# University of the Virgin Islands
# Division of Science and Mathematics

# 10th Annual
# Fall Research Symposium

St. Thomas Campus

September 21, 2008

Student Research Projects

ABSTRACTS

# 10th Annual UVI Undergraduate Research Symposium

St. Thomas, U.S.V.I.

September 21, 2008

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# The Effects of Oxotremorine on the Pyloric Central Pattern Generator of the Caribbean Spiny Lobster, *Panulirus argus*

Rifa Abdullah

Richard Hall, PhD

In spiny lobsters, motor commands to muscles for eating are produced by small neural circuits known as the central pattern generators (CPG) that are located in four ganglia of the Stomatogastric Nervous System (STNS). The paired commissural ganglia (CoG) are part of the central nervous system (CNS) and send axonal projections to two peripheral ganglia: the esophageal ganglion (EoG) and ultimately through a solitary nerve to the distal stomatogastric ganglion (STG). We are investigating the ability of CNS neurons of the CoG to influence the activity of a peripheral CPG.

The pyloric CPG located in the STG produces rhythmic bursts of action potentials that power food sorting. When connectives from the CoG to the STG are cut, the pyloric CPG disappears; thus input from higher centers are required to produce a pyloric rhythm. Previous work demonstrated that superfusion of the STG with muscarinic agonists such as pilocarpine and oxotremorine transiently increase burst frequency and duration of bursts of the pyloric dilator (PD) of the pyloric CPG while inhibiting activity of the ventricular dilator (VD) and lateral pyloric (LP) neurons. We hypothesize that the CoG's utilize the same set muscarinic controls on the pyloric CPG as observed by direct superfusion of the STG. We predict that superfusion of the paired CoGs with oxotremorine will increase duty cycles of PD bursts while decreasing duty cycles of VD and LP bursts. To test this prediction, we superfused both CoGs with oxotremorine saline ranging from $10^{-5}$ to $10^{-4}$M for five minutes and followed each treatment with a twenty-minute wash with lobster saline.

Oxotremorine superfusion of the CoG increases PD duty cycle up to concentrations of $2x10^{-5}$M oxotremorine but absolute changes depend on control burst frequency. At a pyloric rhythm of 1.4 Hz, the duty cycle of PD increased from 0.325 ± 0.007 to 0.569 ± 0.149. While preparations with rhythm frequencies of 0.4 Hz, PD duty cycles increased slightly from 0.153 ± 0.043 to 0.224 ± 0.007. The relationships between VD, LP, and PD duty cycles are complex and complicated by variations in VD and LP bursting. In general, as PD and VD duty cycles increase, LP duty cycles decrease. While oxotremorine superfusion of the CoG clearly increases PD duty cycle, it also increases variability in VD and LP bursting characteristics.

NIH MBRS-RISE Grant Number: GM061325

# Does the Heart's Elastic Visceral Pericardium Act as a "Spring" in the Normal Cardiac Cycle?

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This cardiac physiology research aims to explore the mechanical properties of the visceral pericardium (VP) to gain a greater understanding toward how the VP supplements the energy used during the heart's cardiac cycle to perform work and required to regain the heart initial state, after contraction. The visceral pericardium (VP) is the outer most layer of the heart and consists of collagen and elastin fibers oriented nearly perpendicular to the outer most myocytes of the left ventricle (LV) myocardium. The orientation of the fibril structures and the known effect the VP has on the passive mechanical properties of the LV has led us to believe that the VP mechanically contributes to the normal cardiac cycle of the heart where its purposes are symbolic to that of a mechanical spring in which would affect the end systolic and initial diastolic periods of the cardiac cycle. Specifically, we hypothesized that the twisting of the ventricles at end-systole would result in the loading of the VP elastin "spring" and that the unloading of energy will increase the rate of untwisting which is thought to affect the filling of the ventricle in early diastole. In order to test this, we mechanically disrupted the VP layer of pig hearts (n=6) and analyzed the motion of the heart before and after the disruption ((NIH, National Heart, Lung, Blood & Institute protocol H-0213). The motion of the heart was captured using high-speed imaging (200 fps) and video analysis to determine any effects on the local twist angle on the surface of the heart. We also analyzed changes in the gap size in the disrupted VP, comparing systolic and diastolic levels. We predicted that during the loading of the VP the gap size would increase. Our preliminary analysis shows disrupting the VP did affect the rate of change in the in the twist angle during contraction (.62 ± .09 vs .45 ± .12 rad/sec), however, no significant change was found during the relaxation phase of the cardiac cycle. The analysis of the gap size showed a consistent and significant increase in the gap size at end-diastole (11.0 ± 0.7 vs. 9.2 ± 0.7 pixels). These results do not support the VP acting as a spring to increase the filling of the heart in early diastole, but do point to it playing a role in the contraction phase of the cardiac cycle.

Funded by NIH MARC Grant # GM008422 and NIH National, Heart, Lung & Blood Institute Laboratory of Cardiac Energetics

# A* Algorithm for GPS Path Finding

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With the recent growth in the use of highly accurate geodetic surveying techniques, primarily due to the widespread adoption of GPS by the surveying community developed the desire for a general framework for the optimal design of GPS surveying networks. GPS allows us to perform precise positioning at a fraction of the cost required by traditional methods. However, the time and cost of achieving this precision on networks can only be optimized if the logistics of the GPS fieldwork are properly investigated. This study presents and analyses an example of a path finding problem and the time taken to calculate the shortest path. Therefore, rather than adopting normal shortest path search methods, a best first search that employs heuristics will be used to produce good and time efficient results.

A* (A Star) search algorithm is an example of Best-First search that use a more complex heuristic to select a path through the tree. It is an admissible heuristic method that provides optimal solution and guarantees to find the shortest path. In this research, A* search algorithm is proposed. The proposed algorithm is adjusted and customized to suit the condition on the road network.

Acknowledgement:
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# Newly Restored Eelgrass Has Similar Species Diversity as Eelgrass from a Self- established Eelgrass Bed

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Eelgrass (*Zosteria marina L*) is a marine angiosperm which grows in shallow waters up to 6-10 meters deep. Eelgrass can grow to lengths of 1-2 meters tall. It reproduces sexually as well as asexually. Eelgrass meadows serve as habitats for many marine organisms such as flounders and act as a nursery to juveniles in the Gulf of Maine. Many areas have lost almost all their eelgrass in Frenchman Bay, Bar Harbor, Maine. One such area is Hadley Point, Bar Harbor, Maine. In 1996, eelgrass coverage in Hadley Point was 60-80%, in 2005, there was 10-15% and presently it is estimated that there is 1%. In this preliminary study, we looked at the organisms found on individual eelgrass plants in a self-established eelgrass meadow compared to a meadow which was restored off Hadley Point during the summer of 2007. The hypothesis tested was there is a richer species diversity found in self-established eelgrass beds as compared to restored eelgrass beds. Two pop-nets were deployed during the first low tide on the 6th and 7th of August, 2008 of each day at 7:34 and 8:19 am respectively at the restored area and the self-established area. Thirty minutes after deployment, 10 random scopes and four plants were taken from within the pop-net. Water temperature, salinity, dissolved oxygen and biological oxygen demand were tested at each site. The total number of organisms found per plant and the total length in cm of all the blades were tallied. From the self-established eelgrass plants, there were 9 taxa and in the restored eelgrass area, there were 10 taxa. Plants from the restored area eelgrass had 1448 organisms and plants from the self-established eelgrass had 296 organisms. Total organism counts for all plants also included the root systems. A two-tailed t-test revealed that there was no statistically significant difference between the number of organisms on the blades of the eelgrass plants in the self-established eelgrass bed and the eelgrass bed restored in 2007. Mussel seeds were overwhelming at both sites and accounted for more than 90% of the organisms found. The diversity of organisms in both restored eelgrass area and self-established area was essentially the same. However, since there was variability between plants further study would have to be done on plants to be certain that there is significant difference. The results from these studies indicate that restored eelgrass beds begin to function as significant habitat for marine organisms within one year. It may be possible to restore not only the eelgrass in Maine bays, but to restore the population structure of local marine resources as well.

Research was funded by NSF REU MDIBL (DBI 0453391) & NIH MBRS-RISE Grant Number: GM061325

# Comparison of Soil Characteristics in Waterways Based on Various Land Cover Classifications in St.Croix, USVI

Hema Balkaran*, Tristian Mohammed, Brian Daley and Russell Slatton

Abstract

Loss of forest cover is frequently associated with a decrease in water quantities and qualities leading to unhealthy waterways, characterized by degraded soil and water. This study was conducted to determine if there are differences in soil characteristics in waterways based on land cover or land use. We expected to find that the forested waterways (commonly known as guts) will exhibit relatively healthy soil conditions while guts that have recently experienced land cover change will show signs of soil deterioration.

We used the results of a recent land cover change analysis by UVI-AES (Agricultural Experimental Station) in which the results determined the type and extent of land cover. Using a Geographic Information System (GIS) and Global Positioning System (GPS) technology we selected 30 sample sites from waterways in three categories, forested, deforested and recently forested. We collected soil samples at each site and tested their physical and chemical properties.

Results from the seven tested variables (temperature, pH, nitrate content, bulk density, electro-conductivity and infiltration rate) indicated that the forested waterways have displayed soil with the most favourable properties. Data from recently forested and deforested waterways were variable, but had a similar trend of soil degradation. We interpreted from the results that there was a similarity of soil properties between the deforested and reforested waterways. Recently forested sites were formally deforested sites where as the deforested sites were formally recently forested sites.

Research partially funded by VI-EPSCoR

# Initial Estimations of Sea Turtle Densities in Various Bays of St Thomas, US Virgin Islands

Tiffany Bernier, Agene Rogers, Latisha Ramsey,
Mentor: Dr. Paul Jobsis

Green Sea Turtles are currently critically endangered. However, some Green Sea Turtle populations close to St Thomas appear to be growing. St. Thomas of the United States Virgin Islands has a long history of sea turtle harvesting. Indeed, some of the locations are even named for the turtles that once occupied these areas such as Caret bay and Trunk Bay. Unfortunately, there is not an accurate record of the turtle population numbers around St Thomas. There is no way to determine if the population numbers of turtles are increasing or declining. The first step in creating a conservation plan to preserve these critically endangered animals is to determine their population size, as well as their use of certain habitats. The goal of this semester's research is to create a database that will accurately state the population number of green sea turtles within the waters of John Brewers Bay, Lindberg Bay, and other nearby locations. The numbers of green sea turtles that utilize these bays will be estimated by swimming surveys. We will use line-transect techniques and equations to estimate the populations. During these surveys, we will also document the general appearance of the turtles' health and any noticeable behaviors, such as feeding, resting, swimming, or possibly mating. Other species, such as Hawksbill Sea Turtles will also be noted. This information will then be vital in the planning of future research on green sea turtles. Furthermore, this information will fundamental in the planning and creation of appropriate conservation plans for maintaining green sea turtle population numbers in and around St Thomas, United States Virgin Islands.

Funding Sources Include: The HUCU-UP and MBRS RISE Scholarship Grants

# Development of Infrared and Raman Spectral Databases for Characterization of Hanford Tank Waste Samples.

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Approximately 210,000 $m^3$ of radioactive waste, generated as a result of past plutonium production processes, are being stored in tanks at the Hanford site in Richland, WA. Over the last 60 years some of these tanks have lost their structural integrity, and have begun to leak harmful chemical and radioactive materials into the surrounding sediment and groundwater.

The U.S. Department of Energy (DOE) and its contractors are developing means to treat and dispose of the radioactive Hanford tank waste. For the high-level waste (HLW) solid fraction of the tank waste, the baseline pretreatment and immobilization strategy is to leach with aqueous sodium hydroxide (and with sodium permanganate for wastes high in chromium) and vitrifying the leached solids in borosilicate glass. One of the main challenges to developing efficient pretreatment processes is the identification of the specific chemical species contained within the waste tanks. These waste tanks contain a complex mixture of inorganic compounds including various oxides/hydroxides of Al, Bi, Cr, Fe, U, etc. Inorganic mineral phases such as nitrate cancrinite ($[Al_6Si_60_{24}](NO_3)_2 \cdot 4H_2O$) have also been observed in the soil around the tanks, formed by interaction of the tank material with surrounding sediment.

In this study we have begun to construct a vibrational spectral database of potential waste components which will be used to spectroscopically characterize tank waste samples. Inorganic compounds were obtained from commercial sources with the exception of nitrate cancrinite, lanthanum (III) pyrophosphate, sodium uranium(VI) phosphate and iron(III) hydroxide which were synthesized according to published sources. The spectra of the various inorganic compounds were obtained using both Raman and Infrared (IR) spectroscopy. The spectra were entered into a database and labeled accordingly. The database was tested using spectra obtained from actual tank waste samples. The IR spectrum for one such tank waste sample was modeled using Microsoft Excel™ from the spectra of several inorganic compounds likely to be present in the sample. A reasonable fit to the experimental data was obtained, but the result indicated the actual tank waste material contained at least one unidentified component. Based on these results it can be concluded that IR spectroscopy and Raman spectroscopy hold potential as valuable tools for characterizing tank waste. These techniques may prove to be especially useful for amorphous solid compounds that cannot be identified by their X-ray or electron diffraction patterns.

Funding sources include: NIH MBRS-RISE Grant Number: GM061325

# Wet Chemical Synthesis of Monodisperse Silver Particles

Jeremiah Browne
Paul Carpinone
Dr. Kevin Powers

Silver particles have various uses due to their unique properties which range from use as antimicrobial agents to use in catalysis, biological labeling, surface enhanced Raman spectroscopy (SERS), and conductive inks for printed circuit boards. The goal for the summer was to research methods of producing silver nanoparticles (NPs), in order to gain a fundamental understanding of how these particles are formed and how the size and morphology can be manipulated. The ideal method would allow me to produce particles with a controllable dimension (ex. Length of a rod or diameter of a flake). Ideally the diameter of a rod or thickness of a flake would be kept below 100nm (for particles with a dimension in the micron range). This required an in depth look at various reducing agents, surfactants, and synthesis methods and their effect on the morphology of the nanoparticles, to obtain the best combination for a formula. Silver particle synthesis is more challenging than that of other noble metals due to the tendency of silver to aggregate. It was found that the type and amount of surfactant used greatly affected the silver particles, from how well the particles stayed separated to the type of particles in the colloid. Polyvinylpyrrolidone used in conjunction with ascorbic acid and a mild heat yielded the largest amount of HAR (high aspect ratio) particles. Testing still needs to be done to optimize the synthesis of silver particles.

Acknowledgements:
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# Regulation of the Cell Cycle by Adenovirus

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In the United States cancer is the second leading cause of death. Additionally, the therapies used to treat cancer are either highly invasive or toxic to the body. This is because they do not differentiate between normal and cancerous cells. Adenoviruses, however, has been shown in clinical trials to specifically kill cancer cells and are significantly less toxic, making them of interest as cancer treatments. In a recent publication, Cherubini, et.al reported that mutant adenovirus onyx-015 induced endoreduplication in normal cells. However, whether adenovirus induces endoreduplication in cancer cells remains to be determined. In aim 1 of this study, experiments were done to determine if adenovirus induces endoreduplication in cancer cells. Here we report that mutant as well as wild type adenovirus induced endoreduplication in cancer cells.

The adenovirus E4orf1 protein activates the PI3-kinase pathway and members of this pathway have been reported to enhance endoreduplication. Therefore in aim 2 we seek to determine if the PI3-kinase pathways is involved in adenovirus-induced endoreduplication. To test this, various inhibitors of the PI3-kinase pathway were used. In all the samples excluding mock, the drug Rapamycin caused a decrease in endoreduplication with a significant decrease in dl309. The drug LY294002 also caused a decrease in endoreduplication in the samples, though to a lesser degree. This suggests that the P13-kinase pathway is involved in adenovirus induced-endoreduplication.

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# Determining the Most Effective Human Adenovirus That Can Be Used to Kill Cancerous Cells

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Currently, there are three options that can be used to treat the cancer – chemotherapy, radiation therapy, and surgery - that are either toxic or invasive. Therefore, a need for a less invasive and non toxic method to treat cancer is critical. In clinical trials, adenoviruses have been proven to be safe showing minimal toxicity. An adenovirus is a non-enveloped virus that is composed of a nucleocapsid and a double stranded linear DNA genome that is responsible for upper respiratory infections. Additionally, adenoviruses' unique ability to selectively kill cancer cells made it an excellent candidate to treat cancerous cells.

Even though adenoviruses are found to be effective at killing cells in culture, there are aspects that can be improved. In this experiment, we compared eight mutant adenoviruses to determine which would be most effective in killing HeLa cells. Based in the information that was acquired from reading several papers, I hypothesized that dl1520 would have been the most effective adenovirus used to kill HeLa cells compared to the others used in the experiment. Graphs were made to compare the percent of infected cells that were still alive after pre-determined hours. The results illustrated that my hypothesis was false and that dl1005 was most efficient in killing the infected cells. A P-value (.03) was determined, which showed that the percentage viable cells between the dl1520 and dl1005 were significant meaning dl1005 can be a better candidate in treating cancerous cells.

Funded by the Historically Black College and University – Undergraduate Program Award HRD-9979896

## Mutant Adenovirus 3112 Reduces U87 (brain cancer) Tumors in Nude Mice

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Despite the oncolytic efficacy of chemotherapy, radiation therapy, and surgery, these forms of treatment also destroy living tissues. An ideal cancer therapy therefore should be noninvasive and exhibit minimal toxicity. Adenovirus (ONYX-015) has been in phase III clinical trials in the United States and is used to treat cancers in China. Although ONYX-015 is effective at killing cancer cells in tissue culture in clinical trials, it is less effective at reducing tumor size. Therefore, a virus with the advantages of ONYX-015 with improve killing effects would be beneficial. The viral early region 4 contains proteins that are reported to inhibit virus-induced cell death. Removal of these proteins in the context of ONYX-015 may increase its killing potential. We compared the mutant form of adenovirus which lack either E4orf1 or E4orf3 to ONYX-015, to determine if these mutations enhance the killing of malignant glioblastoma cell line U-87 in a nude mice model. We hypothesized that MAT2 (mutant E4orf1) and virus 3112 (mutant E4orf3) would decrease the tumor volume more effectively than ONYX-015. To test these hypotheses, U-87 cells were implanted in 20 nude mice and the tumor volume (width$^2$ x ½ length) assessed for each mouse. As a control, U87 cell line was implanted in five mice without any viral treatment. Virus 3112 had more oncolytic potency than ONYX -015 and MAT2. Although MAT2 was less effective at reducing the tumor size than virus 3112, MAT2 is shown to be more oncolytic than ONYX-015. Because of small sample size these experiments are preliminary; nonetheless results suggest that mutation of E4orf3 in virus 3112 increased the oncolytic potency of these viruses.

Funded by the Historically Black College and University – Undergraduate Program Award HRD-9979896

# Determination of Nanomolar Concentrations of Acetaminophen (Paracetamol) in Aqueous Media by a Simple Colorimetric Method using a Liquid Waveguide Capillary Cell coupled to a UV/Vis Spectrophotometer

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Pharmaceuticals and personal care products are being increasingly found in urban watersheds with unknown consequences for aquatic life. Few means of measuring these chemicals have been developed thus those that are presently in use are often expensive and time-consuming. We modified a simple, rapid colorimetric method for measuring acetaminophen by coupling a liquid waveguide capillary cell to an Ultraviolent/Visible Spectrophotometer© to improve the sensitivity required for the examination of environmental samples. Various colorimetric methods were analyzed and manipulated to create a technique which measured low quantities. Success was achieved by using 2-nitroso-1-naphtol-4-sulfonic acid and trichloroacetic acid as the color reagent to induce a color change along with sodium nitrite. In freshwater standards, we were able to detect the concentration limits of acetaminophen as low as 11.9 nM and quantify concentrations as low as 37.3 nM. We also tested on 3% salt solution to observe that salinity did not significantly affect the concentration. We determined that freezing at -20$^{o}$C was an appropriate method for sample storage prior to performing measurements. We also tested solid phase extraction C-18 cartridges to condense the concentration of acetaminophen in a large sample of water to a small manageable amount. This method was used to show that nanomolar concentrations of acetaminophen are present in the Willamette River, Oregon (0.67 nM). Future studies entail researching the effects of acetaminophen on aquatic organisms.

Funding sources include: Center for Coastal Margin Observation and Prediction, Oregon Health & Science University, Beaverton, Oregon and the National Science Foundation & NIH MBRS-RISE Grant Number: GM061325

## Particle – Process Analytical Technology (P-PAT)

Presenter: Javan Cooper[1]
Mentors: Jie Li, Dr. Kevin Powers and Dr. Gary Scheiffele, University of Florida
Institution: University of the Virgin Islands[1]

The goals of this study are to identify and evaluate on-line analytical tools, develop process control strategies based on the feedback gathered and identify gaps in existing quality assurance techniques. The FDA is mainly concerned about the development of particle characterization methods for in-process materials. Our approach for this project will be to develop a synthesis loop, which will gather feedback data that will be used to develop new process control strategies. The proposed outcomes of this study are increased production efficiency and improved product quality.
The Stober Synthesis method produces the particles that will be studied in this project. In this synthesis method, ethanol, deionized water and ammonia hydroxide (catalyst) reacts to form a basic cosolvent system. Once formed, tetraethoxy silane (TEOS) is added to the solution. TEOS hydrolyzes and supersaturates the solution with silicic acid, which nucleates and grows into spherical, relatively monodisperse silica particles. In an effort to semi-automate the production of these particles inside the synthesis loop, the pump rate of an air-driven pump was tested. Unfortunately, the tests proved that the pump rate was very unstable. As a result, the implementation of a more reliable pump is being considered for this project.

This research project is being funded by the Particle Engineering Research Center (PERC) and its industry partners & SEAGEP.

## Virgin Islanders Can Identify Corals: Divers More So Than Non-Divers

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Coral reefs are a vital part of the marine ecosystem and are home to the most biodiversity in the world. However, the number of healthy reefs on the planet is sharply declining due to natural and human activity. As the need to conserve our reefs increases, so too does the need for the public to become better aware of the threats posed to the reefs and the marine ecosystem. Before management measures can be implemented, the knowledge of the public must first be assessed. To do this, a survey was conducted in the summer of 2008 in St. Thomas, United States Virgin Islands. Participants were asked to identify pictures of ocean organisms and answer question regarding their perception and knowledge of coral and how they relate to the ocean. The survey found that the average of correctly identified pictures for scuba divers was highly significantly greater than the average of participants that stated they did not dive ($p<0.001$, t-test). The same was true for snorkelers whose total average of correct answers was significantly greater than those who did not snorkel ($p<0.001$, t-test). Virgin Islanders were better able to identify coral than participants of a similar study done in Brazil were. For example, 90% of the Virgin Islanders surveyed could identify the Elkhorn coral (*Acropora palmata*) in contrast to less than 50% of the Brazilians surveyed.

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*Special thanks to Coki Beach, Frenchtown Deli, K-Mart, Nisky Shopping Center, Red Hook Ferry Terminal and Tutu Park Mall for letting us conduct our survey on their facilities*

# Synaptic Interactions Between Neural Cells in the Pyloric Circuit of the Stomatogastric Nervous System

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The Pyloric Central Pattern Generator is a small, neural circuit composed of 14 neurons found in the stomatogastric ganglion (STG) of decapod crustaceans. These neurons act as cellular oscillators that generate rhythmic bursting activity that controls food straining in the foregut. The pyloric CPG is a model circuit for studying control of rhythmic motor behavior such as walking, breathing and chewing. However, within the STG, these rhythmic bursts of motor commands are dependent mainly on modulatory, graded synaptic potentials (GSPs). Previous studies have shown that decreasing temperature reversibly weakens the strength of GSPs. Our preliminary studies indicate that while decreasing assay temperatures slows bursting behaviors, temperature acclimation to colder temperatures actually increases bursting behaviors. Our research goal is to establish whether temperature acclimation can increase the strength of GSPs. The aim of my research was to locate and measure the synaptic interactions between the pacemaker neuron (AB), the pyloric dilator (PD), and the neurons that control pyloric constrictor muscles. I will be comparing the effects of assay temperature on rhythmic bursting behaviors with effects on GSP strengths in warm-acclimated animals. These studies will establish the range of assay temperatures where GSPs become temperature sensitive.

*Funded by NSF HBCU-UP*
*Special thanks to Hiba Mustafa and Rifa Abdullah*

## Investigation into the Function of the Heart's Visceral Pericardium

Adrianne Crooke
Mentor: Dr. Paul Jobsis

The visceral pericardium (VP) is the outermost layer of the heart and is rich in elastin and collagen that give this layer considerable strength and elasticity. Presently the function of the VP is not fully understood. Aside from the importance of better understanding the normal function of the heart during diastole, the VP is affected by various cardiac diseases including myocarditis, pericarditis, and recovery from cardiac arrest to name just a few. The VP is known to affect the opening angle and the pressure volume relationship in the relaxed heart, but it is unclear if the VP effects the contraction or relaxation of the beating heart. The orientation of the elastin fibers of the VP on the heart surface suggest that it may affect the twisting and untwisting of the ventricles during late systole and early diastole. During early diastole the pressure within the ventricle drops below zero as the heart springs open. The mechanism of this opening of the heart is unclear. Could the VP be responsible for the rapid opening of the ventricles in early diastole? To investigate this we disrupted the VP layer in pig hearts, (n=6, National Heart, Lung and Blood Institute protocol H-0213), imaged the heat with a high speed camera, and measured the affect on the local twist angle of the surface of the left ventricle (LV) and effects on LV pressure. Our preliminary findings indicate that there is a difference in the rate of change in the local twist angle in the area of the disrupted VP layer (0.62 ± .09 vs 0.45 ± .12 Rad/sec) during contraction, but no significant affect on the LV pressure or maximum and minimum dp/dt before and after disruption. The results do not support the VP functioning as spring to open the ventricles during early diastole.

Funding from this project was received from the NIH's National Heart, Lung and Blood Institute's Laboratory of Cardiac Energetics and NIH MARC (GM008422) and RISE (GM61325) grants to the University of the Virgin Islands.

# Total Phenolic and Antioxidant Activity of Breadfruit Leaf Tea

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Oxidative tissue damage has been implicated in several diseases including cancer, Alzheimer's and hypertension. It is widely accepted that consuming foods high in antioxidants provides significant protection against these diseases.
Breadfruits are a rich source of polyphenolics, which often display significant antioxidant activity. The breadfruit leaf is used in the Caribbean as folk-medicinal remedy for hypertension. The following study seeks to determine the total phenolic content of the breadfruit leaf teas, prepared from leaves at varying stages of maturity, using the Folin Ciocalteau (FC) method. The leaves were collected from the University of the Virgin Islands St. Thomas campus and the Agriculture Station of St. Thomas. All three teas yellow, green and dried had similar total phenolic content. Yellow breadfruit leaf tea (YBLT) had a total phenolic content of 0.032mM GAE/mg tea concentrate, green breadfruit leaf tea (GBLT), 0.018mM GAE/mg tea concentrate and dried breadfruit leaf tea (DBLT), 0.027mM GAE/mg tea concentrate. The determination of the total phenolic contents as well as the LCMS analysis and identification of the tea components will be discussed. Additionally, the antioxidant activities of the teas were determined by an iron catalyzed liposomal model and fluorescence spectroscopy used to monitor lipid peroxidation.

## Additive Properties of Euler's Totient Function

Presenter: Andre Douglas
Faculty Mentor: Dr. Douglas Iannucci

Let φ(n) denote Euler's Totient Function, which counts the residues relatively prime to n. We observe that φ(n) is multiplicative, i.e. φ(mn)=φ(m)*φ(n), if gcd (m,n)=1 (greatest common divisor of m and n is 1). We are interested in finding all integers m,n such that φ(m+n)=φ(m)+φ(n). We investigate special cases (such as, m+n is prime and m+n is the square of a prime), and search for ways to generate possibly infinitely many solutions.

Funded by NSF HBCU-UP

## U.S Virgin Islanders are Knowledgeable about Usefulness of Coral Reefs

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The health of coral reefs has been deteriorating due to reasons that are within and beyond our control. Coral reefs are usually said to be rainforests of the sea for they are very complex structures, productive and diverse just like terrestrial rainforests. Without proper care and treatment, the health of our beautiful "rainforest" will come to an end. Many fail to understand that their actions may have a negative impact on the environment but is it really their fault? If one does not consider their actions as wrong why should it be changed especially towards something they think has no use to them? Specifically, does one's age group and educational level influence how one perceives the usefulness of coral reefs? A survey study was conducted on human perception on the importance of coral reefs based on age and educational level. The survey was conducted via personal interviews at various public locations on St. Thomas, V.I. or participants could access the survey online at their own convenience. Newspaper advertisements and posts on social networks regarding the survey's purpose directed the public to the survey link. Results suggest that there is no significant difference in the perception of coral use to humans among age groups or educational level. Regardless of age group or educational background, the average response gathered showed that many knew at least 5 or 6 ways how coral reefs are useful to humans. This suggests Virgin Islanders will support efforts to protect coral reefs. Efforts should be placed to encourage positive behaviors towards the coral reefs while continuing to educate about their benefits.

*Acknowledgements*: Funded by NSF HBCU-UP; Lana-Vento Charitable Trust

# The Influence of Red Mud and Stabilized Red Mud on Seed Germination and Plant Growth

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Red mud is an end-waste product from the process of isolating alumina from bauxite. It has a red-clay color and a mud-like appearance when wet, a pH ranging from 12-14 and poor drainage which severely inhibits plant growth. These factors make growing plants in red mud nearly impossible. However, work was recently completed on St. Croix, USVI to develop a protocol to stabilize the red mud and reduce the pH. The objective of this research was to compare seed germination and plant growth in red mud and stabilized red mud to determine if the stabilized red mud will sustain and promote plant development. This was done by growing a variety of plants from diverse plant families, Solanaceae, Cucurbitaceae, Caricaceae and Poaceae (tomato, cucumber, papaya and corn, respectively). Seeds were planted in ProMix with 0%, 10%, 25% and 50% red mud and 25%, 50% and 100% stabilized red mud. Seed germination was recorded for 18 days. Plant height, number of leaves and general appearance were also recorded over time. Water samples were collected from leachate from the pots and pH was determined weekly. Deceased plants were also collected and dried in preparation for a leaf analysis. Plants in the red mud treatments were adversely affected, exhibiting delayed germination, reduced growth and a variation in leaf color. In contrast, the plants in the stabilized red mud mixtures grew normally. However, the 100% treatment had poor germination which was probably due to poor aeration in the soil. In red mud treatments, total plant height and number of leaves gradually decreased as the concentration of red mud increased, whereas in stabilized red mud plants did well at 25% and 50%. These results indicate that the use of stabilized red mud promotes seed germination and normal plant growth over a wide range of concentrations as compared to red mud which caused nutrient deficiency symptoms and early plant death.

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# Levels and Demographic Correlates of Life Satisfaction among African American Undergraduates

Afiya Fredericks

Life Satisfaction accounts for the global evaluation of an individual's quality of life according to their own criteria. This has received little research attention in the past, but has in recent years become a topic of great interest. The majority of research on Life Satisfaction has used majority older populations and predominantly White samples. Research that has looked at African American populations finds that determinants of life satisfaction in Whites tend to be different in African Americans. It is important to add to the limited body of research by understanding what relationships exist between demographic variables and different levels of life satisfaction among African American undergraduates.

This research used a questionnaire to collect demographic data, and the Satisfaction With Life Scale to assess the individuals' level of life satisfaction. Data was collected and Pearson's Product Correlation, One Way ANOVA and Tukey's LSD were run. These results do not indicate a statistically significant correlation between the chosen demographic variables and life satisfaction. The results do show that parents' marital status has an impact on African American undergraduates' life satisfaction. Additionally, undergraduates with one or more parents deceased reported statistically lower levels of life satisfaction than individuals whose parents were married and single. These findings show that parent's marital status may affect their children even well into their undergraduate years.

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# There is a correlation between the carapace width and the burrow diameter of the Great Land Crab, *Cardisoma guanhumi.*

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*Cardisoma guanhumi* is a large burrowing land crab that can be found throughout Central and South America, the Gulf Coast and the Caribbean including, the Virgin Islands, the Bahamas and Puerto Rico. Adult crabs of this species can measure up to 10-11 cm and weigh up to 500 g. Their burrows are usually found no more than 5 km from the ocean and are located in low-lying wetland area such mangroves and the banks of salt ponds. Understanding the size frequency of these crabs would be important to understanding the population dynamics of the species. However, trapping these crabs is difficult, expensive and time consuming. Among other species of land crabs there is a correlation between carapace width and burrow diameter. Because this correlation existed in other species I decided to determine if the same correlation could be found with the *C. guanhumi.* Using traps made from PVC pipes (8, 10, and 13 cm in diameter) and a few wire traps, we trapped the crabs and measured the carapace width (CW) as well of the burrow diameter (BW). Statistical tests determined that there was a positive correlation between CW and BW ($R^2$=.691, p-value<.001). The equation for the best-fit line is BW= 0.1.489(CW) - 1.251. This equation can be used to estimate the size of the crabs in the holes using the burrow diameter. This will eliminate the need to catch crabs to determine size frequencies within the area. The $R^2$ value of .69 is lower than that of other species of land crabs (fiddler crab and soldier crab) and may suggest that the crabs may migrate from burrow to burrow. We are unsure whether this correlation applies to the other study sites because we were unable to visit these sites to gather data. Future studies on correlation between carapace width and burrow diameter need to be done to determine if there will be similar results for those locations, as well as using data from more crabs so that there may be a better best-fit line.

*Acknowledgements:* Special thanks to Christina Colletti and DF&W for allowing me to use their facilities to conduct my research. Also, special thanks to the National Science Foundation and the Emerging Caribbean Scientists Summer Undergraduate Research Experience Program.

# Rapamycin has an Inhibitory Effect on Primary Effusion Lymphoma (PEL) Cells' Growth

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Human herpesvirus-8 also known as Kaposi's sarcoma-associated herpes virus (KSHV) is a gamma herpes virus that causes Kaposi's sarcoma (KS), multicentric Castleman's disease (MCD) and primary effusion lymphoma (PEL). PEL is a non-Hodgkin's type of B-cell lymphoma, initially identified as an AIDS associated malignancy. KS is characterized by cutaneous skin lesions, and came into prominence as an AIDS defining disease. Rapamycin is an immunosuppressant drug commonly used in transplant patients and additionally shown to have antitumor activity. Rapamycin targets the pro-growth mTOR signaling pathway; it inhibits phosphorylation events downstream of mTOR. This study looked at the effects of rapamycin on the growth of PEL cells. The effect of rapamycin on PEL cell growth was monitored by treating two different PEL cell lines with an ethanol control and seven different concentrations of rapamycin. The number of live cells was counted every 24 hours for 4 days. Proteins were extracted from two PEL cell lines both treated with ethanol and rapamycin; the proteins were blotted with anti phosphorylated S6 ribosomal protein. Also, proteins were extracted from three representative PEL cell lines and they were plotted for Akt, mTOR, TSC1, TSC2, Raptor, and Rictor. There were less live cells in rapamycin treated PEL cells compared to the ethanol treatment. Also, rapamycin treated PEL cells had a reduced presence or complete absence of phosphorylated S6 ribosomal protein. However, all three PEL cell lines showed the presence of Akt, mTOR, TSC1, TSC2, Raptor, and Rictor. Therefore, I can conclude from this study:

1. PEL cells are susceptive to growth inhibition by Rapamycin.
2. Rapamycin specifically inhibits phosphorylation of S6 ribosomal protein.
3. MTOR signaling pathway is conserved in PEL.

Research is supported by NIH MBRS-RISE Grant Number: GM061325

## The Relationship between Anemia and Depressive Symptoms in Police Officers

Jacinthia Greaux
Luenda Charles, PhD.

Depression is a psychological disorder that affects mood and behavior and is characterized by sadness, insomnia and loss of appetite. Anemia is physiological disorder identified by a decrease in red blood cells and is characterized by dizziness, weakness and paleness of skin. Our objective was to investigate the relationship between anemia and depression in police officers. We conducted a cross-sectional study of 105 randomly selected officers, 63 men and 42 women, from the Buffalo, NY. Police Department. Anemia was assessed by Complete Blood Count on fasting blood samples, and depression by the Center for Epidemiological Studies Depression (CES-D) Scale. Pearson's correlation, Student's *t*-test, ANOVA and ANCOVA were used to assess associations in SAS. Officers were predominantly white and ranged from 27 to 61 years of age. Nine percent of officers were depressed and anemia was prevalent in 24% of women and 2% of men. Among women, hemoglobin was positively correlated with age ($p$=0.044) and years of service ($p$=0.012). Among men, hemoglobin was positively correlated with alcohol intake ($p$=0.004) and depression score with Body Mass Index ($p$=0.005). No associations were observed between mean CES-D score by gender-specific tertiles of hemoglobin in multivariate models adjusted for age, education and Body Mass Index. Anemia was not significantly associated with depression in this cohort. Further investigation is recommended on larger samples of workgroups at risk for depression.

Research is supported by NIH MBRS-RISE Grant Number: GM061325

## Collaborative Sketching Software for Mobile Devices

Kevin Harry

Sketching is a valuable tool commonly performed in the early stages of design. For example, it is important in the development of software, because a simple drawing is sufficient to represent complex ideas. A large percentage of sketches in software design are done using traditional methods (e.g. pencil and paper). This method is usually effective for small teams working on a project. However, in today's society it is common for people in different locations across the world to collaborate projects. To support mobile collaborative sketching, software must make sketches available, portable, easily reproduced, shared and editable. Our Real-Time Collaborative Sketching (RTCS) software will accomplish this by providing a sketching environment made for real-time remote collaborative editing. The RTCS software will also function on desktop computers but offers the portability of mobile devices such as PDAs and Smartphones.

## Separation of Lanthanide Ions with Kläui Ligand Resin

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Current procedures for separating and concentrating radionuclides for detection are complex, and can be both expensive and time consuming. Therefore, the purpose of this research is to attempt an alternative method of separating lanthanide ions through the use of an extraction chromatography resin containing a surface adsorbed Kläui ligand salt. Based on prior research with actinide ions, it is hypothesized that the lanthanide ions would bond strongly with the Kläui ligand. Klaüi ligand, $C_5Me_5Co(OP(OR)_2)_3^-$ (R=Me, Et, i-Pr, n-r)(LOR), has a unique affinity for lanthanide and actinide ions in the presence of competing metal ions. The use of 1 wt% NaLOR (R=Et or n-Pr) adsorbed onto resin support was shown to selectively extract lanthanide ions from aqueous nitric acid solutions of different concentrations. In order to further evaluate the efficacy of these materials in radiochemical separations, the selectivity of the resins in separating lanthanide ions were examined by measuring the distribution coefficients ($K_d$) values for $Eu^{+3}$, $Nd^{+3}$, and $Pr^{+3}$ over a range of solution conditions. As the amount of resin used increased, the $K_d$ value increased; therefore, the more ligand added to the metal, the more the lanthanide ions would bind. Future work will involve the determination of the $K_d$ values for the remainder of the lanthanide series to further assess the potential of the Kläui ligand for intra-group lanthanide separations. The success of this research is important, because it will assist in expanding and improving current automated radiochemical methods, which should lead to decrease in the cost of developing and implementing.

# Bioactive Metabolites from Yellow Breadfruit (*Artocarpus altilis*) Leaves

Timarah A.J Hodge
Keisha Christian, Andrita Griffin, Omar E. Christian.

Folk medicine has been a successful progenitor in identifying biologically active compounds from various Caribbean plants. The leaves of *Artocarpus altilis* (breadfruit) represent one such example. A decoction of the yellow leaves of the breadfruit tree has been acclaimed to have antihypertensive properties. *Artocarpus altilis* is a rich source of prenylated flavonoids which display mild cytotoxicity toward various cancer cells. The purpose of this study is to identify the bioactive metabolites in the Virgin Island collection of the yellow breadfruit leaves. We herein describe the fractionation and biological evaluation of the ethyl acetate extract of yellow *A. altilis*. The ethyl acetate extract displayed moderate cytotoxicity against human and murine carcinoma cell lines, H125 and C38 respectively. Chromatography of the ethyl acetate extract yielded several pure metabolites. The identities of these metabolites were determined based on mass spectral analysis and NMR spectroscopic analysis. The structure elucidation as well as the biological activities and the total phenolic content will be discussed.

Research funded by NIH

# Use of Isotopic Dating Methods to Distinguish the Connection of the Argentine Precordillera Terrane to Laurentia

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The Argentine Precordillera terrane, now at the eastern foothills of the Andes in western South America, shows evidence of extraction from the Ouachita embayment of Laurentia, now southern North America. Detrital zircons from both synrift and synorogenic regions of the Precordillera were collected and analyzed for the uranium (U) to lead (Pb) ratios, and hafnium (Hf) and lead isotopes using a Multi-Collector Inductively Coupled Plasma – Mass Spectrometry (MC-ICP-MS). Although, by theory, the Precordillera may have been a part of Gondwana (now South America) from the start, the U-Pb ages showed a strong Grenvillian association, which consequently partially confirmed the connection to Laurentia. Focusing on a belief that rifting occurred during the Cambrian period and accretion to South America during the Ordovician, results were expected to mimic the rocks of this time. The results of the Hf isotopes, which help to determine the extent of mantle contribution to the magmas from which the U-Pb analyzed zircons crystallized, were compared to Hf results from the Southern Appalachians and Granite Rhyolite regions of North America, which showed that the some grains had a more juvenile signal than those in North America. The Pb isotopes results were consistent with those from the Amazonia region, whose rocks can be found throughout South America and western Africa. The Hf and Pb isotopes results did not pinpoint the origin of the Precordillera, but did support the proposed connections between South and North America.

This research was supported by the South East Alliance for Graduate Education and the Professoriate program which is funded by the National Science Foundation.

# The Hydrothermal Synthesis and Characterization of Barium Strontium Titanate, ($Ba_xSr_{1-x}TiO_3$)

Presentor: Dexter Hypolite

Mentors: A. Wilk, P. Xu, L.Cai, S. Phadke, & Dr. J. Nino

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Barium strontium titanate (BST) with Ba = 0.9, 0.8 and Sr = 0.1, 0.2 and Barium Titanate (BT) were produced using a hydrothermal synthesis route. X-ray diffraction revealed $TiO_2$ impurities in the BST, but revealed a phase pure BT powder. The BT was synthesized using a variety of compositions leading to mixed results. The phase pure BT was created using a mixture of anatase and rutile nanopowders at a temperature of 120 $^oC$. The unsuccessful attempt at BST synthesis may be attributed to an incomplete reaction of the $TiO_2$ reagent. However, the phase pure BT compositions varied from currently existing work and reveal an alternate method of BT synthesis.

The program was funded by the South East Alliance for Graduate Education and the Professoriate (SEAGEP).

# Will Analyses of Complete Sequences from the Large Ribosomal Subunit (28S) Produce a Well-supported Phylogenetic Hypothesis for Relationships Among Scleractinian Coral Families?

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Scleractinian corals are the foundation of coral reefs, intricate ecosystems that serve as habitats for a diverse array of organisms and provide many benefits. Conservation of coral reefs depends on a clear understanding of evolutionary relationships among corals. Taxonomic classifications based on morphological traits divide the order Scleractinia into seven suborders, but molecular phylogenetic analyses divide the order into only two clades that do not correspond to any of the seven suborders hypothesized based on morphological data. However, relationships between groups within each clade are not well resolved. Scleractinian molecular phylogenetic analyses have included sequences from the nuclear 28S ribosomal gene, yet these analyses included representatives of only up to 14 of the 25 scleractinian families and did not include all of the variable regions of the gene. Although the 28S gene is approximately 2400 base pairs long, previous analyses have included only 200-700bp of the gene. We hypothesize that analyses of the complete 28S gene region from a greater number of taxa will result in a highly robust hypothesis for relationships among sub-groups within each of the two clades supported by all molecular analyses. We analyzed samples representative of 9 scleractinian families. We extracted coral DNA using a CTAB protocol, and amplified the 28S gene region using the polymerase chain reaction (PCR). DNA sequences of PCR products were determined by automatic sequencing. A BLAST search aligned our sequences to other scleractinian 28S sequences in GenBank. These sequences will be aligned and used to construct a phylogenetic tree based on maximum parsimony and maximum likelihood criteria. Initial analyses are expected to generate a phylogenetic hypothesis that is concordant with other molecular phylogenetic analyses, but further analyses will be necessary to determine whether complete 28S sequences provide a more robust hypothesis than analyses from shorter regions of the 28S gene and other gene regions. Samples representative of all 25 scleractinian families will be analyzed. Complete sequences from the 18S, 16S, and COI gene regions will also be included in future phylogenetic analyses.

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## Cytotoxic Metabolites of Agelas conifera

Vanessa Malone
Mentor Dr. Omar Christian

*Agelas conifera* (aka the brown tube sponge) is a common Caribbean sponge specie known for its musky brown color and its symbiotic relationships with fish and coral. The symbiotic relationships are especially important and have drawn much attention to the sponge. *Agelas* produces several antibacterial and defensive bioactive metabolites, such as bromonated ageliferins and debromoscletins, throughout its lifespan.
Recent success with other metabolites (i.e. psammaplyns) has resulted in increased research activity and prompted our own research. With the intent of extracting new and potent solid tumor selective metabolites from Caribbean sponges, several samples of *A. conifera* were collected from USVI reefs and examined for general cytotoxicity and solid tumor selectivity. Dried sponge material was extracted with hexane, ethyl acetate, and methanol. The crude ethyl acetate extract was the most potent; significantly inhibiting the proliferation of human and murine colon and lung carcinoma cell lines at a concentration of 5 µg/ ml. The extract was also cytotoxic to normal cells. Bioassay guided fractionation of the ethyl acetate has yielded several pure bioactive metabolites. We'll discuss the chromatographic separation and purification of bioactive compounds. The structure elucidation is based on 1D and 2D NMR data.

Funded by NSF HBCU-UP

# A GIS analysis of St. Croix

Tristian Muhammad

This study was conducted to analyze the health of St. Croix's waterways use of a Global Information System (GIS). Guts are important because they have a direct affect on water resources and GIS technology make's it easier to manage a project on an island wide scale. We predict that in areas of change soil quality would be directly affected. ArcGIS enabled us to utilize STX land cover change analysis, a recent study by AES which classified St. Croix into 5 land cover types on two dates ten years apart and mapped the change. Using this GIS program we also overlaid a USGS gut layer onto the land cover change analysis and buffered the gut 15ft on each side to represent a stream. A class name was determined by the cover type that the buffered streams intersected. The three stream classifications forest to non-forest (FN), non-forest to forest (NF), and forest to forest (FF) where saved as separate layers. These three classifications were selected to explain how development may have an affect on the health of the guts. In ArcGIS with the tool random point generator, 10 randomly distributed points in each classification were created with a minimum of 500m apart in case they fell in the same gut. The points were uploaded on to the Garmin 130 GPS units. We navigated to each point made observations, conducted tests, and took samples for lab testing. The data collected supported our initial predictions that the areas of change NF and FN soil would be directly affected. In conclusion GIS and GPS technology proved to be an affective tool to perform a comprehensive analysis of St. Croix's waterways.

Research supported by VI EPSCoR

# The Pyloric CPG Responds to Cholinergic Treatment of Higher Neural Centers in the Stomatogastric Nervous System (STNS) of *Panulirus argus*, the Caribbean Spiny Lobster

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The stomatogastric nervous system (STNS) controls all motor activity of the lobster foregut and is comprised of four ganglia. The paired commissural ganglia (CoG) are located within connectives of the central nervous system and send axonal projections to two peripheral ganglia: the esophageal ganglion (EoG), and through a single nerve to the most distal stomatogastric ganglion (STG). The pyloric central pattern generator (CPG) in the STG produces rhythmic bursts of action potentials even in isolated STNS preparations. Central nervous system input is necessary for the pyloric CPG and cutting all connections from the CoG to the STG stopped bursting activity. While two neurons in the CoG are known to influence the pyloric rhythm, the pharmacology of these interactions is not clear.

Lobsters, like most animals, employ relatively few types of neural transmitters in motor circuits. We hypothesized that control of higher motor centers will involve neurotransmitters also used in peripheral centers. Acetylcholine is an important inhibitory neurotransmitter in the pyloric CPG and acts through muscarinic receptors. To test this hypothesis we superfused the CoGs with a muscarinic mimic, oxotremorine, at concentrations ranging from $1x10^{-5}$M to $7x10^{-5}$M, for five minutes followed by twenty minute washes with lobster saline. Pretreatment Pyloric burst frequencies ranged from 0.45 to 1.24 Hz, and doubled following superfusion of the CoG with 2 X $10^{-5}$M oxotremorine. Saline washes and higher concentrations of oxotremorine did not significantly increase bursting activity. The response of the Pyloric rhythm following treatment of the CoG with oxotremorine differs from responses following direct application of oxotremorine to the STG (Bal et al., 1994). First, a 4-fold higher concentration of oxotremorine was required to obtain maximal effects when acting through the CoG (2 x $10^{-5}$M versus 5 x 10-6M). Second, the maximal increase in burst frequency following superfusion of the CoG with oxotremorine was proportional to pretreatment activity. Third, indirect stimulation of the pyloric CPG via the CoG had long acting effects that are not diminished significantly during 20-minute washes. Thus, we confirm our original hypothesis that muscarinic neurotransmitters are involved in higher center control of the pyloric CPG; however, central effects are distinctly different from peripherial effects on the pyloric rhythm.

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# Human T-cell Leukemia Virus Type-1 Insertion Sites of Human T-cells

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Retroviruses integrate into cellular genomes and can activate oncogenes or inactivate tumor suppressor genes. Understanding this process will open a myriad of doors within the realm of cancer biology for scientists to explore underlying the mechanisms by which retroviruses cause cancer. This research is focused on determining the T-cell genome insertion sites of HTLV-1. HTLV-1 is a complex retrovirus that induces Adult T-cell Leukemia/Lymphoma (ATLL) after a long latency and in only 5% of carriers. The latency of over 30 years and low incidence implies that multiple oncogenic "hits" accumulate before leukemia/lymphoma develops. To evaluate the role of insertion sites in HTLV-1 induced transformation, an *in vitro* assay was applied to transform T-cells by an irradiated HTLV-1 viral producing cell line. Splinkerette-PCR was used to clone and map insertion sites from infected T-cells. Insertion sites of HTLV-1 were identified in the HUT102 (HTLV-1 secreting) cell line. Results show that retroviral insertional mutagenesis may be an important mechanism in HTLV-1 induced cancer. Further research, including functional analyses of the genes found would provide more concrete data and evidence of HTLV-1 insertional mutagenesis of human T-cells.

## REFERENCES

(1) Poeisz BJ, Ruscetti RW, Gazdar AF, Bunn PA, Minna JD and Gallo RC. (1980). *Proc. Natl. Acad. Sci. USA,* **77,** 7415-7419.
(2) Teich N, Wyke J, Bernstein A and Hardy W. (1985). *RNA tumor viruses.* Weis R, Teich N, Varmus H and Coffin J (eds). Cold Spring Harbor Laboratory, pp 785-998.
(3) Uchiyama T, Yodoi J, Sagawa K, Takatsuki K and Uchino H. (1977). *Blood.* **50,** 481-492.
(4) Yoshida M. (2005). *Discovery of HTLV-1, the first human retrovirus, its unique regulatory mechanisms and insights into pathogenesis.* Oncogene. **24,** 5931-5937.

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# Cistern Water Quality in the St. Thomas, St. John District

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Water usage in the Virgin Islands is an interesting scientific and an important public health problem. Historically water has been available mostly from catching rainwater and storing that water. The island aquifers are small and provide a small percentage of the water needed. Rainfall averages 40 inches per year and is seasonal. There was a dramatic increase in population starting in the 1960's during which the population increased from 20,000 to the presently over 110,000 resulting in that over 50% of the residences in the USVI use cisterns as their only source of water.

There has not been a study of the presence of environmental pollutants such as polyaromatic hydrocarbons (PAH) or heavy metals in cisterns in the Virgin Islands. Nor has there been a recent study of usage patterns of cistern water.

During this study we have collected 36 liter samples of water from random areas on St. Thomas, St John and Water Island. Data on cistern conditions, usage, water source and other relevant historical data have also been investigated. Samples collected will be subject to GC/MS and ICP/MS analysis in the near future. Information on cisterns and their water analyses will be correlated to establish a baseline to determine if water quality issues exist and to provide a basis for future monitoring of cistern water.

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# Comparing the two major Image Compression algorithms JPEG & GIF used on the web

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Image compression today plays great importance in many different areas that utilize images as their eye catcher so to speak. This encourages users to explore web pages more in-depth and also plays a great role to help users understand in whatever they are doing. Image compression is minimizing the size in bytes of a graphics file without degrading the quality of the image to an unacceptable level. The reduction in file size allows more images to be stored in a given amount of disk or memory space. It also reduces the time required for images to be sent over the Internet or downloaded from Web pages.

For Internet use, the two most common compressed graphic image formats are the JPEG format and the GIF format. The JPEG method is more often used for photographs, while the GIF method is commonly used for line art and other images in which geometric shapes are relatively simple. Image compression can be lossy or lossless. Lossy methods are especially suitable because the loss of fidelity is acceptable to achieve a substantial reduction in bit rate.

The problem today is JPEG and GIF are so well used new users are unsure of which to use. This research use both compression algorithms on different image types in an effort to find and compare in the fields of image quality, space performance and the greatest factor of all visual representation. The final results caused us to accept our hypothesis because the JPEG compression algorithm produced better overall results than that of the GIF compression algorithm.

## Shrimp symbionts display short term anemone fidelity

Adam Ringel

Stephen Ratchford, UVI

A 2-year study of the population dynamics of the anemone *Bartholomea annulata* and its shrimp symbionts indicates that there is 50% turnover in anemones every 3 months and that the symbiotic shrimp associated with the anemones may be even more dynamic, such that there is no correlation between shrimp found at one time and shrimp found 3 months later on any given anemone. These findings prompted us to investigate whether the various symbiotic shrimp species show any fidelity to individual anemones over a shorter term – one day to one week. We repeatedly surveyed approximately 50 tagged anemones in Brewers Bay, St Thomas, VI, recording the number of each shrimp species on each anemone on day 0, day1, day3 and day 6 in early September 2008. For each species, we conducted regression analysis of the number of shrimp found on one day versus on subsequent days. All species of shrimp displayed statistically significant correlation over all time periods investigated, suggesting at least for periods less than a week, these species are loyal to individual anemones.

Research Supported by PR SeaGrant

# Feeding behavior of juvenile *Diadema antillarum*, the long-spined black sea urchin

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*Diadema antillarum* play an important role in the coral reef community as a keystone grazer. As such they eat algae which compete with coral for space on the reef. Their grazing maintains algal density to a low level allowing corals to flourish and facilitating the recruitment of new corals. However, in the early 1980's there was a Caribbean wide die-off of *Diadema* by a still unknown pathogen removing 99% of the population. This created the opportunity for macroalgal cover on reefs to increase. Thus, the return of *Diadema* to reefs is important, but the feeding preference of the juvenile urchin (< 2 cm) is uncertain. Recent availability of the juvenile urchin in Brewers Bay, St. Thomas allowed for an assay in which its feeding preferences were assessed. All urchins and algal samples were taken from Brewers Bay, which is adjacent to the University of the Virgin Islands St. Thomas campus. Five trials were conducted, each with 30 juvenile urchins, and each was fed a single algal thalli for five days. Trials tested: the red alga *Acanthophora spicifera*, the brown alga *Dictyota menstrualis*, the calcified green alga *Halimeda opuntia,* the uncalcified green alga *Caulerpa macrophysa*, and the brown alga *Lobophora variegata*. Juveniles had distinct significantly different preferences (Kruskal Wallis, $p < 0.001$): they ate large amounts of *Acanthophora* and *Caulerpa* but much less of the other species. This information may help managers wishing to return urchins to reefs.

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# Digital Infrared Thermal Imaging to Measure Eye Temperatures in Cattle Correlates to Core Body Temperature

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The use of digital infrared thermal imaging (DITI) to measure eye and muzzle temperatures of cattle as a correlate to core body temperature was investigated. Senepol cows (n = 44) were used in this study during normal animal management practices. Ocular and muzzle temperatures measured using DITI were compared to rectal and vaginal temperatures. Thermal images of the left and right eyes and the muzzle of each cow were taken using a digital infrared thermal camera (FLIR ThermaCAM EX320). Vaginal and rectal temperatures were recorded using a digital veterinary thermometer (GLA Agricultural Electronics, M700 series). Thermographs of eyes were analyzed by taking the maximum temperature of the area of the whole eye. Thermographs of muzzles were analyzed by recording the maximum temperature of the area between the nostrils. Ambient temperature and relative humidity during the data collection period were recorded using a data logger (Onset Computer Corp.). All data were analyzed to determine correlations among the various body temperature measurements using SAS (1999). It was found that both vaginal temperature ($r = 0.520$, $P = 0.0004$) and rectal temperature ($r = 0.583$, $P < 0.0001$) were correlated with mean eye temperature. Muzzle temperature was moderately correlated only with the mean eye temperature ($r = 0.479$, $P < 0.001$). The use of DITI to measure eye temperature of cattle is a correlate to core body temperature, thus an effective means to assess body temperature and reducing the need to handle animals. More importantly, thermal imaging is useful when the animal's state of health is in question. With further study, this could have implications as a non-invasive means of measuring the body temperature in both domestic and non-domestic animals.

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## Simple Predator and Prey Modeling

Students: Alfonso Rodriguez, Jr.

Faculty Mentors: Dr. Jerry Ridenhour (Head of the Math Department on the University of Northern Iowa)

Sometimes predator-prey models are given for situations in which the prey has a refuge where they are safe from predators. The purpose of the project is to create a stable predator and prey model for deer and deer hunters in a specified area with the inclusion of a refuge for the deer. The project uses differential equations to analyze and model the population of the deer and the population of the hunters. The prey population is divided into two classes, those inside and those outside the refuge. Two possible models are proposed, each based on logistic assumptions and allowing migration of prey into and out of the refuge. The models consist of systems of three nonlinear autonomous differential equations. Equilibrium points are found and population dynamics are discussed.

## Most Young U.S. Virgin Islanders Have Some Understanding of Coral

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It is very important that people possess some knowledge of coral. By understanding what coral is, how useful it is to the environment, and how our actions can affect coral in positive or negative ways, people may be able to alter certain behaviors and help protect the corals. To understand how much Virgin Islanders know, a representative sample survey was conducted in the summer of 2008 by interviewing VI residents, both in person and by web, about their knowledge of corals and the ocean. I wanted to see if males of the age range 18-30 knew more about corals than females of the same age range, or vice versa. Most young Virgin Islanders do have some understanding of coral. For example, 82% females and 74% males could correctly explain what a coral was. And when presented with three photos of ocean organisms, males correctly identified them with an average of 2.28, while females correctly identified the photos with an average of 2.45. The sexes did not differ significantly in knowledge of coral ($p=0.247118$ t-test ($p>0.05$), $p=2.210454$ chi-square test ($p>0.05$)). This suggests that most young Virgin Islanders have some knowledge and understanding of coral. This contrasts with a similar study in coastal Brazil in which only 60% knew what a coral was.

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# Cleaner shrimps *Periclimenes pedersoni* and *Stenopus hispidus* affect the mean size of flatworm parasites *Neobenedenia mellini* on a Caribbean reef fish

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Ectoparasites are harmful to reef fish because they damage the fishes' skin and make them more susceptible to disease (Thoney and Hargis 1991). Fish may be cleaned of parasites and other debris by cleaner fishes or shrimps at cleaning stations (Côté 2000). The effectiveness of cleaner fish is well documented, but the role of different cleaner shrimp species is not well studied (Becker and Grutter 2004). Two Caribbean shrimps, Pederson cleaning shrimp, *Periclimenes pedersoni,* and banded coral shrimp, *Stenopus hispidus*, were recently tested for their effect on fish parasite loads (McCammon et al. 2008). Pederson cleaning shrimp reduced parasite loads on fishes but the banded coral shrimp did not (McCammon et al. 2008). Another way cleaners can affect parasite populations is by changing the mean size of parasites on the host fish. The ability of cleaner shrimps to remove parasites, especially larger ones, should have a positive impact on fish health by reducing damage to the host's skin. In addition, reduced parasite size could reduce overall parasite populations on the reef by removing the parasites with the greatest reproductive output. The mean length of parasites from fish that did or did not have access to cleaning shrimp was quantified *to test the hypothesis that Pederson cleaner shrimp and banded coral shrimp affect the average size of monogenean parasites on the blue tang fish* (Acanthurus coeruleus*)*. Blue tang were housed in an aquarium where they were constantly exposed to the infective stages of the parasite; the control treatment contained fish alone, and the experimental treatment included access to cleaner shrimps. After two weeks each fish was recaptured and put in a freshwater bath for five minutes to remove the parasites. Parasites were preserved in ethanol, photographed under a microscope and their lengths measured using NIH Image J. Pederson shrimp significantly reduced the average size of parasites on the blue tang ($p < 0.05$, t-test), suggesting that they prey selectively on larger parasites. Banded coral shrimp also affected the mean parasite size on the blue tang ($p < .001$, t-test) but they did not have as great an effect as the Pederson shrimp.

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# Generating Large Primes for the RSA Algorithm

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The RSA algorithm or cipher system was invented by Rivest, Shamir, and Adleman in the 1970's. It is a public key cipher system based on modular exponentiation where the keys are pairs consisting of an exponent *e* and a modulus *N* that is the product of two large primes *p* and *q*. It is an algorithm used to encode and decode messages. It depends on using two large primes which are kept secret and their product is made public. We will show how to find large primes and use them to explain the RSA algorithm and how it works.

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## Developing an AdHu5 vector for a HIV-1 Vaccine

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HIV has developed into a pandemic and the number of infected individuals continues to grow at an alarming rate. Thus the need for a vaccine is desperate. Despite recent antiviral strategies, Human serotype 5 adenovirus has achieved the most success as a potential HIV vaccine candidate. Adenovirus is known for causing illnesses such as diarrhea, pink eye and the common cold. Nevertheless, the benefits of using adenovirus to construct an AdHu5 HIV-1 vaccine vector include the fact that the virus has been proven safe; the virus's ability to naturally induce long lived mucosal and systemic immunity, and ease of manipulation.

The purpose of this research is to determine which AdHu5 mutant virus would be the best candidate for designing a vector to develop an effective HIV-1 vaccine. Cell lines H-1299, U-87, and Hela cells were infected with nine mutant adenoviruses. The nine adenoviruses were analyzed for their ability to produce late viral proteins. The virus that produces the least amount of late viral proteins is expected to elicit the least adverse immune response and hence be the safer candidate. Our results show that in both H1299 and U-87, virus dl223 exhibited the least amount of late viral protein production. In Hela cells, dl1520 produced the least amount of viral proteins. Future research would involve placing the HIV *gag* or *env* gene into one of these vectors and assessing the immune response. Additionally, chimeric viruses made from other Ad subgroups with similar mutation to dl223 or dl1520 may be used in creating an AdHu5 HIV-1 vaccine vector.

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# Knockdown of GFP in NIH-3T3 Cells Using RNA Interference

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Professor Zappe

RNA interference (RNAi) is a mechanism that inhibits gene expression by simply blocking the translation process. Initiation begins at the moment the cell has been introduced to double-stranded RNA (dsRNA), which then activates the dicer enzyme to cleave the dsRNA into these short fragments called small interfering RNA (siRNA). The pieces of siRNA create a pool from which the RNA-induced silencing complex (RISC) would incorporate one strand of the siRNA that has the complementary sequences to the messenger RNA (mRNA) thus blocking translation of the RNA. RNAi is a naturally occurring process that regulates development and genome maintenance. Today, RNAi is widely used especially for cell cultures because it can induce suppression of a desired gene, which can be used to better understand the functions of genes in different cells. We plan to use RNAi technology to determine the function of the genes involved in the differentiation and self- renewal of neural stem cells. A series of experiments were conducted using fibroblast (NIH-3T3) cells to determine whether siRNA can knockdown a targeted gene. NIH-3T3 cells were modified to express the green fluorescent protein (GFP). If siRNA interferes with expression, the cells would no longer express GFP. The problem has been getting the RNA into the cell (transfection). We tested two commercial siRNA's, siQuest and TKO, as transfection reagents. Base on our results, the siQuest transfection reagent was more effective at suppression of the GFP. By proving that the RNAi works effectively when a transfection reagent is present, we can proceed with testing this experiment on neural stem cells and conduct reverse screening that would allow us to knockdown more than one gene at a time in the future.

# Identification of Candidate Genes that Sensitize Cells to Taxol in *Chlamydomonas reinhardtii*

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Taxol is a natural product that acts to arrest dividing cells and is used as a chemotherapeutic agent. It blocks the breakdown of microtubules during mitosis. The purpose of this study is to use the ease of mutant isolation in the unicellular, green alga *Chlamydomonas reinhardtii* and to identify mutations that sensitize cells to Taxol. These genes will be mapped using molecular markers. Following mutagenesis, *Chlamydomonas* cells were screened for flagellar defects and then for supersensitivity to Taxol. Approximately 400 cilia defective mutants were isolated and 16 of these also conferred supersensitivity to Taxol. Previous work from the Dutcher laboratory has shown that mislocalization of the microtubule severing protein, katanin p80, causes Taxol supersensitivity. Consequently, each of the taxol supersensitivity strains was mated with a strain carrying an epitope tagged katanin p80 transgene to examine the localization of this protein in the mutants by immunofluorescence microscopy. Using a polymorphic strain, the mutant phenotypes will be mapped using derived CAPS (dCAP). This study will identify mutations that fail to depolymerize microtubules as monitored by the increased sensitivity to Taxol. Genes that have homologs in humans are candidates for determining appropriate pharmacological doses of Taxol in cancer treatment.

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## Photochemical Reaction Screening of Santonin

Student Presentor: Ophelia Wadsworth
Faculty Mentor: Paul Ralifo, PhD., Center for Chemical Methodology and Library Development

The aim of this research is to utilize α-santonin (**1**) and its derivative, lumisantonin (**2**), as scaffolds for reaction discovery and chemical diversification. Our initial efforts to make **2** resulted in the formation of two compounds: (i) ethyl ester of isophotosantonic acid (**3**, 50.6 %) and (ii) a tricyclic derivative containing a seven-memebered ring (**4**, 11.7%). Compound **3** was proposed to have formed via a ketene intermediate while **4** from a carbocation intermediate. With this in mind, we decided to build a small library, by trapping the ketene intermediate leading to **3,** with dienophile nucleophiles which could possibly set the stage for intramolecular Diels Alder reactions (**Type I** compounds). The carbocation intermediate leading to **4** could be trapped by bisnucleophiles which could effect intramolecular Michaels addition to the α,β-unsaturated carbonyl moiety, increasing the structural diversity of this set (**Type II**). In addition to building a library of complex, diverse derivatives, the newly synthesized structures will also be screened for novel bioactivity.

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