University of the Virgin Islands

17th Annual
Fall Student Research Symposium

Sunday, September 27th, 2015
1:00 pm to 3:00 pm
Administration & Conference Center
University of the Virgin Islands
St. Thomas Campus

Welcome!

Our research symposia showcase the diversity of UVI's STEM research activities while increasing awareness of research opportunities available for undergraduate students at the University of the Virgin Islands and abroad. Students present scientific posters that display the results of research projects in a variety of disciplines conducted alongside faculty at the University of the Virgin Islands, as well as at other mainland institutions. The events are organized by the Emerging Caribbean Scientists (ECS) Program in collaboration with the College of Science and Mathematics of the University of the Virgin Islands.

The mission of the ECS Program is to increase undergraduate student research training and promote excellence for STEM (science, technology, engineering, and mathematics), psychology, and nursing majors at the University of the Virgin Islands.

Thank you for attending. Enjoy!

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Gb3 Expression on Human Cervical Cancer Cells and Effects of Shiga Toxin-2

Annalyn Brown
Mentor(s): Ji Hye Seo, PhD
Department of Pathology & Laboratory Medicine, Boston University School of Medicine

Bacterial infections caused by enterohemorrhagic *E.coli (*EHEC*)* can lead to the development of hemolytic uremic syndrome (HUS) which may be fatal. In order to treat those suffering from this infectious disease, the effects of these bacteria must be studied *in vitro* before they can be monitored in animal models. Human epithelial cervical cancer cells (HeLa) were challenged with the Shiga toxin type 2 produced by these bacteria to evaluate effects on cell viability. Cells also were incubated with antibodies to determine Gb3 expression (CD77), the receptor on cell surfaces that binds the toxin, by flow cytometry. We hypothesize that HeLa cells would exhibit Gb3 receptors on their cell surfaces as well as be susceptible to the toxin. HeLa cells expressed Gb3 on their cell surfaces and qPCR was used to quantify mRNA for alpha-galatosidase, an enzyme important for Gb3 synthesis. HeLa cell sensitivity to Shiga toxin type 2 could not be determined due to inconclusive results. Further tests would need to be performed to obtain reproducible results for HeLa cell sensitivity to Shiga toxins. Understanding the receptor expression and toxin sensitivity relationships in different cell types contribute insight into the pathophysiology of the bacterial toxins.

This work was funded by UVI MARC 5T34GM008422 and NIH/NIAID R25HL118693.

Utilizing micromodems for underwater communication

Antonios Doliotis
Mentor(s): Dr. Xiaobo Tan
Michigan State University

Micromodems are electronic acoustic communication devices that modulate incoming signals with data and sends the modulated signal to another device. They are specially designed for underwater communication. Micromodems utilize frequency-shift keying (FSK) and phase-shift keying (PSK) modulation for underwater communications. Micromodems have been used for deep sea expeditions and submarines, and they have been tested to work at depths up to 11,000 feet.

Each micromodem will have their own host computer, and the two micromodems need to communicate wirelessly with each other as well as their respective host. One host will emit a ping that will be received by both micromodems. The micromodems will acknowledge that a ping was received and send a messages back to their host. After the ping, the distance between each micromodem will be calculated based on the type of signal used and the medium the micromodems are in (water or air). In addition, the micromodems must be able to send a mini-data packet and a binary message. The micromodems will be tested and programmed on land first, then they will be installed on robotic fish to test their communication speed and efficiency in water.

Once the two micromodems can successfully communicate underwater with each other and the host, more micromodems will be used to communicate with each other and the host in a mesh network. Using a large group of micromodems will be useful for effective deep sea communications for underwater rovers and submarines.

Funding Source: National Science Foundation

Evaluating the differences of bat habitat use and activity patterns using captive and passive methods.

Aseneé Flaharty and Muhammad Thuneibat
Mentor(s): Renata Platenberg, Ph.D.
University of the Virgin Islands

Bats are the only native mammals of the Virgin Islands. There are five species, which are comprised of three fruit eaters (*Artibeus jamaicensis, Brachyphylla cavernarum, Stenoderma rufum*), one insectivore (*Molossus molossus*) and one fish eater (*Noctilio leporinus*). Our research evaluated the differences in habitat use of different species using the following three methods: capture of flying bats using mist nets, visual observation of flying bats, and ultrasonic recordings of echolocation calls. We utilized sound processing software to analyze the recordings. We conducted five netting and observation surveys in four different locations on St. Thomas (Hendrick's Bay, Humane Society, Magens Bay and Neltjeberg Bay). The ultrasonic recorders were placed in two different locations (Hendrick's Bay and Neltjeberg Bay) and left for three nights. We evaluated bat use of three different habitats (closed forests, guts and open woodlands). All five species of bats were identified using mist nets, with a mean of 2.0 ±1.0 species per survey. We were only able to identify two species (*M. molossus* and *N. leporinus*) using either the recorders or visual observations. We identified the activity times using the recorders and the spatial and temporal separation of the two species by observations. Different methods provided different pieces of information that collectively showed niche partitioning between *M. molossus* and *N. leporinus*. Despite overlapping in activity time and habitat, these two species showed separation in their use of habitat. Our methods used were unable to assess separation between the fruit-eating species due to their similarities.

Funding for this program is provided through a grant from the National Science Foundation's HBCU-UP program, with additional support from the Community Foundation of the Virgin Islands.

Difference in feeding behavior among parrotfish species

Austin Dubbs
Mentor(s): Dr. Marilyn Brandt
University of the Virgin Islands

Coral reefs worldwide have changed dramatically over the past few decades. Overfishing on a variety of herbaceous organisms has been shown to change the coral reef ecosystem due to the removal of macroalgae control agents. In the US Virgin Islands, overfishing of several species of parrotfish has resulted in detrimental impacts to the health of the local coral reefs by allowing overgrowth of coral by various species of algae. An overabundance of algae on coral reefs can also result in decreased coral growth and recruitment. Various parrotfish species control the abundance of algae but it is not known how this varies with species. The point of interest in this study is comparing the feeding behavior among these different parrotfish species. This project used observational behavioral analyses to quantify and compare parrotfish feeding behaviors among species. Parrotfish of different species were followed for twenty minutes and every action taken by the fish, including the number of bites and the substrate targeted, was recorded during that timeframe. Benthic surveys were also performed to determine the availability of algae on the reefs compared with algae known to be preferred food by parrotfish. We expect that grazing rates and food preferences will vary by species and that some parrotfish species will have a greater impact on algae cover. This project is a crucial step in understanding the species-specific roles parrotfish play on coral reefs, and will contribute to our understanding of these important fishery species and their habitats.

Acknowledgments: VI-EPSCoR and NOAA CRCP

Antioxidant Activity in Local Algae

Brianna Scotland
Mentor(s): Bernard Castillo II, Ph.D.
University of the Virgin Islands

Antioxidants provide many benefits to the human body. They protect the cells against damages caused by oxidation reactions. Antioxidants act as a reducing agent that stops oxidation, which cause free radicals. Prevention of cancer, heart diseases and aging signs are just some benefits of antioxidants. Antioxidants can be found in varieties of foods such vegetables, fruits and algae. The objectives of this experiment were to: 1) determine the antioxidant activity in local algae and 2) correlate the macroalgae phyla with antioxidant activity. Our hypothesis was that the algae within the phylum Phaetophyta would have the higher total antioxidant activity than the algae within the phyla Rhodophyta and Chlorophyta. The methodology used to determine the antioxidant activity was the ABTS/H_2O_2/HRP decoloration assay. The drop in absorbance was scanned in UV-VIS spectrophotometer at 730 nm. The antioxidant activity was reported as µmole Trolox Equivalent (TE) per gram dry weight for algae. *Codium isthmocladum* (Chlorophyta) had the highest total antioxidant activity (872.96 µmol TE per gram dry weight), relative to all samples. *Penicillus capitatus* (Chlorophyta) had the lowest total antioxidant activity (56.79 µmol TE per gram dry weight). In conclusion, antioxidant activity was found in the six local algae and Phaetophyta did not have the highest antioxidant activity.

This research was funded by NSF HBCU-UP Grant #1137472.

How Halophila Stipulacea came to the Caribbean

Calwyn Morton
Mentor(s): Dr. Avram Primack
University of the Virgin Islands

Halophila stipulacea is an invasive species of sea grass that has recently been found in the Caribbean. The purpose of my research was to investigate how *Halophila stipulacea* may have migrated to the Caribbean. I tested the hypothesis of Lipkin (1975) that *Halophila stipulacea* could have moved on board a small boat, and the hypothesis that it could have arrived in the water transported by currents. To test these hypothesis I took samples of *H. stipulacea* and exposed them to the conditions that would be experienced under each hypothesis. The health of the samples was monitored using a portable fluorometer. I observed that plant health declined slowest when left floating on the water's surface while health declined faster when removed from the water, exposed to freshwater, and when kept in a damp cloth.

This research was funded by NSF HBCU-UP Grant #1137472.

Climate Data Analysis

Candace Petersen
Mentor(s): Dr. Avram Primack
University of the Virgin Islands

This study examined climate data collected by National Climate Data Center at the National Oceanic and Atmospheric Administration between 1951 to 2013 for the Territory and the larger Caribbean for seasonal and long term patterns. We chose to use data from 1972 to 2013 because it has the most continuously operating stations that recorded MAX and MIN temperature and precipitation. At many of the stations data was recorded by hand. At others, mechanical devices were set by hand. Both of these can result in errors and missing entries in the data series. I reviewed the data and constructed criteria in order to determine potential errors. The remaining data was reviewed and analyzed for patterns over the chosen years. As a result, it appears that from 1972 to 2013 that temperatures are steadily rising.

This research was funded by NSF HBCU-UP Grant #1137472.

Size doesn't matter: population dynamics of Pocillopora meandrina at Palmyra Atoll

Cheryl Petsche[1]
Mentor(s): Clinton Edwards[2], Yoan Eynaud[2] and Jennifer Smith[2]
[1]University of the Virgin Islands, [2]Scripps Institution of Oceanography

Corals have the ability to survive partial mortality as a result of colonial biology. Some corals, especially branching corals, can also grow rapidly (>5 cm/year). Pocillopora colonies were analyzed to establish 1) if mortality frequency increases with colony size and 2) if distribution of colony size changes over time. Analysis of permanent quadrat picture digitization along the fore reef at Palmyra Atoll for five consecutive years derived individual colony area, which was then placed into corresponding size classes. One-way ANOVA tests concluded no relationship ($p>0.05$) between mortality rates and size classes, along with colony size distributions throughout the five years. Colony size is not a reliable means for predicting mortality frequency within the colony for this data set.

Funding Source: HBCU-UP

Probability Distributions of Yellowfin Groupers within the Grammanik Bank

DeWein Pelle
Mentor(s): Jonathan Jossart MS, Richard Nemeth, PhD, Robert Stolz, PhD
University of the Virgin Islands

This project, is a continuation of a University of the Virgin Islands study conducted by Richard Nemeth, PhD and Jonathan Jossart, MS which sought to asses a probable location of habitation by the *Myteroperca venenosa,* yellowfin grouper, within the Grammanik Bank seasonal closure.

The yellowfin grouper is a coral reef fish that is prevalent within the western Atlantic Ocean, the Caribbean Sea as well as the Gulf of Mexico. Additionally, the grouper species is believed to live in reef areas with significant depth; however, migration to shallower areas are seasonally common. The aforementioned study utilized passive acoustic telemetry to track and monitor several factors of copious specimens. This current project seeks to utilize existing data to extend the abovementioned study through the application of several probability distribution functions (PDF's), operations used to define the probability of any quantifiable information and its possible outcome, to analyze plausible location for fish spawning. Uniform distribution shows a constant prospect from two foci, or otherwise two locations, in a set area of relatable distribution. Multivariate-normal distribution, a generality of the univariate normal to two or more variables, was also applied. Utilizing these methods with the dataset, we were able to identify probable fish location. Furthermore, the completion of this project assists in the zoning of the *Myteroperca venenosa* for proper cultivation whilst finding an amendable agreement to allow sustainability for the fishing industry in an avid attempt to avoid the yellowfin grouper's extinction within the Virgin Islands territory.

This project was funded by NSF HBCU-UP Grant #1137472 grant and while the deploying and maintaining of an acoustic array were funded by numerous agencies including Puerto Rico Sea Grant (#R-31-1-06), NOAA Saltonstall-Kennedy program (#NA09NMF4270068), the

Time-Resolved Pump-Probe Reflectivity

Elangeni Yabba[1]
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A pump-probe experiment is often used to study ultrafast carrier dynamics in semiconductors. Before conducting our experiment, we hypothesized that the pulse duration would be approximately 7 picoseconds and the carrier lifetime would be approximately 4 nanoseconds. In order to carry out these high-speed measurements, it is important to know the duration of the excitation laser pulse. Autocorrelation measurements are used to estimate the laser pulse duration and involve a series of steps. First, the beam is split into two separate paths. Mirrors are then arranged so that the beams are parallel and within a few millimeters of each other and the path lengths identical. Then, the beams are focused onto a beta barium borate nonlinear crystal. A stepper motor is used to adjust the position of a mirror, which results in the appearance of a third beam, the desired autocorrelation signal between the two beams. The third beam is directed towards a photodetector which is connected to a lock-in amplifier and a computer program (LabVIEW). The program records the data and plots a graph of the amplitude of the pulse versus the time delay. The pulse duration was estimated to be 6.27 picoseconds, in excellent agreement with the manufacturer of the Nd:Vanadate laser.

In a time-resolved pump-probe reflectivity experiment of a semiconductor (InGaAs), an ultrashort laser pulse is split into two portions; a stronger beam (pump) is used to excite photocarriers in the semiconductor and a weaker beam (probe) is used to monitor the time dependent change of the reflectivity of the sample. Measuring the changes in the reflectivity as a function of time delay between the arrival of pump and probe pulses yields information about the photocarrier lifetime of the sample. Time-resolved pump-probe experiments permit the measurement of the photocarrier lifetimes of different materials to be evaluated and helps one decide which material is best for different optoelectronic applications.

This research was funded by the UMBC College of Natural Mathematics and Science and Graduate School and University of the Virgin Islands MARC grant 5T34GM008422.

Cyber Analysis, Simulation and Experimentation Environment (CASE-V) Text Bed

Eliakin del Rosaro and Gabriel Ramos
Mentor(s): Dr. Jonathan Graham
Norfolk State University

As cyber threats grow in uniqueness, network protectors are being outclassed by uniquely developed threats. Data mining techniques, such as Classification, provide a prediction mechanism that can be used to detect uniquely developed threats. These techniques can be researched and optimized to enhance their prediction performance. To further study prediction mechanisms, an integrated platform containing a substantial amount of resourceful tools is essential. Using machine learning, data modeling, and algorithm simulation, we can build models to predict possible unknown threads from patterns obtained from known data. The logic can then be incorporated into Intrusion Detection System signatures and custom-built detection scripts. This process, in return, enhances Network protector's abilities to defend against cyber threats. This project introduces a developed integrated cybersecurity test-bed that will be used in training and development of new cybersecurity tools.

This work is supported through funding from the DOD Award # DE-NA0002686 and DOE Award # FA8750-15-20120.

Algal dominance and herbivore preferences in the tropical intertidal: a comparison of organisms near Brewers Bay, St. Thomas

Francheska Brenes-Rivera and Joshua Hazel
Mentor(s): Dr. Edwin Cruz-Rivera
University of the Virgin Islands

The intertidal is considered a model ecotone for the study of how gradients in biotic and abiotic factors shape species abundances and distributions. While many temperate studies have focused on temperate intertidal areas, there is surprisingly little on the effects of herbivores on tropical intertidal areas. This study focused on the feeding preferences and algal distributions of two tropical bays: Brewers Bay Perseverance Bay. Benthic surveys showed significant differences in the amount of total algal cover and high variance in the dominance of different algal species at five transect points within these bays. The area of bare substrate varied significantly among sites, with Brewers East and Perseverance Bay having the highest amount of uncolonized space, while Black Point beach had the lowest. Brewers Bay east showed a high abundance of the cyanobacterium *Lyngbya majuscula*, which was not detected or occurred at very low cover in all other sites. In contrast, the brown alga *Sargassum polyceratium* dominated at Brewers Bay gut, but was only found at lower amounts in Perseverance Bay, and was absent from the other three sites. The seagrass *Thalassia testudinum* and the red alga *Laurencia papillosa* occupied similar areas at Brewers Bay West, while none of the other sites showed similar cover from a seagrass. However, *L. papillosa* was also found in high amounts at a second site. The most diverse community in terms of algal cover was found at Black Point Beach, where the brown algae *Padina sanctae-crucis* and *Dictyota ciliolata*, and the red algae *Jania rubens*, *Laurencia papillosa*, and mixed crustose corallines occurred at similar abundances that were significantly higher than those of other algae. At Perseverance Bay, the brown algae *Padina sanctae-crucis* and *Dictyota guineensis* occupied the most space, but their densities were statistically equivalent to those of *Sargassum polyceratium*. Between site comparisons of the dominant primary producers found significant differences for all species compared, except the green turf alga *Cladophoropsis membranacea*. Although numbers of sessile and motile fauna were overall very low, a high and significantly different density of the rock-boring urchin *Echinometra lucunter* was found at Black Point Beach. Feeding preferences for five common algae and cyanobacteria (*C. membranacea*, *J. rubens*, *P. sanctae-crucis*, *L. majuscula*, and *Schizothrix* sp.) varied among the grazers tested, with the sea hare *Dolabrifera dolabrifera*, and the amphipod *Ampithoe* sp. showing no preference among diets. The urchin *Echinometra lucunter*, in contrast, significantly rejected the cyanobacterium *L. majuscula*, but consumed all other algae and cyanobacteria at similar amounts. The congeneric crabs *Mithraculus sculptus* and *M. coryphe* showed an interesting contrast, with the former, strongly and significantly preferring the cyanobacterium *Schizothrix* sp. over all other foods, and the latter significantly consuming *C. membranacea* and *P. sanctae-crucis* above other foods.

This work is supported through funding from the
DOD Award # DE-NA0002686 and DOE Award # FA8750-15-20120.

Exploring contextual profile for protein sequence analysis

Gejae Jeffers
Mentor(s): Dr. Jian Peng
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University of Illinois at Urbana- Champaign

Due to the demand for an increased amount of sequential data, researchers are developing clustering profile techniques with high sensitivity and fast throughput. Currently, traditional profiling for clustering genome sequences is widely usedover the k-mer based profiler. The k-mer based profiler enables more sensitivity throughput in certain databases and encourages the interaction of the sequence for precise homological classification. Here we applied the k-mer algorithm to multiple genome sequence files, based on a 7-mer to 15-mer parameter and integrated the output to the Kclust, UCLUST and CD-HIT clustering programs. We predicted the k-mer profiler would allow more sensitive and precise modeling for protein sequence analysis and homology classification by a distinguishable percentage.

Funding Source: MARC grant #5T34GM008422

Antioxidant Activity in Fresh Herbs

Genique Nicholas
Mentor(s): Dr. Bernard Castillo II
University of the Virgin Islands

Antioxidants are substances believed to prevent oxidation of substances within a cell. Recent research has shown that antioxidants are used to prevent degenerative diseases such as cancer, cardiovascular and neurological diseases. Some examples of foods that contain antioxidants are apples, berries, potatoes, grapes, and herbs. The main objectives for our research were: 1) to determine the total antioxidant activity in the fresh herbs and 2) to determine which would be the best source of antioxidants. Our hypothesis is that the hydrophilic antioxidant activity (HAA) would be higher than the lipophilic antioxidant activity (LAA) in all of the fresh herbs tested. There were 9 different herbs tested, namely sage, parsley, thyme, 2 types of oregano, basil, chives, mint, and rosemary. These plants were planted and grown specifically at the UVI Greenhouse in the Albert A. Sheen Campus. Antioxidants from these herbs were extracted in both aqueous (HAA) and organic (LAA) solvents, using an aqueous buffer and ethyl acetate, respectively. In order to determine the antioxidant activity in these herbs the ABTS/H2O2/HRP decoloration method was used and scanned at 730nm using a UV-VIS spectrophotometer. The antioxidant activity was reported as Trolox equivalent per grams dry weight of fresh herbs. From the results, HAA was generally higher than the LAA in all herbs. From the data we collected, mint (12032.13µmol Trolox Equivalent per gram dry weight) had the highest total antioxidant activity. It was also observed that parsley (57.97 µmol Trolox Equivalent per gram dry weight) had the lowest total antioxidant activity.

This research is funded by NSF HBCU-UP Grant #1137472.

Large-eddy simulation of tidally-driven turbulent flows in shallow continental shelf

Jakobi Peets
Mentor(s): Dr. Tejada-Martinez and Dr. Mario Juha
University of South Florida

This research performed in computational fluid dynamics focuses on conducting preliminary simulations that will eventually help improve models to track the path of oil or other spilled material in coastal regions, such as the recent Deepwater Horizon Spill in the Gulf of Mexico. These preliminary simulations consist of tidal boundary layer flows with surface cooling in order to identify instances during the tidal cycle when conditions become favorable for the development of full-depth convective cells, which lead to turbulent vertical mixing throughout the full-depth of the water column. These simulations are characteristic of shallow continental shelf regions between 10 and 30 meters deep. In the planned simulations, turbulent vertical mixing is caused by surface cooling and the tidally-driven vertical shear in the boundary layer flow. Tidal forcing in conjunction with surface cooling can lead to full-depth convective turbulent structures which homogenize momentum and scalars throughout the water column and thus strongly impact the distribution of spilled material such as oil particles. Furthermore, vertical mixing throughout the full depth of the water column can play an important role in the re-suspension of sediments and subsequent oil sedimentation.

Funding Source: National Science Foundation

Electrical Conductivity and Raman Spectroscopy Measurements of Electrodes for LiFePO4 Battery

Jared A. Hanley
Mentor(s): Dr. Quinton L. Williams
Department of Physics and Astronomy, Research Experience for Undergraduates, Howard University, 2355 6th St. NW, Washington, DC 20059

The benefit of $LiFePO_4$ as a cathode material in rechargeable batteries has sparked considerable research interest. The 2015 Research Experience for Undergraduates (REU) in Physics at Howard University provided an opportunity to examine the electrical conductivity of carbon-coated $LiFePO_4$. 4-Point Probe resistivity testing shows that the cathode has an electrical conductivity value of $\sigma=1.45 \times 10^{-7}$ S/cm which is in good agreement with values reported in the common literature. In later research, an increase in magnitude to ~ 10^{-4} S/cm is expected with the insertion of gold nano-particles. This could place the $LiFePO_4$ combination in the same class with high rate competitors such as $LiCoO_2$ and $LiMn_2O_4$.

This research was funded by the NSF and Howard University REU in Physics Site (NSF Grant PHY-1358727).

Fingerprinting Fish: Computer-aided pattern matching of the Nassau Grouper *Epinephelus striatus*

Jarvon Stout
Mentor(s): Dr. Brice Semmens
Scripps Institution of Oceanography

Photographic mark-recapture is a cost effective and non-intrusive method that is used to gather data on population dynamics of a given species. This method, coupled with pattern matching software, can be a great tool in the research and conservation of critically endangered species such as the Nassau grouper. Two reference images of 62 individual Nassau grouper at spawning aggregations in the Cayman Islands and grouper from the New England aquarium were captured from video. Using the Intelligent Individual Identification System (I^3S), each image was compared against all other images within the database to find any possible matches. The I^3S software successfully matched 32 Nassau grouper with images of themselves. These results suggest that with further modification, the I^3S software can be used to identify individual Nassau grouper at spawning sites. Understanding the effects of image characteristics on error rates will significantly improve the use and effectiveness of pattern matching software for future research and conservation of endangered species.

Funding for this research was provided by the National Science Foundation.

A search for structure in gamma ray burst x-ray flares confirming whether they are similar to the three pulse structure found in prompt emission pulses

Jason Baron
Mentor(s): Dr. David Morris and Judy Racusin
Goddard Space Flight Centre, NASA

Gamma Ray Bursts (GRBs) are the most luminous electromagnetic events known to occur throughout the Universe. These violent explosions produce relativistic jets in a short burst of prompt emission and are followed by an afterglow emitted across the electromagnetic spectrum. During the afterglow, there are periods of sporadic increase in the X-ray flux, known as flares. Only ~1/2 of all GRBs produce flares. We present a sample selection of the brightest isolated flares observed by the Swift X-Ray Telescope (XRT). Using light curves from the XRT Team repository at the University of Leicester between 2005 and 2014, and our own light curve fits, the sample was filtered using a stringent set of criteria. We selected bursts that: 1) had a high peak flare flux to afterglow ratio, and/or 2) a high fluence (integrated flux). By further analyzing these flares, we plan to study the underlying structure of flares, searching for the three components that have been seen in isolated prompt emission pulses: an initial small rapidly decaying pulse, followed by the main flare which then decays over time and is finally followed by another small but slower decaying pulse. Seeing a similar behavior in X-ray flares as we see in prompt pulses will tell us about the physics of relativistic shocks.

Funding Source: NASA

Deriving Vibrational Scaling Factors for Metal-Carbonyl Complexes

Jean Devera‡
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Metal carbonyls are well-known molecules throughout chemistry and are used in metal purification, organic synthesis, homogeneous catalysis, polymerization chemistry, and drug development. Recently, metal carbonyl complexes have been studied in the gas phase with mass spectrometry and infrared laser photodissociation spectroscopy. Density Functional Theory (DFT) is often used to assign structures and aid in the interpretation of the experimental data. Spectra obtained from gas-phase experiments on neutrals and ions are ideal for such comparisons to theory. However, since vibrational frequencies calculated via DFT are harmonic, theoretical spectra do not perfectly coincide with experimental values. As a result, scaling factors are calculated to account for anharmonicity. Furthermore, the frequencies predicted by DFT calculations vary depending on the basis set and functional used. To obtain reliable and unbiased vibrational scaling factors for metal carbonyl systems, a systematic study is required. The aim of this project is to calculate scaling factors for different functional/ basis set combinations using DFT, by comparison to experimental data. Calculations were conducted on 21 metal carbonyl complexes using the Gaussian 09 program. Three basis sets: LanL2DZ, LanL2TZ, and Def2-TZVP were employed for each of the four functionals: B3LYP, BP86, M06, and M06L. Scaling factors were obtained for each basis set/functional combination and when implemented, theoretical bands are in excellent agreement with experimental bands. The vibrational scaling factors calculated in this study can be used by scientists and engineers when studying carbonyl stretches in various metal-carbonyl systems.

Funding Source: NSF HRD-1505095

Dietary modulation of insulin sensitivity in antioxidant excess mice

Jonique George
Mentor(s): Dr. Nalini Santanam
Department of Pharmacology, Physiology, & Toxicology, Joan C. Edwards School of Medicine, Marshall University, Huntington, WV

Oxidative stress is an important player in metabolic disorder. We hypothesized that increasing antioxidant defense will protect against obesity and insulin resistance (IR). To test this hypothesis, male *C57Bl/6J* mice, human catalase transgenic mice (*Cat-tg*), and catalase transgene in ob/ob mice (*Bobcat*), were fed normal chow (NC), fish oil (OM3), or high fat-HF diet for 8 weeks. Weekly body weights and food consumption was determined. ECHO-MRI was used to measure body fat and lean mass composition. HOMA-IR was calculated based on fasting glucose and plasma insulin levels. Surprisingly, we found that antioxidant catalase transgenic mice (*Cat-Tg*) in comparison to *C57* mice were overweight and insulin resistant. HF diet further increased HOMA-IR in *Cat-Tg* mice, however, OM3 diet lowered it. In contrast, the *Bobcat* mice had lowered insulin resistance. Nrf2 is a transcription factor that regulates redox homeostasis. It is activated by oxidative stress and induces the transcription of antioxidant enzymes. Fibroblast growth factor-21(FGF21) is a hormone that regulates metabolism by improving insulin sensitivity. Elevated Nrf2 activity has been linked to decreased FGF21 levels which are implicated in IR. In our study we observed that the *Bobcat* mice were protected from obesity and insulin resistance. These mice had higher mRNA expression of FGF21 but lower Nrf-2 in adipose tissue. The increased expression of Catalase transgene in Ob genotype (*Bobcat*) altered its metabolic phenotype. In future studies the dietary modulation of Nrf2-FGF21 signaling and its relation to insulin sensitivity will be further explored in these novel antioxidant excess mice models.

This research was supported by NIH Grant P20GM103434 to the West Virginia IDeA Network for Biomedical Research Excellence.

Examining Genome Differentiation of Old and New World *Anas Platyrhyncos*

Krislen Tison
Mentor(s): Jeffery Peters
Wright State University

Mallard ducks (*Anas platyrhnchos*) are a Holarctic species with a distribution ranging between the Arctic Circle and the Tropic of Cancer. These ducks are capable of migrating long distances in both North America and Eurasia. The objective of this study was to test for significant differentiation between North American and Eurasian mallards. A pseudo---random sampling of 3,710 independent nuclear markers were isolated using a double---digest restriction--associated DNA sequencing (ddRAD---seq) protocol for 27 New World (NW) and 23 Old World (OW) mallards, and 1 mallard from Laysan Island off the Hawaiian archipelago. Although OW and NW mallards showed overall low differentiation (overall F_{st} = 0.02), principle component analyses (PCA) revealed that 95% of the samples from both OW and NW do not completely overlap. F_{st} distributions of ddRAD---seq markers showed an exponential decrease with the highest estimates reaching an F_{st} of 0.33. These results suggest that population structure between NW and OW mallards is likely the result of genetic drift, rather than selection. Our findings are in contrast to previous work that suggested no structure in mallard ducks. Moreover, given that mallards are carriers of avian influenza, this research has the potential to shed light into geographical pathways of avian influenza transmission.

Funding Source: NIH grant 5R25HL103168-05

Sexual Selection and its Relation to Isolative Reproduction I n Three-spine Stickleback (*Gasterosteus aculeatus)*

Kyle Gonsalves
Mentor(s): Robert Mobley
Michigan State University

Sexual selection amongst animals is a huge driving force for evolution. Sexual selection is a process by which a specific set of traits are favored and can consequently lead to divergent speciation. Recent studies have found that there is currently a divergence of species occurring amongst the three spine stickleback. This emergent splitting has caused scientist to categorize some populations as separate species known as Limnetic and Benthic. These populations are biological species as they are reproductively isolated. Understanding stickleback female mating choices is a key component to understanding factors that may contribute to the divergence of these species. Two primary sensory elements that may be involved with sexual selection amongst three-spine stickleback are olfaction and the lateral line system. These two sensory systems are used to identify differences in species. Thus, our research interest lies in the significance of olfaction and the lateral line systems in female mating choice of conspecific and heterospecific males in three-spine stickleback. We hypothesize that if olfaction and/or the lateral line systems are removed, female three-spine stickleback will be unable to distinguish between the two species. We conducted a behavioral study to determine the effect that olfaction and the lateral line system have on female selection of males in both species. I compared courtship between benthic, marine and limnetic females with conspecific and heterospecific males. During these trials the females had their olfactory, lateral line system or both of the senses removed. Gravid females were placed in tanks with either a conspecific or heterospecific male and observed for a set amount of time. Specific courtship behaviors conducted by the females were recorded. We were able to collect data on 73 behavioral trials. An analysis was conducted to determine if there were any noticeable differences in preferences by female population or experimental manipulation. We ran statistical tests and found that when Limnetic females that underwent experimental treatments showed a decrease in discrimination for mating with Limnetic males. We believe that this phenomenon of decreased discrimination could occur when mating conspecifically with Benthics or Marines which would cause a breakdown of these two species reproductive isolation. With these results we can glimpse into the consequences of changes in sensory modalities that can be brought about by disruptions in their ecosystem, which could lead to abnormal mating behaviors.

This project is being funded by the NSF Grant DEB-0952659 through Janette Boughman as well as through a MARC through MARC 5T34GM008422 Grant.

The West Indian Sea Egg (*Tripneustes ventricosus*) is negatively impacted by the invasive seagrass *Halophila stipulacea*

Kyle Jerris
Mentor(s): Dr. Teresa Turner
University of the Virgin Islands

The West Indian Sea Egg (*Tripneustes ventricosus*) is one of the most prominent grazers on Caribbean seagrass beds. On some Caribbean islands such as Martinique and St. Lucia, there is a commercial fishery for the West Indian Sea Egg. Because Caribbean seagrass beds are being invaded by the Indian Ocean seagrass *Halophila stipulacea, T. ventricosus* is a prime candidate to control it. This study conducted on St. Thomas, United States Virgin Islands, aimed to determine whether *Tripneustes* can act as a biological control for *Halophila* as well as what effects this seagrass might have on the urchin. To determine site preference, surveys were conducted at three habitat types. These surveys showed that these urchins preferred turtle grass (*Thalassia testudinum*) beds and rock substrate over *Halophila* beds (ANOVA p=0.0022) Only one urchin was found in a *Halophila* bed, suggesting it might not control the invasive seagrass. A multi choice feeding experiment was then conducted to determine preference among the seagrass species found on the island. The experiment showed that *T. ventricosus* greatly preferred *T. testudinum* over any of the other seagrasses (Friendmans test p=0.0001). To further determine if the West Indian Sea egg would be a suitable biocontrol for *H. stipulacea,* urchins were fed either *Halophila* or *Thalassia* for five weeks. At first some of the urchins in the *Halophila* treatment refused to eat. After some time, more urchins started to eat the *Halophila,* which suggests that they can eat *Halophila* in natural conditions. As a proxy for health, I observed the urchins' righting behavior. The majority of the *Halophila* treatment urchins had a dropping behavior when righting themselves, suggesting that they have poor health on this food. Thus *Tripneustes* probably cannot control *Halophila* and indeed its population might be negatively impacted by the invasion.

This research was supported in part by the National Science Foundation's Virgin Islands Experimental Program to Stimulate Competitive Research (VI-EPSCoR award #1355437) and the Center for Marine and Environmental Studies at the University of the Virgin Islands.

Comparison of Benthic Assemblages in Native vs. Invading Seagrass Beds

Lauren Arnold
Mentor(s): Dr. Ratchford
University of the Virgin Islands

Halophila stipulacea is a non-native seagrass, which was introduced into the Caribbean at Grenada in 2002 from the Western Indian Ocean. Since then it has been recorded in many Eastern Caribbean islands including St. Thomas. One study concluded that this invading seagrass could outcompete the native seagrasses. *Syringodium filiforme* and *Halodule wrightii* are seagrasses native to the Caribbean Sea and found in the shallow waters of Brewers Bay. The purpose of this research was to determine some impacts of this invasion by examining the possible differences in the benthic fauna in the native and invading seagrasses. We suction sampled $0.1m^2$ areas haphazardly in 10 native, invading and mixed seagrass beds. In the lab, the samples were thoroughly examined; the organisms and seagrasses were extracted. The organisms were identified by major taxonomic group. The seagrasses were identified by species and separated into detritus "brown" and live "green", the dry weights of each sample were taken. There was no significant difference in the number of organisms and the faunal diversity in the different seagrass habitats. Fauna included clams, crabs, shrimp, worms, fish, snails, and many more. There was more detritus in *Halophila* beds than in *Syringodium* beds. Sampled fauna still need to be more precisely classified. The effects of *H. stipulacea* on turtle grass *Thalassia testudinum,* bare sand patches and deeper areas need to be studied.

This research was supported in part by the National Science Foundation's Virgin Islands Experimental Program to Stimulate Competitive Research (VI-EPSCoR award #1355437) and the Center for Marine and Environmental Studies at the University of the Virgin Islands.

Pursuit Curves

Leon Wheeler
Mentor(s): Dr. Andrew Gard
College of Science and Mathematics, University of the Virgin Islands

First studied in 1732 by Pierre Bouguer, a pursuit curve is a path traced by a point (interpreted as a fox, for example) that always moves directly towards a moving target (a rabbit, for example). In this research, we have added an underlying vector field (wind or a water current, for example) and analyzed the changes to the pursuer's path. Using Octave, we solved the resulting differential equations numerically and compared the results for varying relative speeds. This work lays the foundation for analysis of more complex pursuit scenarios.

Funding Source: NSF HBCU-UP Grant #1137472

Mechanism of the Oxidation of a Cobaloxime by Bromine and Sodium Hypochlorite in Aqueous Media

Lorne Joseph
Mentor(s): Dr. Alvin Holder
Old Dominion University

Bis(dimethylglyoximato) cobalt(II) [$Co^{II}(dmgH)_2$] has been reported as a mild reducing agent, but more recently, this complex has received renewed interest because of its potential use as a molecular electrocatalyst for the electrogeneration of H_2 from aqueous media. An analogous complex, [$Co(dmgBF_2)_2(H_2O)_2$] (where $dmgBF_2$ = difluoroboryldimethylglyoximato) has also been studied as an electrocatalyst, but its chemical properties as an oxidant has not been well studied. As such, the objective of this project was to carry a detailed redox study involving the cobaloxime, [$Co(dmgBF_2)_2(H_2O)_2$] **1**, using bromine and sodium hypochlorite (NaOCl) as oxidants. Throughout this study the main hypothesis was as follows: **the cobaloxime (with a +2 oxidation state) will be oxidized by the respective oxidant to form a cobalt(III) complex**. A detailed investigation of the oxidation of [$Co(dmgBF_2)_2(OH_2)_2$] by NaOCl and Br_2 was carried out using stopped-flow spectrophotometry at 450 nm, and the reaction was monitored for the cobaloxime's disappearance in the presence of the oxidants under pseudo-first order conditions (over the ranges of $1.0 \leq [NaOCl] \leq 10.0$ mM and $0.5 \leq [Br_2] \leq 4.0$ mM) with a constant ionic strength at 0.60 M (NaCl). The main reaction products were $[Co^{III}(dmgBF_2)_2(OH)_2]^-$ and $[Co^{III}(dmgBF_2)_2(OH_2)(OH)]$ in the presence of Br_2 and NaOCl, respectively. The reaction rate for the Br_2 study was observed to be pH dependent, where the pseudo-rate constant (k_{obs}) values were observed to increase as the pH values decreased. At 10 °C, the rate of reaction was observed to be first order with respect to the Br_2 concentration, whereas it was observed to be second order with respect to the NaOCl concentration. An equilibrium constant and a rate constant for the oxidation of the complex was calculated from the study involving Br_2, where $K = 3.5 \times 10^2\ M^{-1}$ and $k = 6.6 \times 10^2\ s^{-1}$, respectively. For the NaOCl study, two rate constants were observed, $k_1 = 7.6\ s^{-1}$ which corresponded to a reaction pathway independent of the NaOCl concentration, and $k_2 = 2.3 \times 10^4\ M^{-1}\ s^{-1}$, which represented a dependence on the concentration of the oxidant. From the kinetics it was observed that there was a fast oxidation of the cobaloxime followed by the slow substitution of the aqua and hydroxo ligands to form the respective cobalt(III) complexes. This slow substitution of the inert cobalt(III) metal center was observed when the reaction was carried out over a 24 hour period. In this reaction, the cobalt(III) products were obtained from THF (for the bromine reaction) and H_2O (for the sodium hypochlorite reaction); then analyzed using elemental analysis and ^1H and ^{59}Co NMR spectroscopy. In conclusion, it was observed that in the presence of the two oxidants, a rapid electron transfer occurred from the cobaloxime to the oxidant, followed by a very slow substitution of the axial ligands on the resulting cobalt(III) metal center.

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Identifying Intrinsic Resistance in *Pseudomonas aeruginosa*

Nirisha Commodore
Mentor(s): Barbara Kazmierczak, MD/PhD
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Antibiotic resistance in multiple species of bacteria has become a major health concern in recent times. The opportunistic bacterial pathogen, *Pseudomonas aeruginosa,* displays intrinsic resistance to multiple classes of antibiotics, and can readily acquire resistance to antibiotics used in clinical practice. We propose to identify genes that underlie mechanisms of intrinsic resistance by detecting those required for fitness in the presence of antibiotics. To this end, a mutant library of *Pseudomonas aeruginosa* (PA14) was generated by random transposon mutagenesis. Insertion sequencing (InSeq) was performed on two library replicates to identify genes disrupted by transposon insertions. Our results showed that transposon insertions were well dispersed throughout the genome with approximately one insertion every 100 base pairs. Approximately 5,000 nonessential genes were disrupted and genes lacking insertions correlated to previously identified essential genes. 77% of mutated genes contained two or more insertions and the abundance of insertions was comparable between the two samples. The mutant library will be grown in sub-microbicidal concentrations of antibiotics such as Vancomycin, Meropenem, Ciprofloxacin, and Tobramycin, which represent classes of drugs that are both effective and non-effective in treating *Pseudomonas* infections. The output population will be sequenced and the abundance of transposon insertions between the original mutant library and the post-experiment population will be compared to identify disrupted genes that contribute to fitness in the presence of each antibiotic. Identification of genes involved in these intrinsic resistance mechanisms may provide new targets for the development of antibacterial drug treatments, which has been at a standstill for over twenty years. A better understanding of genes involved in intrinsic resistance mechanisms may provide insight into antibiotic resistance in other organisms and ways in which this resistance can be incited or repressed.

Research Funding: Yale BioMed Summer Undergraduate Research Fellowship

Developing a Test Stand for Lifetime Measurements using a Narrow Gap Detector

Omani Tuitt[1]
Mentor(s): Dr. Joe Hill-Kittle[2], Dr. Keith Jahoda[2] and Dr. David Morris[1]
[1] University of the Virgin Islands
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The University of the Virgin Islands (UVI) recently won a proposal "The First Four-Year Physics and Astronomy Degree at the University of the Virgin Islands; A new Era in Caribbean Participation in NASA Science" in collaboration with NASA Goddard Space Flight Center (GSFC). The proposal included building a detector life-test chamber at UVI to support the degree program as well as assist NASA by running tests on detector components and reporting the results.

The team at GSFC is developing X-ray polarimeters that can be used in detecting and imaging astrophysical sources such as black holes and neutron stars. The purpose of our research is to understand the effects that the degradation of gas has on the performance of the detectors. The current generation of time projection polarimeter incorporates a narrow gap detector assembled with epoxy. The addition of the epoxy allows a smaller gap with the minimal amount of changes from the original design, enhancing the performance of the detectors.

With the use of epoxy, lifetime measurements have to be made to see how the epoxy detectors compared to previous iterations. We have been studying the effects on the narrow gap detector in the Mahaffey chamber in order to determine whether the epoxy affects the cleanliness of the gas. Tests have been conducted with a residual gas analyzer (RGA) in order to monitor the cleanliness of the gas inside of the Mahaffey chamber while being baked out. Results show that the detector is in fact getting cleaner as time progresses. The plan is to recreate a detector that meets the performance criteria for 2 years and has minimal degradation.

Funding Source: NASA grant NNX13AD28A

The Efficacy of Latency Reversing Agents on HIV Latency in vitro

Rawle C. Watkins Jr
Mentor(s): Nancie M. Archin, PhD
University of North Carolina at Chapel Hill

In the past 30+ years, treatment of the human immune deficiency virus (HIV) has dramatically improved such that infected individuals are able to live longer due to antiretroviral therapies (ARTs). HIV being the clever retrovirus that it is, mutates in order to ensure its survival, and resists therapy [3]. This is the reason ART are taken in combination to keep the virus from gaining the upper hand. The virus is able to successfully gain entry into $CD4^+$ T cells by the use of glycoproteins on its surface. Once inside the cell, it uses a specific enzyme that allows its viral RNA to be transcribed into viral DNA, which is then integrated into the host DNA [1]. These sleeper cells go undetected by the host immune system and are unaffected by ART. Although a patient may have low levels of viremia, if they stop ART the latently infected cells start producing new virions, which infect more cells [2]. Latency reversing agents (LRAs) are able to reverse HIV latency causing the $CD4^+$ T cells to start producing virions. Once the cells produce virions they will also exhibit cell surface markers that the host immune system can respond to and target the infected cell for termination [3]. The right combination of LRAs has the potential to eliminate the latent HIV reservoir, thereby reversing infection. For this experiment we used J89 and 2D10, HIV, infected cell lines, along with patient primary cells in order to test the efficacy of the LRAs. Patient cells, J89 and 2D10 cell lines were treated with the following compounds: SAHA, J001 and SAHA+J001. Results from qRT-PCR and flow cytometry show that the SAHA+J001 is the best combination for effectively reversing the latency of HIV *in vitro* in J89/2D10 cells. In patient cells, J001 appeared to be better by itself. These results are particularly exciting and have the potential to exterminate HIV.

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Coral Recruits on Palmyra Atoll Exhibiting 'Stranger Danger'

Richard Laplace
Mentor(s): Dr. Stuart Sandin
Scripps Institution of Oceanography, UCSD

Corals are sessile animals that form some of the most biodiverse regions in the world. Since these animals are usually found growing on a piece of hard substrate, they search for cues before settlement as planktonic larvae. These animals have been known to show density dependent recruitment, and one species *Montastrea faveolata,* shows a Janzen-Connell effect where young individuals do not mix with adults to escape bacterial and other conspecific related diseases. This information thus spurs the question do coral recruits show density and distance dependent recruitment towards other recruits? In order to answer this question photomosaic analyzing techniques were used to find average distances between all found coral recruit genera at three sites on Palmyra Atoll, which includes *Montastrea,* Fungids, *Favia, Pavona, Pocillopora, Stylophora, Porites, Hydnophora, Acropora, Lobophyllia,* unkown and, other corals. It was found that each genera has their own specific bias, showing clustering when compared to certain species but over-dispersion towards others. These findings are also heavily skewed by population size since the genera compared were found at vastly different densities. In the future including studies of adult distances to juveniles conspecifically would potentially provide information on possible Janzen-Connell effects.

This work was completed in the UCSD Scripps Institution of Oceanography Summer Undergraduate Research Fellowship (SURF) and supported by The Office of the President UCSD.

Antioxidant Activity in Hibiscus Sabdariffa

Ryan Shaw
Mentor(s): Dr. Bernard Castillo II
University of the Virgin Islands

Antioxidants are substances that are believed to prevent the destructive unwanted oxidation of substances in a cell. Research shows that antioxidants play a role in the prevention of multiple degenerative and neurological diseases. Anti-oxidants are found in fruits and in plants. Sorrel (*Hibiscus sabdariffa*) is a tropical plant that produces a red fleshy calyx that is used to create a local drink in the U.S Virgin Islands. Sorrel is known to be a rich source of anthocyanin. Recent work from the UVI-Agricultural Experimental Station on different sorrel breeds produced hybrids that are potentially more potent and resistant to harsh weather, droughts and pests. This study aims to investigate the different anti-oxidant activities of different hybrid sorrel. We hypothesized that the darker colored sorrel samples would have a higher Total Antioxidant Activity (TAA) compared to lighter colored sorrel. Seven different sorrel samples were used in this study, which were grown at the University of the Virgin Islands Albert A. Sheen campus. Anti-oxidants were extracted separately in aqueous phosphate buffer solution (Hydrophilic) and in ethyl acetate (Lipophilic). We used the azino-bis-(3-ethylbenzthiazoline-6-sulfonic acid/H2O2/horseradish peroxidase (ABTS/ H2O2/HRP) decolouration method to determine the TAA. The samples were monitored at 730 nm in a UV-VIS Spectrophotometer over the course of 5 minutes. All antioxidant activities were in units of µmol of Trolox equivalent per grams of dry weight. Our results showed that in general, the Hydrophilic Antioxidant Activity (HAA) of all the sorrel samples tested were significantly higher than the Lipophilic Antioxidant Activity (LAA). Sorrel sample (DWx100)xK had the highest TAA (45,965.91 µmol of Trolox equivalent per grams of dry weight) and sample 245xK R23P13 had the lowest TAA (14,823.8µmol of Trolox equivalent per grams of dry weight). In conclusion, *Hibiscus sabdariffa* was judged as a significant source of antioxidants.

This research was funded by NSF HBCU-UP (Grant Number HRD – 1137472).

The Effect of Rk35 Anti-Myostatin on Muscle Growth and Neurotrophic Factor Expression in Heart Tissue and Cardiac Muscle Cells in Culture

Serena R. Joseph
Mentor(s): John-Mary Vianney and John M. Spitsbergen
Western Michigan University

It is known that myostatin adheres limitations to muscle growth in skeletal muscles. Inhibition of myostatin signaling allows an increase in muscle growth, which may be useful in restoring muscle mass and strength in animal models of muscular dystrophy. Glial cell line-derived neurotrophic factor (GDNF) is a neurotrophic factor that is found in cardiac muscle which supports autonomic nervous system development and maintenance. Levels of GDNF in cardiac muscle have been shown to change with exercise and aging. **Our agenda seeks greater understanding of how GDNF expression is regulated in the absence of exercise, in myostatin inhibited mice. We are proposing that significant change in GDNF content will occur in cardiac muscle following anti-myostatin treatment.** GDNF content in heart tissue and in cardiac muscle cells in culture was measured by ELISA. Molecular size of myostatin and GDNF was determined using Western Blot. This pilot study has concluded that myostatin protein is present in cardiac muscle and cardiac cells in culture. Treatment of mice with anti-myostatin had no effect of body weight, although there was a trend towards an increase in weight in treated mice ($p=0.15$). An increase in myostatin content was shown in cardiac muscle in control mice vs. mice that were treated with Rk35 (anti-myostatin). There was a trend towards lower GDNF production in cardiac muscle in mice treated with anti-myostatin, but this was not significant ($p=0.44$). Future studies will be conducted to examine the shift in GDNF levels in cardiac muscle, cardiac cells and cell culture medium. If GDNF expression is found to change with muscle hypertrophy, this may provide a link between muscle growth and altered nervous system function.

This study was supported by NSF Grant DBI-1062883 and RISE 5R25GM061325.

Development of a Protocol for Enrichment of Hemogregarine-Infected Fish Erythrocytes and Transmissible Cysts

Shanan Emmanuel
Mentor(s): Dr. Jennilee Robinson
Brown University

Caribbean dusky damselfish, *Stegastes adustus,* are infected with hemogregarine-like apicomplexan parasites. Little is known on the mode of transmission of these parasites from fish to fish. Specifically, it is unclear if the mode of transmission is via blood-feeding crustaceans similar to Plasmodidae or by fecal-oral transmission like Sarcocystidae. We hypothesized that the hemogregarine is transmitted from host-to-host via cysts through the fecal-oral route, reminiscent of *Toxoplasma* infections in humans. To investigate this hypothesis we developed a protocol for isolation of cysts from fish fecal matter using Percoll step gradients, which separated the components of the fecal matter according to density. Preliminary results suggest that the parasite is transmitted through a fecal-oral pathway*,* because of the presence of sporulated and unporulated cysts. In addition, we developed a protocol for isolation and visualization of the infected erythrocytes from damselfish blood. Blood was also fractionated by differential centrifugation on Percoll gradients. Visualization of cells from fractionated blood employed stains including trypan blue, DAPI and pinacyanol chloride. Studies of the hemogregarine parasite can potentially serve as a good candidate model to study Toxoplasmosis in humans.

Funding Sources: MARC 5T34GM008422

Quantification and Separation of target Organic Acids via HPLC

Shanece Esdaille
Mentor(s): Dr. Wayne Archibald
University of South Florida

We are now living in an innovative technological world. With the vast amount of technological advances as well as the upgrades seen in electronic devices, the demand for materials needed to build these technologies are also increasing. The overall aim of this research seeks to develop a method for the extraction/recovery of lithium and cobalt metals from spent lithium-ion batteries via fungal bioleaching. The objective of my research that contributed to the overall aim was to analyze organic acids that would be produced by fungi using High Performance Liquid Chromatography. Citric acid, Gluconic acid, Oxalic acid, (L)-Malic acid and Tartaric acid were the five target acids used for analysis. The HPLC was calibrated to quantify and separate organic acid mixtures which will be used to help understand the organic acid production by fungi. Each acid was calibrated and R^2 values were calculated. Oxalic acid had an R^2 value of 0.9986, Gluconic acid; 0.9851, Tartaric acid; 0.9975, (L) -Malic acid; 0.9994, and Citric acid 0.9984. Organic acid mixtures were used in the calibration of HPLC to prepare for an analysis of organic acid mixtures produced by fungi.

This Undergraduate Research program was funded by the National Science Foundation.

Three Dimensional (3D) Design and Printing of a 6MW Offshore Wind Turbine

Sherika Jacobs
Mentor(s): Dr. Archibald & Dr. Head
Morgan State University

Three-dimensional (3D) printing is currently being used as a means of producing (3D) solid items from digital files in a cost effective and time efficient manner. This paper will focus on designing a prototype of a 6 megawatt (MW) offshore wind turbine by Siemens. Specifically, the research conducted will focus on answering this question: Can prototyping a 6 MW offshore turbine using a 3D printer function to complete various reduced-scale experimental tests that simulate realistic offshore conditions? Polylactic (PLA) plastic will be used to print the turbine. The most important factor that must be considered in this experiment is the dimensions of the turbine. Froude Scaling (100:1) will be used to scale down the turbine. The turbine will first be modeled in Tinkercad and printed using a MakerBot ®, which is limited to using PLA or Acrylonitrile Butadiene Styrene (ABS) plastic to print and maximum dimensions of 11.2" x 10.6" x 9.06". As a method of overcoming this obstacle, connections will be made in Tinkercad so that turbine can be printed in various segments and connected after printing. Future experiments will be conducted to determine the operative viability of the archetype 6MW offshore turbine.

Funding Sources: Emerging Caribbean Scientists (ECS) Program

Differential Success of Primers on Tissue Samples Extracted from Populations of Molossus molossus on St. Thomas

Villisha Gregoire, Semonie Rogers, and Danelly Samuel
Mentor(s): Dr. Alice Stanford
University of the Virgin Islands

Velvety free-tailed bats (*Molossus molossus)* are widely distributed throughout tropical Central and South America and the islands of the Caribbean. *Molossus molossus* are regarded as commensal insectivorous species, which occupy human habitats and aid in reducing insect populations in ecosystems. The overall objective of this study is to evaluate the genetic diversity of *M. molossus* between populations in St. Thomas and populations in St. John. Understanding the genetic diversity of the bats will aid in their possible conservation and restoration. Specifically, the aim of our project was to evaluate the success of the primers on the bats' DNA samples. The study sites involved in this research included Stumpy Bay, Magen's Bay, Smith Bay and Vessup National Park. Tissue samples and primers were collected and tested for DNA extraction and gene amplification of specific microsatellites. To unveil which primers work best with the DNA extract, various conditions such as DNA concentrations, annealing temperatures and different primers were manipulated for the amplification of the DNA. The primers which depicted the most amplification were H12, A10 and D15. We also concluded that the work strength of the primer was not dependent upon the DNA concentration, DNA purity, and the nucleic acid purity of the extraction. Statistical testing will be done in the future to determine the genetic diversity of the *M. molossus* on St. Thomas and St. John.

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Using x-ray photoelectron spectroscopy to investigate doped graphene: electronic and surface properties

Ykeshia Zamore
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College of Science and Mathematics, University of the Virgin Islands, 00802
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Graphene, a 2D gapless semiconductor, has emerged as a promising material in a broad spectrum of applications in the era of post silicon electronics. This experiment entails doping a sample of graphene and using X-ray Photoemission Spectroscopy at the Center for Functional Nanomaterials. So far, the samples are being doped using surface transfer doping via thermal/ebeam evaporation. The goal of this project is to further understand the effectiveness of metal doping compared to organic doping using evaporation and the surface chemistry of graphene and its dopants.

Funding Source: MRSEC

Food has no significant effect on color of Elysia crispata, the solar powered lettuce sea slug, in a short term study

Zola Roper
Mentor(s): Ariel Hawkins and Dr. Teresa Turner
University of the Virgin Islands

Elysia crispata is a common herbivorous benthic marine invertebrate known as the lettuce sea slug studied because it has the unusual ability to sequester chloroplast from algal cells and utilize them for energy and coloration. These sequestered chloroplast are taken up by the digestive diverticula. This slug is a sacoglossan species that feeds on green macroalgae by scraping through their cell walls and ingesting the internal cytoplasm. I hypothesized that there would be different changes in coloration of the slug when fed different colored species of green algae, *Bryopsis pennata* and *Caulerpa racemosa*, or when it is starved. Thirty (30) slugs ranging between 2 cm to 5.5 cm were collected by snorkel in Brewers Bay, St. Thomas in May 2015. Ten (10) slugs were chosen for each treatment to include the green algae (*Bryopsis pennata*, *Caulerpa racemosa*) or starvation. The experiment was ran for 24 days (June 16, 2015 to July 9, 2015). Slugs were photographed before and after the experiment using a digital camera and then images were imported into Image J to obtain RGB (Red Green Blue) values. Additional initial and final weights of the slugs was also taken in grams. The slugs in all three treatments lost weight, but starvation slugs lost the most weight although this was not significant (Kruskal Wallis, $P > 0.05$). All slugs in each treatment changed Green values. The Green values became lighter in all three treatments but the starvation treatment had the greatest difference although not significant (ANOVA $P > 0.05$). These results suggest that coloration may not come from the food or that the experiment was too short for changes in coloration to occur.

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Event Organization Team:

- Dr. Stanley Latesky, *Judges Coordinator*
- Dr. Alice Stanford, *RISE Coordinator, St. Thomas*
- Dr. Robert Stolz, *HBCU-UP Program Director*
- Dr. Aletha Baumann, MARC & *RISE Coordinator, St. Croix*
- Ms. Aimee Sanchez, *Data Specialist*

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