key element of UVI GREAT is the scintillator crystal which detects the Gamma -rays from a GRB. When the GRBs occur, the light interacts with the crystal which then produces UV light that is converted into a digital signal and read by the SiPM (Silicon Photomultiplier). This research project focused on simulating the behavior of high energy photons as they interact with the UVI-GREAT instrument. Processes that are simulated include the photoelectric effect, Compton scattering, and pair production.

To begin the research, MEGAlib and GEANT4(Cosima) were downloaded to simulate the high-energy Gamma-Ray photons that are produced by GRBs. Geomega, a package included in the MEGAlib software, was downloaded to create a simulation model of the scintillator crystal as well as define and specify properties such as the density, material, volume and shape while Cosima was used to simulate high energy Gamma-Ray particles at the simulation model. Cosima then records the amount of trigger events and save them to “sim” files which can only be read by REVAN (Real Event Analyzer). REVAN combines the Cosima (detectors) and Geomega (simulation model) file to produce detailed results on the events which aids in the ability of the UVI GREAT CubeSat to characterize GRBs.

Acknowledgement: NASA MIRO program grant #NNX15AP95A

Dessin d'Enfants from Cartographic Groups

Ashly Powell
Mentor(s): Edray Goins, PhD.
Co-Authors: Nicholas Arosemena and Yaren Euceda

Mathematical Science Research Institute

Q&A Session 4: Math, Engineering & Computer Science (1:25-1:30pm)

A Belyi map is a morphism $\varphi : S \to P^1(C)$ of degree N defined on a Riemann surface S which is branched above $\{0, 1, \infty\}$. Its monodromy group is a transitive subgroup of the symmetric group S_N ; it is contained in a triangle group $\Delta(x, y, z) = \langle \sigma_0, \sigma_1, \sigma_\infty \rangle$ generated by permutations $\sigma_0, \sigma_1, \sigma_\infty \in S_N$ satisfying the relations $\sigma_0^x = \sigma_1^y = \sigma_\infty^z = \sigma_0 \circ \sigma_1 \circ \sigma_\infty = \mathbf{1}$. The Dessin d'Enfant $\Delta_\varphi = (B \cup W, E)$, associated with the monodromy group, is the bipartite graph whose "black" vertices are $B = \varphi^{-1}(0)$, "white" vertices are $W = \varphi^{-1}(1)$, and edges $E = \varphi^{-1}([0, 1])$. The monodromy group may be viewed as the cartographic group of the bipartite graph.

Our objective for this project is to work in the reversed direction. Lets say that we are given a transitive permutation triple $\sigma_0, \sigma_1, \sigma_\infty \in S_N$, which satisfy (i) $\sigma_0 \circ \sigma_1 \circ \sigma_\infty = \mathbf{1}$ and (ii) $G = \langle \sigma_0, \sigma_1, \sigma_\infty \rangle$ and is a subgroup of S_N. Then there exists a special bipartite graph $\Delta \hookrightarrow S$ that can be drawn on a Riemann surface in a way that its cartographic group is G. Essentially for this project we focused on drawing Dessin d'Enfants when the Riemann surface has genus greater or equal to 1 ($g \geq 1$) by using the examples that appears in the L-Series and Modular Forms Database (LMFDB).

Funding provided by National Science Foundation under Grant No. DMS-1659138 and the Sloan Grant under Grant No. G-2017-9876.

Producing Synthetic Observation of Dust Emission

Silene Prentice
Mentor(s): Dr. Jonathan Ramsey and Dr. Jan Staff

University of Virginia

Q&A Session 5: Physics & Astronomy (1:35-1:40pm)

When stars are very young and are in early stages of formation, they called a protostar. As they evolve, and accumulate mass from circumstellar disk, they produce protostellar outflows. Protostellar outflows are made by gas and dust that never reach the young star, interacting with a dusty envelope and being ejected perpendicularly into space. The objective of my research is to produce synthetic observations of protostellar dust outflows at different masses in its evolution.

RADMC-3D is a software used to calculate dust temperatures when given a certain density and dust opacity. Using densities taken from Staff et al. (2019), RADMC -3D and other python plotting libraries, dust temperatures were calculated, and the first stage of images were produced for the evolving young stellar object at 1, 2, 4, 8, 16 and 24 solar masses. Many factors, distance from Earth and atmospheric interactions to name a few, impact what we observe with a telescope. Future work includes implementing those variables using CASA, Common Astronomy Software Applications. Towards this goal, images at wavelengths relevant to the Atacama Large Millimeter/ sub-millimeter Array (ALMA) or Very Large Telescope (VLT) will be produced.

Funding provided by NSF award #1910271 and NASA #NNX15AP95A.

Modeling Infection Rates in the USVI

Teh'Rhon K. Rabsatt
Mentor(s): Dr. Marc Boumedine

University of the Virgin Islands

Q&A Session 4: Math, Engineering & Computer Science (1:30-1:35pm)

Modeling and simulating infectious rates during a pandemic are critical to slow down and eradicate the spread of the COVID-19 disease. Decision makers are using those models and simulations to recommend life-saving interventions. In addition, slowing the rate of transmission also has an essential impact on the resources available to the health care system. Effective decisions allow relaxing interventions such as travel bans, social distance, business closures which are keys to relieve the pressure of the economic system. The U.S. Virgin Islands are heavily dependent on tourism industries. Models of infectious disease rates designed specifically to the U.S. Virgin Islands are urgently needed to assist in making appropriate public health interventions. Designing and testing such models also requires reliable data.

This research studies the susceptible–infected–resistant (SIR) compartment model. The SIR model is simple to understand with a few parameters and can be adapted to fit data in the US Virgin Islands. Using Biopython and pre-constructed infectious which were slightly modified I attempted to simulate the current infection rates of COVID-19 in the Territory. The data streams used were infection data from the WHO and VI Census data as they proved the most authoritative data available. The simulations showed that should the VI begin to loosen social distancing and public safety restrictions infection rates will grow astronomically. My simulations show that we would see high recovery rates which is common with the virus but a factor I could not properly simulate was the limitations of our healthcare system. My work with mathematical models to simulate infection rates in the USVI has highlighted the importance to the public and the scientific community to accessing reliable raw and aggregated data sets.

In conclusion, creating a model to test out expected error rates, model parameters, and source reliable data streams are the best way to resolve these issues, but this has proven difficult. Without quality tested infection disease models for the Virgin Islands the expected error rates remain a mystery and worst of all, the knowledge of which model parameters work best to tailor a model to the infectious scenarios of the Virgin Islands. From this research, I have derived that the SIR model for modeling COVID-19 spread is still incomplete due to a lack of accurate model parameters. Additional work is necessary to further research on modeling infectious diseases in the Territory.

Keywords: Model, Infectious, COVID-19

Research Funding provided by NIH MARC at UVI: A Holistic Approach (Grant #5T34GM008422-26).

Marine Natural Compounds Isolated from Sponges, Cyanobacteria, Coral, Tunicate, and Algae as Potential Inhibitors Against the Main Protease of SARS-CoV-2—A Molecular Docking Study

Jada Roberts
Mentor(s): Dr. Neelam Buxani
Co-Author: Taquanna Baron

University of the Virgin Islands

Q&A Session 3: Biology & Chemistry (1:30-1:35pm)

There is limited information on treatment for immunization against the virus COVID-19, our goal is to create potential antiviral therapeutic agents against SARS-CoV-2. Main proteases (M^{pro}) by using the antiviral potential of marine natural products. For present study, 71 marine compounds isolated from algae (brown, green, red), sponges, corals, tunicates, dinoflagellates, and cyanobacteria collected from mainly Caribbean and Indo-Pacific regions were selected to assess their inhibition potential of active site of Main protease of SARS CoV-2 (PBD code: 6W63) through structure based Virtual screening methods mainly Docking *via* Glide software. Based on docking score (in XP mode), 22 compounds showed significant inhibitory potential, out of that 3 compounds have shown better results than co-crystallized ligand found with protein crystal (used as positive control). We ranked the compounds based on their Glide docking scores (GDS), compounds isolated from brown algae showed remarkable inhibitory potential and we believe that these marine compounds are appropriate leads for the development of therapeutic drugs against SARS-CoV-2. It was determined that these three compounds; Dieckol (GDS= -11.952), Diphlorothohydroxycarmalol (GDS = -10.076), and 6, 6'-bieckol (GDS = -8.676) all taken from brown algae proved to be the top three best results. Also, ADME properties of all these compounds were also studied and their drug likelihood was evaluated to better conclude our findings.

Keywords: Marine natural products, COVID-19, docking, Marine proteases (M^{pro}), Dieckol, Diphlorothohydroxycarmalol, 6, 6'-bieckol

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Solar Energy Sustainability in the US Virgin Islands

Kiwanee Smith
Mentor(s): Dr. Gregory Guannel and Ariel Stolz

University of the Virgin Islands, Caribbean Green Technology Center

Q&A Session 1: Marine & Environmental Science (1:45-1:50pm)

On island, the cost of living is relatively expensive when compared to cities in America. The US Virgin Islands' economy is six times more energy-intensive and per capita, US Virgin Islanders use seven times more electricity; this causes Virgin Islanders to spend five times more money on electricity. To try and resolve this, in 2010, Former Governor DeJongh implemented a plan using renewable energy that would decrease petroleum use by 60% by 2025. Our goal at CGTC was to find out whether the territory could operate and function properly using only solar energy and if not, how capable are we of getting close to 100% sustainability.

Looking at solar radiation data for the territory through ArcGIS, the eastern part of St. Thomas, the western part of St. John, and the south-southeastern part of St. Croix seems to be the best locations for any solar farm building; in these regions, there are actually two solar farms (one in Donoe on St. Thomas, and one in Spanish Town on St. Croix). We completed two working codes that would allow us to combine the data into bigger sets of data (weekly, monthly, etc.) so that we could find not only where, but when energy production would be greatest. Once we figure out how to approach this question, we plan on working with the different governmental agencies to see how this could affect electric transportation usage on island.

Management of Sensor Networks

Shimeeka E.H. Stanley
Mentor(s): Leigh Torgerson

Jet Propulsion Laboratory

Q&A Session 4: Math, Engineering & Computer Science (1:35-1:40pm)

In order to advance or excel in science exploration we must explore all of the possibilities. In this project, we are focusing on developing an efficient way to gather data by using Disruption-Tolerant Networking (DTN). Disruption Tolerant Networking (DTN) is a set of protocols that can enhance Internet capabilities in environments that does not have efficient data communication: where Internet does not function well. By taking advantage of DTN's useful qualities, we can accomplish sending and receiving data across secluded areas with harsh conditions successfully without interruption. This will be done by gathering and formulating a group of sensors that can interact with one another to send messages from one node to the next. By using the advantage the AMMOS Instrument Toolkit provides, it will help control and monitor the DTN which will grant the ability to gather information from these remote areas. 802.11 radio links will be set up and established between nodes. By using this radio packet scheme, it will allow DTN to transfer data to the location. If success is achieved in this project, it will demonstrate that DTN can be a useful and versatile way to send messages across deep space successfully and gather useful data.

Calibrating the VIRT Photometric System

Mitchell S. Turnbull Jr.
Mentor(s): Dr. Antonino Cucchiara

University of the Virgin Islands

Q&A Session 5: Physics & Astronomy (1:40-1:45pm)

In this project we focused on the calibration of the Virgin Islands Robotic Telescope (VIRT) photometric system. VIRT is a semi-robotic 0.5m Cassegrain telescope is located at the Etelman Observatory on St. Thomas and it is used by the University of the Virgin Islands physics students and faculty. This telescope is used to do research astrophysical objects, focusing on transients phenomena, including Gamma-ray Bursts, Gravitational Waves counterparts, and other periodic phenomena. VIRT CCD (charged coupling devices) is used in order to take images in different photometric Johnson VBRI filters. Using this data from the R filter images collected by the VIRT telescope, we calibrated the telescope by comparing the magnitudes and fluxes of a set of Landolt standard stars.

Photometric calibration is important because without a fully calibrated system astronomers from different locations cannot accurately compare data coming from different facilities, therefore leading to different scientific conclusions. For our calibration process, we took a series of images of standard stars and recorded the air mass values for when the images were taken, exposure times, and other useful information.

In our project we focus on the calibration the VIRT CCD R Band filter.

First, we took sets offive consecutive images for each star in the in R band. Next, we averaged the air mass and exposure times for each sets, and finally we calculated the median of the R band measured magnitudes for each standard star.

In order to assess our calibration accuracy we plotted the air mass versus calibrated standard magnitude and later, we estimated the R band Zeropoint (ZP).

Using just seven standard stars, the estimate R-band ZP= -3.6 with minimal scattering. While this is a preliminary results, many more standard stars have been observed and we plan to continue the work done in this project in order to improve the R-band Zeropoint for higher precision and to estimate the zeropoint in the other filters (V and B bands).

Project supported by Army Education Outreach Program (AEOP), Research & Engineering Apprenticeship Program (REAP).

Experimenting with Deep Learning Applications: An Authentic Classification Project on COVID-19 X-Ray Images

Khalai I. Vanterpool
Mentor(s): Dr. Marc Boumedine

University of the Virgin Islands

Q&A Session 4: Math, Engineering & Computer Science (1:40-1:45pm)

Nowadays, machine learning skills are becoming essential for performing knowledge discovery tasks and solving challenging problems such as image classification. Deep learning is an interesting topic in higher education and many talented students in the Science, Technology, Engineering, and Mathematics (STEM) programs are eager for hands-on experience and application that is related to deep learning. Reports of cases of an unknown pneumonia emerged December of 2019 in Wuhan, China, the agent was identified as coronavirus (SARS_CoV-2), and the 2019 novel coronavirus disease was named COVID-19 by the World Health Organization. There is a demand to implement supplemental coronavirus detection to forestall the spreading amongst healthy individuals. Image classification is a supervised learning task that involves multiple labels of classification. This paper conducts a study of deep learning models and compares classification results of coronavirus detection models. The models are used to identify features on its own, using the weights and biases learned through the training of the network. An analysis is done on the trained models to compare the performance of the model's architecture and its parameters. The experiments were conducted with chest X-ray images of 674 Covid-19 positive patients, 1432 normal and confusion matrices to evaluate the model's performance.

The Genetic Variability in Invasive *Halophila stipulacea* Seagrass in the U.S. Virgin Islands

D'Shaunique Walters
Mentor(s): Dr. Alice Stanford
Co-Authors: Shantae Lewis and Emely Henriquez

University of the Virgin Islands

Q&A Session 3: Biology & Chemistry (1:35-1:40pm)

Invasive species can affect an ecosystem function and structure. *Halophila stipulacea* is a seagrass that is native to the Red Sea and Indian Ocean, but has expanded in the Eastern Caribbean. Since its expansion in the U.S. Virgin Islands in 2012, there is little known about its invasion mechanism. The objective of this study is to identify if the population genetics structure of *H. stipulacea* in the U.S. Virgin Islands has been altered following hurricanes Maria and Irma in 2017. In addition, we hypothesized that the genotype will correlate with the depth based on previous findings discovered that this species has multilocus genotypes. To test our hypothesis, we performed 2bRAD genotyping to identify single nucleotide polymorphisms on samples collected at Brewers Bay, St.Thomas at various depths. By using this method, we will be able to identify the clonal diversity of *Halophila stipulacea*. In the genetics of the populations of *H. stipulacea,* we discovered that when we compared 2017 to 2019 there was no significant difference ($p=0.085$). We also found no difference in the genetic structure of samples collected in 2017 from Brewers Bay at different depths. Furthermore, we identified that although the majority of the samples collected in 2017 and 2019 were clones ($psex= 7.84 \times 10^{-88}$) we found that some samples collected in 2019 had some individuals that were not clones. Our findings have identified that *Halophila stipulacea* in the region, appears to be using asexual reproduction as its main reproductive mechanism. The genetic variation may result from both sexual reproduction and somatic mutation.

This research was funded by UVI NSF HBCU-UP Grant #1137472 and the Emerging Caribbean Scientist Program.

Relationship between Subjective Social Status, Perceived Discrimination, and Late-Life Depression on Executive Functioning in Older Afro-Caribbean Adults

Azriel A. Williams
Mentor(s): Aletha Baumann, Ph.D. , Karin Schon Ph.D., and Michael Rosario

University of the Virgin Islands

Q&A Session 2: Education & Social Science (1:45-1:50pm)

When people get older, executive functioning declines, which can be compounded by behavioral health and a person's subjective social status (SSS). According to the literature, we expect to see that SSS moderates the relationship between perceived discrimination, depression, and executive functioning of older Afro-Caribbean adults. Late-life depression, a mood disorder, is associated with a lower executive functioning in older adults and will be measured by the Geriatric Depression Scale. Perceived discrimination is associated with lower cognition in older adults, will be measured by the Experiences of Discrimination. SSS, a measure of social class, will be measured by the MacArthur Subjective Social Status Ladder. Executive functioning will be measured by the National Alzheimer's Coordinating Center's Uniform Data Set. Participants will be 60 Afro-Caribbean adults aged 50 to 80 years old who have lived on St. Croix for at least 30 years. A linear regression model will be performed to ascertain if depression, perceived discrimination, and SSS predict executive functioning. Recruitment for participants started before the research was suspended due to COVID-19. Three participants completed the battery of tests, and an additional three completed one-half of the tests. This study will be moved to a non-face-to-face setting, completed by the individual participants in their homes, and mailed back to researchers. Although COVID-19 is not the only factor in this decision, the time it takes to complete the tests and that one test had to be completed in the early morning made recruitment for the face to face study difficult.

Grant funded by the Alzheimer's Association and UVI MARC grant award #5T34GM008422.

Meta-analysis of Gene Expression Variability in Asthma

Ellaina A. Wyllis
Mentor(s): Lavida R. K. Rogers, PhD

University of the Virgin Islands

Q&A Session 3: Biology & Chemistry (1:40-1:45pm)

Asthma is a long-term inflammatory disease of the airway producing symptoms such as wheezing, coughing, chest tightness, and breathlessness. The Centers for Disease Control and Prevention (CDC) reported chronic lower respiratory diseases, such as asthma, as the 4th leading cause of death in the United States. The CDC also ranked asthma as one of the most common chronic diseases affecting children. The underlying cause of asthma is not yet fully understood. However, it is suspected that both genetic predisposition and environmental factors influence an individual's susceptibility to the disease. Our study aims to highlight differentially expressed genes in asthmatics compared to healthy cohorts. We conducted a meta-analysis of publicly available microarray data from asthmatic and healthy individuals. We curated datasets that used the Affymetrix microarray platform and those that reported the subject's sex and disease state (4 datasets, 807 samples). We pre-processed the raw microarray expression data in R and conducted an analysis of variance that incorporated sex and disease state as effects. We identified 1,641 differentially expressed genes for disease status ($p<0.05$). However, we did not find any interactions between disease status and sex for these genes. Interesting Reactome pathways identified as enriched include neutrophil degranulation and mitochondrial calcium ion transport. Enriched gene ontology terms include hematopoietic cell lineage and prostate cancer. With our current findings and future analyses, we should be able to highlight potential gene and pathway associations that can hopefully be targeted to improve asthma diagnostics, treatment, and preventative care.

Acknowledgments: Funding provided by NIH RISE grant #2R25GM061325-15

Judges

LIST WILL BE UPDATED SOON...

Moderators

Diana Bowen
Dario Carbone
Timothy Kentopp
Stanley Latesky
Alice Stanford

The event organizers would like to recognize the moderators and judges who have volunteered their time and energy to critique the student presentations. They have made a huge contribution to the success of our students, symposia, and community. Their dedication to the advancement of young Caribbean scientists is greatly appreciated. Thank you!

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