Eighth Annual

Summer Research Symposium

July 30, 2010
St. Thomas Campus
College of Science & Mathematics
University of the Virgin Islands

Participants

Mathematics Behind the Science bridge Program	Summer Sophomore Research Institute (SSRI)	Summer Undergraduate Research Experience (SURE)
Wyndi Ambrose	Konstantinos Alexandridis, *Mentor*	Kavita Balkaran
Leonardo Bardomero, *TA*	Marc Boumedine, *Mentor*	Charnele Burton
Elyze Barthelemy	LaVerne Brown, *Mentor*	Cherise Burton
Delanie Blash	Angela Dikou, *Mentor*	Eugene Brooks
Tasha Corneille	Jeremiah Duffy	Marc Boumedine, *Mentor*
Richardson Edwards	Emilio Edwards	Steven Case, *Mentor*
Trichelle Ekpe	Akacia Halliday	Angelica Claxton
Tricia George, *TA*	Gabriel Ible	Angela Dikou, *Mentor*
Taida Gooding	Dimitri Maduro	Danye Gomez
Micadel Hazell	Melisa Matthias	Chinaemere Igwebuike
Abrar Husein	Keturah McCrae	Doug Iannucci, *Mentor*
Tyriq Isles	Kianna Phillip	Precious Laurent
Brian Julien	Jerome Rogers	Mohammad Mustafa
Jerice Lake	Alice Stanford, *Mentor*	Dennis Powell
Marcel Lindsey	Benise Tavernier	Steve Ratchford, *Mentor*
Darnell Little		Alice Stanford, *Mentor*
Danny Lynch		Anne Tagini
Alexia Mintos, *Instructor*		Teresa Turner, *Mentor*
Oshana Mitchell		Basil Williams, Jr.
Tobias Ortega-Knight		Jasna Zekic, *Mentor*
Tyrone Pascal		Thomas Zimmerman, *Mentor*
John Phillip		
Brandon Rhymer		
Amber Stanley		
Micah Thomas		
Kyle Williams		

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Triunitary Perfect Numbers

Leonardo Bardomero
Douglas Iannucci, PhD (mentor)

Given positive integers n and d, we write $d \,||\, n$ if d divides n but the greatest common divisor of d and n/d is 1. We may write instead $d \mid_1 n$. In this case we call d a **unitary divisor** of n. Then we write $d \mid_2 n$ if $d \mid n$ and the greatest common unitary divisor of d and n/d is 1. In this case we say d is a **biunitary divisor** of n, and we write $d \mid_2 n$ in this case. We may extend this inductively: we say d is a **k-ary divisor of** n, and we write $d \mid_k n$, if d divides n, and the greatest common (k-1)-ary divisor of d and n/d is 1. We refer to 3-ary divisors as **triunitary divisors,** and to 4-ary divisors as **tetraunitary divisors,** and so on.

Now let $\sigma^{k)}(n)$ denote the sum of k-ary divisor of n. We say that n is **k-ary perfect** if $\sigma^{k)}(n) = 2n$. In this talk we will give all our results to date regarding the existence of triunitary perfect numbers.

Do Black Long-spined Sea Urchins have substrate preferences?

Eugene Brooks Jr.
Teresa Turner, PhD (mentor)
Summer Undergraduate Research Experience (SURE), University of the Virgin Islands

The Black Long-spined Sea Urchin, *Diadema antillarum* is a herbivorous marine invertebrate which resides on coral reefs throughout the Caribbean Sea and Atlantic Ocean. This keystone herbivore holds a vital role in preserving a coral dominated reef. This was demonstrated when a massive die-off of this species, in the early 1980's, resulted in a phase shift to algal dominated reefs. *Diadema* densities remain low and algal domination persists. Understanding what factors prevent flourishing numbers of *Diadema* requires knowledge of habitat preferences. The question was asked: Do adult *Diadema antillarum* prefer substrate covered with the brown alga, *Dictyota* versus being bare versus crustose coralline red algae? A two part study was, developed. First, urchin transects were sampled at two areas of Brewers Bay, St. Thomas, US Virgin Islands. Four 30 m transects were used, with 10 randomly chosen quadrats for each transect. Areas with high densities of urchins had little or no brown algae. And conversely, areas with high biomass of *Dictyota* had few or no urchins. In the lab, preference experiments were performed in sea water tables. Bare rocks, rocks with crustose coralline algae, and rocks with *Dictyota*, were used to test urchin preference.

This research was funded by NSF HBCU-UP grant # HRD–0506096 awarded to the University of the Virgin Islands.

Data mining of socio-economic factors to predict Violent Crime in Communities

Mohammad Mustafa & Jerome Rogers
Marc Boumedine, PhD (mentor)
Summer Undergraduate Research Experience (SURE) &
Summer Sophomore Research Institute (SSRI), University of the Virgin Islands

One of the key concerns the law enforcement agencies is how to enhance investigative effectiveness by analyzing large data sets that are collected from different sources. The main goal of this research is to predict crime patterns by using data mining tools. The data sets that were used primarily focus on social and economic factors that contribute to obtaining information on the crime per capita ratio. The data were obtained from the machine learning repository at the University of California Irvine (http://archive.ics.uci.edu/ml/machine-learning-databases/communities/communities.names). Data sets were compiled from the 1990 US Census, the law enforcement data from the 1990 US LEMAS survey, and crime data from the 1995 FBI UCR. The data sets includes variables such as the percent of the characteristics of the population, family income, education level, number of police officers, and percent of officers assigned to drug units. The per capita violent crime variable was calculated using population and the crime variables considered violent crimes in the United States such as murder, rape, robbery, and assault. In order to analyze these large data sets, a regression model has been designed and tested using an artificial neural network (ANN) tool available in the data mining package Weka. Given the values of the independent variables (socio-economic factors), the ANN predicts the unknown dependent variable, which is the crime per capita ratio. In order to build an effective predictive model, a series of random testing was done using different parameters for training purposes. These parameters included running tests with different amount of folds, ranging from 2 to 18. Beginning with 128 different socio-economic variables, multiple tests with different amounts of folds have been run. Our experiments show that using 21 attributes at 10 folds give the most accurate prediction. We obtain a high correlation coefficient value of 0.7126 and a mean absolute error being 0.1179 which signified how close our predicted results were to real outcomes. Additional indicators such as the root mean squared error at 0.1795, the root absolute error at a 66 %, and the root relative squared error being at a 77% confirm our results. Based on our current experiments, we are able to conclude that data mining techniques can be used to predict the crime per capita ratio with an accuracy rate of at least 66%. These preliminary results are encouraging and crime data mining has a promising future for increasing the effectiveness and efficiency of criminal and intelligence analysis. Many future directions can be explored in this young field. For example, more visual and intuitive criminal and intelligence investigation techniques can be developed for crime pattern and network visualization. In relation to the Virgin Islands we hope that, based on these current results, data mining could be introduced to assist Virgin Islands' police and enforcement agencies.

This research was funded by VI-EPSCoR grant # 0814417 and NSF HBCU-UP grant # HRD–0506096.

Detecting Viruses Using ELISA for Sweet Potatoes in St Croix, VI

Chinaemere Igwebuike
Thomas W. Zimmerman, PhD (mentor)
University of the Virgin Islands Agricultural Experiment Station
Summer Undergraduate Research Experience (SURE) & Minority Biomedical Research Support Research Initiative for Scientific Enhancement (MBRS RISE),
University of the Virgin Islands

Sweet potato is an important staple food to the Virgin Islands and many other parts of the world. Viruses of the sweet potato plants can tremendously decrease the yield farmers receive from cultivating the tuberous roots of this plant. The objective of this research is to determine if viruses are present in local sweet potato crops and, if so, which viruses are present. ELISA kits were used to determine if viruses are present throughout the local sweet potato crop of St Croix. An ELISA kit uses antibodies to detect the presence of a specific protein produced by a virus; in this case sweet potato leaf samples. Leaf samples were collected from 6 locations around the island of St. Croix and tested for three different viruses. The data was then plotted and graphed onto a map. Forty-two (42) samples of sweet potato leaves were collected from around the island of St. Croix and the University of the Virgin Islands. An in vitro virus-free variety, obtained from the USDA Germplasm Repository, was used as a negative control. Most of the sweet potato plants on the island of St. Croix were positive for at least one virus. ELISA tests indicated that 15 samples were positive for Potyvirus, 12 samples were positive for Cucumber Mosaic Virus and 22 samples were positive for Zucchini Yellow Mosaic Virus. Of these results, 16 sweet potato samples were infected with multiple viruses. Eight (19%) of sweet potato samples tested negative for all three of the virus tests performed. The ELISA test was an effective way to detect the presence of Potyvirus, Cucumber Mosaic Virus and Zucchini Yellow Mosaic Virus in sweet potatoes grown on the island of St. Croix.

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Using Model Railroading to Teach Real-time Control Systems

Basil Williams, Jr.
Steven Case, PhD (mentor)
Summer Undergraduate Research Experience (SURE), University of the Virgin Islands

When teaching computer programming and computer architecture, most universities' curriculum focus on preparing students for careers in developing desktop and web-based business applications. With nearly 99.5% of all processors installed in embedded systems, there is a great need for additional curriculum related to the development of embedded systems (McCormick, 2007). At the University of Northern Iowa, students learn the details of embedded systems development by programming real-time control systems for a model railroad. This research investigates the viability of adapting the laboratory and instructional techniques used at the University of Northern Iowa in order to enhance the computer science and engineering curriculum at the University of the Virgin Islands. The software tools will be migrated from Ada to Java, the hardware will be migrated from HO-scale to N-scale, and the control systems will be migrated from analog-based to digital-based. These modifications are necessary in order to address the constraints and requirements that are unique to the University of the Virgin Islands. This migration of tools and techniques will enable development of a class at the University of the Virgin Islands that will better prepare students with an interest in Computer Science and Engineering for future work in real-time control systems.

McCormick, John W. (2007) 'Model Railroading and Computer Fundamentals", Computer Science Education, 17:2, 129-139.

This research was funded by NSF HBCU-UP grant # HRD–0506096 awarded to the University of the Virgin Islands.

Fireworms *Hermodice carunculata* are not chemically attracted to food smell but may be attracted to smells of conspecific feeding

Anne Tagini
Stephen Ratchford, PhD (mentor)
Summer Undergraduate Research Experience (SURE), University of the Virgin Islands

The fireworm *Hermodice carunculata* is a scavenger and a predator of coral and anemones. Some studies have concluded that *H. carunculata* does not use olfactory senses to find food, but rather only senses food via direct contact. However, we have personally observed that when a dead prey item is introduced, searching behavior begins and leads *H. carunculata* to the food source. We conducted y-maze experiments to determine if *H. carunculata* could chemically detect the presence of dead prey. One side of the maze contained the smell from a large chunk of dead fish while the other contained no prey smell. Fireworms were placed in the end of the maze and observed for up to 24 hours, and in some cases videotaped. A binomial test indicated that *H. carunculata* were not significantly attracted to the odors of dead fish (7 of 15 trials, p=0.69). Video replay showed that the worms explored both sides of the maze extensively. In a second set of experiments the y-maze was used to test whether the scents emitted by conspecifics during feeding, perhaps along with the food scent, attracts *H. carunculata*. One side of the maze contained dead fish and several conspecifics, while the other side did not. During theses trials a second y-maze was constructed. A binomial test suggested that there was no attraction to the conspecifics feeding (10 of 15 trials, p = 0.15). However we noted that results were dramatically different in the second maze versus in the original maze. All 8 replicates conducted in the original maze resulted in fireworms choosing the side with the food and conspecifics (p=0.003). Worms in the second maze tended to go to the left side of the maze whether prey/conspecifics were present or not, implying we had some sort of structural problem in the second maze.

This research was funded by NSF HBCU-UP grant # HRD–0506096 awarded to the University of the Virgin Islands.

Genetic Analysis of Endangered Species, *Erythrina eggersii*

Angelica F. Claxton
Alice Stanford, PhD (mentor)
Summer Undergraduate Research Experience (SURE), University of the Virgin Islands

Erythrina eggersii is an endangered endemic plant species found in the USVI (St. Thomas, St. John), the BVI, and Puerto Rico. The populations protected on St. John are still threatened and suffer damage due to feral herbivorous animals. Continuous construction and development on both St. Thomas and Puerto Rico threaten populations there as well. We will analyze the genetics of available populations to help develop a conservation plan. Genetic diversity aids in the individual's ability to adapt and increases biodiversity. In this summer's research, I analyzed samples from two populations on St. John (Caneel Bay, Fish Bay) to determine polymorphism and heterozygosity. My data has revealed that the first population (Caneel Bay) 84 % polymorphic alleles and 0.27 heterozygosity for the 25 loci analyzed. The second population (Fish Bay) has 48 % polymorphic alleles and 0.21 heterozygosity for the same 25 loci as the first population. The lower numbers in the second population may be due to the small population size (only 4 individuals). Analysis performed by AMOVA concludes there is no significant difference between these two populations. These average heterozygous and polymorphic results, give hope and starting material for the conservation and recovery of *E. eggersii* populations. Because there is no significant difference between these two populations, seedlings from individuals with higher polymorphism and heterozygosity can replenish those individuals in the second population. Despite average heterozygosity and polymorphism, the populations are very small, which is why damage from independent factors like hurricanes, disease, and invasive species may impact more severely than would a larger population. If any individuals of *E. eggersii* can be found on St. Thomas and Puerto Rico, further analysis can determine if these St. John populations can help to restore populations in these areas or vice versus.

This research was funded by NSF HBCU-UP grant # HRD–0506096 awarded to the University of the Virgin Islands.

Hovensa's Fluid Catalytic Cracker 7006 Pump Series Mechanical Seal Failure

Dennis Powell II & Precious Laurent
Jasna Zekic (mentor)
HOVENSA, LLC
Summer Undergraduate Research Experience (SURE), University of the Virgin Islands

This summer internship was helpful in our understanding of how machines work and are essential in helping a factory run. It also helped to show how important a mechanical engineer is to Hovensa. Even though no physical work was done on our part, being able to observe how seasoned engineers dealt with problems as they arose was a good experience. One specific problem would be that of the 7006 Pumps. The Operators and Engineers were taken by surprise when all three pumps (7006 A, B, and C) failed around the same time. Major decision making and troubleshooting took place in determining what the next step would be. Two main questions asked were, what would have cause these pumps to fail and what can be done to solve the issue? Further investigation into these questions lead to a single component called a mechanical seal. The same two questions were then applied to the seal, which finally lead to the flush, or the lubrication to the mechanical seal. The flush, HCO (Heavy Cycle Oil), was contaminated a catalyst from the refining process in it, that got in between the seal of the pump. The problem was solved by changing the flush to LCO (Light Cycle Oil) going to the seal. Changing the flush to the seal resulted in two working pumps that have yet to fail. Knowing that it was the flush that made the pumps fail made it easier to come up with a solution that saved the company lots of money.

This research was funded by HOVENSA LLC and NSF HBCU-UP grant # HRD–0506096.

Overgrowth Interaction of *Dictyota pinnatifida* with Live and Dead *Porites asteroides*

Kianna Phillips & Charnele Burton
Angela Dikou, PhD (mentor)
Summer Undergraduate Research Experience (SURE) &
Summer Sophomore Research Institute (SSRI), University of the Virgin Islands

Presently in the Caribbean, corals have succumbed to the over abundance and replacement of corals by algae on reefs. Scientists are baffled as to why this change or 'replacement' is taking place. In the past, coral reef systems have flourished in low nutrient levels. Over time, this characteristic has changed and nutrient levels have increased highly due to human-induced pollution. With the increase in nutrient levels and other human-induced stressors, such as increase in seawater temperature and overfishing, algal species have become dominant on reef systems and coral reefs seem to have lost their resilience. In nature, algae thrive upon high nutrient content. With this, one can inquisitively state: Do algae possess mechanisms that cause coral mortality in order to take over or does algae take advantage of other factors, which may cause coral mortality for its own blooming to occur? A field experiment was conducted at the University of the Virgin Islands MacLean Marine Science Center, focusing on the coral species *Porites astreoides* and the algal species *Dictyota pinnatifida*, in an effort to determine whether algae overgrow corals when corals dead or alive. Expectations were geared towards *D. pinnatifida* not overgrowing the live *P. astreoides*, which would imply that *D. pinnatifida* is dependent on other prominent factors of coral mortality for its overgrowth. If there is no difference however, in the ability of *D. pinnatifida* to overgrow live or dead P. *astreoides*, it can be deduced that algae use mechanisms which cause coral mortality in order to out compete coral and take over. This experimental research will be a stepping stone in addressing the adverse decline of coral reef systems, our barrier reef protectors, throughout the world.

This research was funded by a 2010 VI-EPSCoR Incubator Grant # 203053, NSF HBCU-UP grant # HRD–0506096, and VI-EPSCoR grant # 0814417.

Overgrowth Interaction of *Dictyota pinnatifida* with Live and Dead *Porites porites*

Melisa Matthias & Akacia Halliday
Angela Dikou, PhD (mentor)
Summer Sophomore Research Institute (SSRI), University of the Virgin Islands

Corals face problems, which vary from overfishing to coral diseases and global warming, which have all led to their decline. This decline has become an issue of concern to many scientists. Throughout the Virgin Islands, as well as other regions of the world, coral reefs are seemingly being replaced by “algal reefs”, prompting the question: Does algae overgrow live or dead corals? This study examines the overgrowth effects of the allelopathic algae *Dictyota pinnatifida* on live and dead samples of the reef-building coral *Porites porites*. Nubbins of live and dead *P. porites* were placed next to *D. pinnatifida* on a wire frame and monitored for overgrowth. We expect that the defense mechanism of *P. porites*, i.e. the production of a thick film of mucus, will be effective at preventing algal overgrowth of *Dictyota pinnatifida.* We also expect that *D. pinnatifida* will overgrow dead corals due to the absence of this defense mechanism. If we find that *D. pinnatifida* does not overgrow the nubbins of live *P. porites,* but overgrows the nubbins of dead *P. porites*, it can be safely concluded that *D. pinnatifida* is unable to overgrow *P. porites* without the help of external disturbances. Also, we can further conclude that “algal reefs” only occur in areas were the corals had since been dead, and, therefore, are not a contributing factor in the recent decline of coral reefs. From this, scientist can go on to further narrow down exactly what is causing the wide spread death of corals.

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Investigation the Synergistic effects of photochemical components in select ethno medical preparations on the island of St. Thomas, USVI

Emilio Edwards
LaVerne Brown, PhD (mentor)
Summer Sophomore Research Institute (SSRI), University of the Virgin Islands

In today's society many diseases have been cured by synthetic medicines made in the laboratories. Efficacy claims from most synthetic pharmaceutical treatments are based on the properties of a single active ingredient. In the Virgin Islands, many locals use ethno medical preparations containing a mixture of several "active" ingredients to relieve themselves of their sickness; this is also called folk medicine. This research investigates the potential synergistic benefits of multi-component ethno medical preparations used in the USVI over single drug therapies. Fractionation/liquid liquid extraction, Brine Shrimp Toxicity assays, LCMS, evaporation and Disc Diffusion assays are some of the methods that were used in our investigation. Of the 28 different ethno medical preparations that were investigated, only three displayed optimum antimicrobial efficacy against S. marcescens bacteria and low cytotoxicity. Kenip leaves (decoction), Red Hibiscus (tonic) and soursop (decoction) will be further investigated to elucidate the bacteriostatic, bacteriocidal, and synergistic vs. additive properties.

This research was funded by VI-EPSCoR grant # 0814417 and NSF HBCU-UP grant # HRD–0506096.

Investigating the Synergistic effects of phytochemical components in select ethno medical preparations on the island of St. Thomas with respect to anti-proliferative effects

Dimitri Maduro
LaVerne Brown, PhD (mentor)
Summer Sophomore Research Institute (SSRI), University of the Virgin Islands

In today's society many diseases have been cured by synthetic medicines made in laboratories. Efficacy claims from most synthetic pharmaceutical treatments are based on the properties of a single active ingredient. In the Virgin Islands many locals use ethno medical preparations containing a mixture of several "active" ingredients to relieve themselves of their sickness; this is also called folk medicine. This research investigates the potential synergistic benefits of multi-component ethno medical preparations used in the USVI over single drug therapies. Fractionation, Brine Shrimp Toxicity assays, liquid-liquid extraction, LCMS, and Disc Diffusion assays will be utilized in our investigation. The main purpose of anti-proliferative drugs is to kill cells or slow down the cell growth process and will be tested using the Brine Shrimp Cytotoxicity assays. From our experimental design we discovered that out of the 28 different concoctions prepared there are four botanicals that are suitable for the anti-proliferative study. Kenip Seeds, Crown of Thorn, Aralias, and Sweet Scent are the plants that will be used for anti proliferative study. Decoctions were prepared for Crown of Thorn, Aralias, Kenip seeds and an infusion for the sweet scent botanical. These plants depicted high cytotoxicity at low concentrations. At the lowest concentrations, Aralia showed a 94% death ratio, 90% for Kenip seeds, 60% for Sweet Scent, and 100% death ratio for Crown of Thorn. These botanical preparations will be further investigated to assess the synergistic vs. additive effects.

This research was funded by VI-EPSCoR grant # 0814417 and NSF HBCU-UP grant # HRD–0506096.

Studying the Historical Ethnoecology of the USVI-St. Thomas Fishing Community

Jeremiah Duffy, Benise Tavernier, & Keturah McCrae
Kostas Alexandridis, PhD (mentor)
Summer Sophomore Research Institute (SSRI), University of the Virgin Islands

Fishing in the US Virgin Islands has been a part of island survival and culture since before Europeans and slave trade found its way into the Caribbean. However, any potential decreases in Virgin Island fisheries, is likely to directly impact the viability of the local fishing industry, and have negative consequences to the fishing communities and their fisheries-dependent livelihoods. The aim of our research is to collect, study, and analyze local ecological knowledge of fishermen and the St. Thomas fishing community and how such knowledge of the past and the present can be best used to inform future sustainable and resilient decisions in regards to USVI fisheries and its management. Our research methodologies includes community-based participatory methods, observational studies, historical archival research, and literature review to gather subjective information to be evidence-based evaluated using qualitative models and methods of analysis. Such methods include content analysis, qualitative classification, photographic interpretation, longitudinal or panel analysis, classification matrixes, and mapping of social networks. We also seek to understand the conditions and thresholds that are likely to produce a sort of “domino effect” and negative feedback mechanisms, ensuing fishery decline resulting in species extinction, coral decay, loss of jobs and food, and increased fish prices in a recession weakened tourism-based economy. We will contribute to the construction of a web-based archive, which will include our findings and digitally cataloged photos and data. This archive will provide the fishing community and future generations with easily accessible public knowledge about themselves, their history, and their environment.

This research was funded by VI-EPSCoR grant # 0814417 and NSF HBCU-UP grant # HRD–0506096.

Fireworm Size and Copepod Parasitic Load are Positively Correlated

Kavita Balkaran
Stephen Ratchford, PhD (mentor)
Summer Undergraduate Research Experience (SURE), University of the Virgin Islands

The fireworm (*Hermodice carunculata*) is a polychaete well known for its fuzzy, stinging chaeta on either side of their long slender lengths. Fireworms are scavengers and predators to corals and sea anemones. Fireworms are parasitized in their gills which also run along their entire length by copepods, *Pseudoanthessius tortuosus*, that belong to the family *Pseudoanthessiidae*, a family that mainly parasitizes echinoderms. This species of copepod was only recently described as parasitizing fireworms in the Caribbean in 2009. We investigated if there is a correlation between the size of fireworms and the copepod parasitic load, as well as if there were differences in parasitic load at different sites. Eleven fireworms were captured in baited traps constructed from PVC fittings. Another 11 fireworms were caught by hand at the airport runway. We were unsuccessful at capturing fireworms in a nearby coral reef. The fireworms were then placed in anesthetic solution (Magnesium Chloride) and left for one to two hours. Under a dissecting microscope, copepods were removed, counted and preserved in separate vials for future references. We found a significant, positive correlation between the parasitic load and the sizes of fireworms found under the dock ($p < 0.001$, $R^2=0.8$). The fireworms collected at the airport runway averaged approximately half the size of the fireworms found under the UVI dock. Despite the size differences, the fireworms at the airport runway still fall within the general trend with the parasitic load with the fireworms found under the UVI dock. It remains to be seen whether the parasitic load affects predatory and scavenging ability of the fireworms.

This research was funded by NIH MBRS-RISE grant # GM061325 and NSF HBCU-UP grant # HRD–0506096 awarded to the University of the Virgin Islands.

Effect of Sarcotesta on Carica Papaya Seed Germination

Danyé Gomez
Thomas W. Zimmerman, PhD (mentor)
University of the Virgin Islands Agricultural Experiment Station
Summer Undergraduate Research Experience (SURE) & Minority Biomedical Research Support – Research Initiative for Scientific Enhancement (MBRS-RISE),
University of the Virgin Islands

Carica papaya L. is a fruit bearing tree whose seeds are surrounded by a thin sheet of a juice-filled membrane called the sarcotesta. The objectives of this project were to determine the influence of the sarcotesta on the germination of papaya and if the affects were different based on variety. Ten varieties of papaya were used for seed extracted from mature fruit that had varying seed size and smoothness. Approximately half were clean of the sarcotesta and the other half were left with sarcotesta intact. Two trials were done, in situ and in vitro. The results revealed that the sarcotesta accounted for ten to twenty-seven percent of seed dry weight. Both trials indicated earlier germination for seed without the sarcotesta. For all ten papaya varieties, seeds with the sarcotesta intact experienced delayed germination, lower germination percentage and seedling failure after germination. Removing the sarcotesta from papaya seeds can improve the rate and survivability of germinating seeds.

This research was funded by USDA-Hatch, NIH MBRS-RISE grant # GM061325, and NSF HBCU-UP grant # HRD–0506096 awarded to the University of the Virgin Islands.

The Genetic Structure of Two Mangrove Species found in the Virgin Islands

Gabriel Ible
Alice Stanford, PhD (mentor)
Summer Sophomore Research Institute (SSRI), University of the Virgin Islands

Although mangroves have significant ecological importance to our marine ecosystems, they have been diminishing rapidly over the last 30 years. Alarmingly, 20% of mangroves found around the world have been depleted and 67% of the mangroves found in the Virgin Islands have been destroyed. Therefore, in an effort to find appropriate ways to conserve these mangrove we seek to find out more about the population genetics of *Rhizophora mangle* (red mangrove) and *Laguncularia racemosa* (white mangrove). This information will allow us to distinguish which populations merit special protection due to the genetic variation of each mangrove community. In this project, we sought to find the best DNA extraction/isolation kit that will have yielded the most DNA with the least contaminants. We used a UV Spectrophotometer to determine the DNA quantification concentrations of our samples. The kits used were the Ultra Clean Plant DNA Isolation Kit (MO BIO Laboratories, Inc) and MasterPure Plant Leaf DNA Purification Kit (EPICCENTRE Biotechnologies). After visualizing the DNA on a 0.7% high melting Agarose gel, our results indicated that there were no visible differences between the two kits. However, we amplified our extracts using a thermo cycler with primers that have been tested and proven to amplify different loci on each species and found that there was a difference between the two kits. We will also be testing different PCR protocols for DNA amplification. All of our samples will be amplified and dehydrated before being sent to the Genetic Ecology Laboratory at Harbor Branch (Florida Atlantic University) to be separated using an automated sequencer. This crucial information will give us insight about the diversity of these plants, enable us to preserve and protect these mangroves from further damage, and monitor the loss of genetic variation in the future.

This research was funded by VI-EPSCoR grant # 0814417 and NSF HBCU-UP grant # HRD–0506096.

Determining Odd Triperfect Numbers

Cherise Burton
Douglass Iannuci, PhD (mentor)
Summer Undergraduate Research Experience (SURE), University of the Virgin Islands

Imagine coming so close to stumbling upon something that scientists deemed non-existent for years. Number theory is so mind boggling. Think back to the first mathematicians who discovered aspects as basic as perfect numbers, the core of my topic. This research project is specifically designed to get a closer look into the world of odd triperfect numbers. In particular, this project aims to find necessary conditions under which these numbers can exist if there are any at all. My hypothesis states that if there exists an odd triperfect number, then its largest prime divisor must exceed one billion. We are calculating the numbers using a program that my mentor has created. It uses simple commands which I have to input to calculate numbers and which allows me to formulate a number tree. We will be able to show that if an odd triperfect number exists, all of whose prime divisors are less than a billion, then 3 cannot be a divisor. This would be a major step toward proving that the largest prime divisor of an odd triperfect number must exceed a billion.

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Marc Boumedine
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Tannesia Petersen
Moneca Pinkett
Sandra Romano
Amanda Wright
College of Science and Mathematics
University of the Virgin Islands
2 John Brewer's Bay
St. Thomas, VI 00802
Phone: 340-693-1230
Fax: 340-693-1245
Website: http://www.uvi.edu

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