MONMOUTH UNIVERSITY

SCHOOL OF SCIENCE

THIRTEENTH ANNUAL

STUDENT RESEARCH CONFERENCE

Wednesday, April 16, 2014

Great Hall
Wilson Hall

Poster presentations of student research projects in

Biology

Chemistry, Medical Technology and Physics

Computer Science and Software Engineering

Mathematics

MONMOUTH UNIVERSITY
WHERE LEADERS LOOK *forward*

MONMOUTH UNIVERSITY
SCHOOL OF SCIENCE

THIRTEENTH ANNUAL STUDENT RESEARCH CONFERENCE
WEDNESDAY, APRIL 16, 2014
WILSON HALL

Presentations by Department

Department of Biology

Carbon Sequestration of *Rhizophora mangle* in the Bahamas
Chelsea Barreto
Faculty Mentor: Dr. Pedram P. Daneshgar

Benthic Macroinvertebrate Communities of Mangrove Ecosystems of South Eleuthera
Douglas Casey
Faculty Mentor: Assistant Dean John A. Tiedemann

Characterization of a Bacterium Isolated from Barnegat Bay, NJ that can Degrade 1, 3, 7-*trimethylxanthine* (caffeine)
Kevin Dillon
Faculty Mentor: Dr. Karen Pesce

Changes in Gene Expression in the Rat Testis Following Inflammation
Genevieve Fasano
Faculty Mentor: Dr. Michael A. Palladino

Statistical Analysis of Division I Women's Lacrosse Athletes Induced with a Reductive Visual Stimulus
Shivam Patel, Alison Keelen, Shayna Popkin, Lauren Johnson
Faculty Mentor: Dr. Bernadette Dunphy

Co-Administration of Amphetamine Modifies the Alcohol Withdrawal Syndrome of Adolescent Rats
Shayna Popkin, Madelyn Mauterer, Oliveia Boutros, Melissa Sparacio
Faculty Mentor: Dr. Dennis Rhoads

Microbial Degradation of N, N-Diethyl-*m*-Toluamide by Acinetobactor
Krystal Rivera
Faculty Mentor: Dr. Karen Pesce

Department of Chemistry, Medical Technology, and Physics

Synthesis of Novel DNA G-Quadruplex Ligands

Samantha Ebner, Wesley Cunningham, Jonas Colmer

Faculty Mentor: Dr. Massimiliano Lamberto

Designing the Next Generation of the Environmentally Friendly Dye-Sensitized Solar Cells

Nicole Famularo, Daniel Chang

Faculty Mentor: Dr. Dmytro V. Kosenkov

Magnetic Iron Oxide Nanoparticles: Environmental Impacts and Potential Applications

Patrick Fedick, Emily Caputo, Peter Chace, Kimberly Belliveau

Faculty Mentor: Dr. Tsanangurayi Tongesayi

An Extended Hückel Approach for Modeling Electronic Excited States in Light Harvesting Complexes

Kristen Flynn, Erik Braunstein, Philip Donahue

Faculty Mentor: Dr. Dmytro V. Kosenkov

The Binding of Toxic Heavy Metals and Metalloids by Captopril Under Simulated Gastric Conditions

Taylor Johnson, Emily Caputo

Faculty Mentor: Dr. Tsanangurayi Tongesayi

Monitoring RNA Folding via Fluorescence

Shreeja Kadakia

Faculty Mentor: Dr. Jonathan Ouellet

Functionalized Gold Nanoparticles for Environmental Chemical Separations

Lauren Lechner, Christopher Wells, Shaharyar Ahmad

Faculty Mentor: Dr. Tsanangurayi Tongesayi

Natural Bond Orbital Analysis of Pentahydrido-3-Methylpyridine Bis(Triphenylphosphine)Rhenium(V)

Omkaran Menon

Faculty Mentors: Dr. Dmytro V. Kosenkov, Dr. Gregory Moehring

Targeted Gene Delivery to HT-29 Cells using Hyaluronic Acid Modified PLGA Nanoparticles

Aban Nikoonezhad

Faculty Mentors: Dr. Xudong Yuan, Dr. Jia Luo

Development of an Aptamer against an Oncometabolite

Krima Patel

Faculty Mentor: Dr. Jonathan Ouellet

Computational Examination of G-Quadruplex Thermodynamic Stabilization through Ligand Binding

Sammy Saka, Gary Prato, Samantha Silvent

Faculty Mentors: Dr. Massimiliano Lamberto, Dr. Dmytro V. Kosenkov

Theoretical Study of Mechanisms of Solvatochromic Shifts in Solvents of Varying Polarity

Kevin Wioland

Faculty Mentor: Dr. Dmytro V. Kosenkov

Department of Computer Science and Software Engineering

SCRIPTA: A Light Grading Tool

Danny Blaney, Valeria Guzman, Giuseppe Aiello, Kyle San Andres

Faculty Mentor: Dr. Cui Yu

Hawk Talk – Athletic Communications System

Bradley Brown, Joe Amato, Xueyi Liu

Faculty Mentor: Dr. Daniela Rosca

Horizon Integrated Development Environment

Buryl Fortney, James Blessing, Hubert Chen, Josh Siemanowicz

Faculty Mentor: Dr. Daniela Rosca

Kane Brewery Management System

Gary Kagan, James Reid Cooper, Sidhdhesh Patel

Faculty Mentor: Dr. Daniela Rosca

A Fast Way to Produce Social Networking Websites

Greg Kilmartin, Brian Zerfass, Cyrus Siganporia, Michael Branco

Faculty Mentor: Dr. Cui Yu

The PUT-A-TAG that Runs on Two Mediums

Patrick McDonald

Faculty Mentor: Dr. Cui Yu

Relationship Between Income and Health

Hemalatha Rengaramanujam

Faculty Mentor: Dr. Jiacun Wang

C.R.S.- Course Registration System

Jake Vernon, Matt Marino, Nicholas Helmstetter, David Aviles

Faculty Mentor: Dr. Daniela Rosca

Department of Mathematics

Queen Conch of Southern Eleuthera

Nicodemo Agostino, Erin Borodunovich, Jessie Reive

Faculty Mentors: Dr. Richard Bastian, Asst. Dean John A. Tiedemann

Statistical Analysis of Macrozooplankton Population Data

Nicodemo Agostino, Erin Borodunovich, Tiffany Mattera, Matthew Hand, Matt Marciano, Devin Green

Faculty Mentors: Asst. Dean John A. Tiedemann, Dr. Richard Bastian

Analysis of Animal Trauma Triage, Mortality Rates, and Hospital Visit Costs across Different Pet Names: How "lucky" is Lucky?

Jessica Cobb, Thomas Darlington, Taylor Krenzke, Krista Varanyak

Faculty Mentor: Dr. Richard Bastian

Determining Differences in Mangrove Volumes by Location

Kaitlyn Kramer, Lauren Johnson, Alex Moncman, Rachel DeStefano

Faculty Mentors: Dr. Richard Bastian, Dr. Pedram P. Daneshgar

MONMOUTH UNIVERSITY

SCHOOL OF SCIENCE

DEPARTMENT OF BIOLOGY

CARBON SEQUESTRATION OF *RHIZOPHORA MANGLE* IN THE BAHAMAS

Chelsea R. Barreto

Department of Biology

Faculty Mentor: Dr. Pedram P. Daneshgar

ABSTRACT

A solution to reduce the impacts of climate change caused by rising atmospheric carbon dioxide is to conserve and restore ecosystems that sequester carbon. Blue carbon ecosystems, which include, mangrove flats, salt marshes, and sea grass beds are costal ecosystems that sequester carbon, which would otherwise remain in the atmosphere as carbon dioxide. While there is little known on the potential of these ecosystems to store carbon, early work suggests that blue carbon sinks may store more carbon than terrestrial carbon sinks. Unfortunately, these ecosystems and mangrove flats in particular, are being destroyed at high rates for development. Should research show that mangrove flats serve as large carbon sinks then it becomes essential to conserve these ecosystems. The primary objective of this work was to determine how much carbon is currently stored in dwarf red mangroves, *Rhizophora mangle,*in The Bahamas. In addition, site-to-site differences in carbon storage will be compared and explained.

In October of 2012, four sites were selected in Eleuthera, The Bahamas attempting to maximize site variability. All sampling was done from six 7 by 7 plots established at each site. Carbon storage was determined from plant biomass, which was extrapolated from plant volumes. Mangrove volumes were determined from growth parameters. In each plot, leaf numbers were estimated, mangrove individuals were quantified, and soil depth was determined. It was observed that there were large differences from site to site in number of individuals, soil depth, and biomass accumulation. The site with the greatest primary productivity also had the greatest soil depth likely making it the greatest carbon sink. It was observed that sediment depth was not necessarily a predictor of productivity as sites that lacked sediment were still productive. Future work will work to explore carbon sequestration in sediment and determine what factors predict productivity.

BENTHIC MACROINVERTEBRATE COMMUNITIES OF MANGROVE ECOSYSTEMS OF SOUTH ELEUTHERA

Douglas Casey

Department of Biology

Faculty Mentor: Assistant Dean John A. Tiedemann

ABSTRACT

Mangrove environments support biodiversity and maintain important ecological services such as nutrient export to adjacent marine ecosystems and carbon sequestration. These areas also provide critical nursery and foraging habitat for commercially and recreationally valuable fish and shellfish species. In The Bahamas, mangroves and associated shallow flats support one of the most productive bonefish (*Albula vulpes*) fisheries in the world. As adults, bonefish forage intensely on the macrobenthos of mangroves and adjacent flats. Unfortunately, these areas also tend to be the focal point of coastal development which often entails clearing sites of vegetation, altering shorelines, and dredging to accommodate marinas, harbors, and residential or resort development.

Given their ecological and economic importance, the conservation and protection of mangroves and nearshore flats ecosystems is imperative to the future of The Bahamas.
Because mangroves are tightly linked with adjacent ecosystems managing them in isolation is unsustainable. However, despite the importance of the linkages between mangroves, flats, benthic invertebrates and fish species, the composition and ecology of mangrove macrobenthic communities in The Bahamas is not well described and poorly known.

The purpose of this project is to begin to quantify the distribution and abundance of benthic macroinvertebrates in mangrove ecosystems of south Eleuthera. Over time, these data will allow us to develop a comprehensive inventory of important macrobenthos associated with mangroves and flats in Cape Eleuthera, develop estimates of species diversity at the selected survey sites, and begin to understand inter- and intra- site variability within the benthic community.

CHARACTERIZATION OF A BACTERIUM ISOLATED FROM BARNEGAT BAY, NJ THAT CAN DEGRADE 1, 3, 7-*trimethylxanthine* (caffeine)

Kevin Dillon

Department of Biology

Faculty Mentor: Dr. Karen Pesce

ABSTRACT

Caffeine is the most widely consumed mood-altering drug (Mohanty 2013) and on average every person consumes 70 mg of caffeine each day globally (Moore *et al.* 2008). Because it is found in various products, caffeine has numerous entry points into the environment to accumulate, such as storm water runoff (Rodriguez del Rey *et al.* 2012). If present in sufficient quantities, caffeine can damage a larval fish's neuromuscular system (Rodriguez *et al.* 2014) and can be toxic to other aquatic organisms (Moore *et al.* 2008). As a result, the biodegradation of caffeine is of interest. A bacterium was isolated from caffeine enriched cultures of samples from the Barnegat Bay. The isolate's ability to grow on caffeine as the sole carbon and nitrogen source was confirmed through further screening. The genomic DNA of the bacterium was isolated and the *16S rRNA* gene was amplified by PCR, cloned, and sequenced to place the bacterium in a phylogenetic context. Further work includes identification and characterization of the genes of the catabolic caffeine pathway.

CHANGES IN GENE EXPRESSION IN THE RAT TESTIS FOLLOWING INFLAMMATION

Genevieve Fasano

Department of Biology

Faculty Mentor: Dr. Michael A. Palladino

ABSTRACT

Research in male reproductive biology is important to gain a greater understanding of infertility, cancers of the male reproductive tract, erectile dysfunction, and fetal development. Inflammation of the male reproductive tract is of particular interest because bacterial and viral infections are known causes of infertility. Lipopolysaccharide (LPS) is an endotoxin found in the outer membrane of Gram-negative bacteria that elicits a strong immune response. Previous work in our lab has shown that HIF-1, a transcription factor considered the master regulator of oxygen homeostasis, increases following LPS-induced inflammation, suggesting a role for hypoxia-related genes in inflammatory responses of the testis.

The goal of this project was to determine the effects of LPS-induced inflammation on genes involved in the hypoxia pathway in the rat testis. The objective was to identify hypoxia pathway genes that are up-regulated or down-regulated following LPS-induced inflammation, and to determine the role of these genes in response to inflammation. Inflammation was induced in Sprague-Dawley rats by intraperitoneal administration of LPS (5 mg/kg body weight) from *P. aeruginosa* for 3 or 6 hours (n= 6-7 animals/time point). RNA was isolated from testes and cDNA synthesized for analysis by quantitative Polymerase Chain Reaction. The RT^2 Profiler™ PCR Hypoxia Signaling Pathway Array was used to evaluate the expression of 84 genes involved in hypoxia pathways.

Results indicated that 5 genes were up-regulated after 3 hours of LPS-induced inflammation, and 3 genes were up-regulated at 6 hours. No genes were down-regulated. LPS-stimulated genes appear to be expressed in the supporting cells of the testis and in developing germ cells. Future studies will investigate the role of these genes in relation to genes of the innate and adaptive immune response pathway. These results will help to elucidate the molecular mechanisms at work in the male reproductive tract following inflammation.

STATISTICAL ANALYSIS OF DIVISON I WOMEN'S LACROSSE ATHLETES INDUCED WITH A REDUCTIVE VISUAL STIMULUS

Shivam Patel, Alison Keelen, Shayna Popkin, Lauren Johnson

Department of Biology

Faculty Mentor: Dr. Bernadette Dunphy

ABSTRACT

A pilot study was performed to induce reductive visual stimulus to enhance athletic ability by improved special sensory function by compensatory response. The pilot study was performed with a small population size with the use of reductive stimuli, Nike Strobe Eyewear. Analysis of the pilot study resulted in samples in an increase of athletic performance in lacrosse study with the use of the goggles.

A second conducted to analyze the improvement in athletic performance of division I women's lacrosse athletes through randomized training with reduced visual stimuli. The sample size included a set of college athletes. The participants were divided into two groups; a control group that actively trained without any visual impairment and an experimental group that actively trained with reduced visual stimuli. The population selected, performed three hand-eye coordination-catching exercises; reverse catches, quick sticks, and cradle catches. Each sample practiced three times per week for four-minute sessions per drill, per arm with a thirty second break in between. Their progress was tested with a pre-test before any training, a mid-test at the second week of training, and a post-test after completion of the four training program. Each examination was performed without any visual impairment. Examiners recorded consecutive catches and total number of catches with a limited number of attempts.

The study resulted in unexpected results where there was decline in mostly during the mid-test which may have been due to systematic or random error. The results were expected to show improved skill acquisition in all drills due to improved cognitive special senses as shown in the pilot study. A following study should be performed to confirm effects of visual stimuli in terms of cognitive learning in athletic sports.

CO-ADMINISTRATION OF AMPHETAMINE MODIFIES THE ALCOHOL WITHDRAWAL SYNDROME OF ADOLESCENT RATS

Shayna Popkin, Madelyn Mauterer, Oliveia Boutros, Melissa Sparacio

Department of Biology

Faculty Mentor: Dr. Dennis Rhoads.

ABSTRACT

The amphetamine Adderall and other central nervous system stimulants are widely prescribed for the treatment of Attention Deficit/Hyperactivity Disorder (ADHD). However, a growing number of college students are reporting non-prescription use of these stimulants as "study drugs". Recent surveys have also reported concurrent use of stimulants and alcohol. Among potential interactions with alcohol, amphetamine would delay sleepiness and sedation, adding to concerns associated with binge drinking. Although there has been extensive research on alcohol and amphetamine individually, few studies have been directed at the simultaneous use of the two substances. The age of most college students is also a factor because the brain continues developing through adolescence and well into the 20s. The goal of this study is to provide insight into the potential short and long-term effects of co-administration of alcohol and amphetamine on the developing brain.

Adolescent rats consume high levels of alcohol when administered in a liquid diet and develop a strong alcohol withdrawal syndrome characteristic of alcohol dependency. The present study tested the effect of co-administration of amphetamine on the severity of the alcohol withdrawal syndrome. The presence of amphetamine (40mg/L) had no effect on consumption of control or ethanol-containing diets. However, when rats consumed amphetamine with alcohol, they showed significantly less signs of alcohol withdrawal including overall withdrawal severity scores that were reduced from 3.9 to 1.4 on a 4-point scale. Measured in an activity chamber, suppression of exploratory movement, an anxiety-like effect of alcohol withdrawal, was also reduced by co-administration of amphetamine. The results suggest that amphetamine co-use may mask physical signs of alcohol dependency. Studies are underway both to expand the behavioral measures related to withdrawal anxiety and to correlate the behavioral results with changes in expression of specific brain receptors.

MICROBIAL DEGRADATION OF *N, N*-DIETHYL-*m*-TOLUAMIDE BY ACINETOBACTER

Krystal Rivera

Department of Biology

Faculty Mentor: Dr. Karen Pesce

ABSTRACT

A growing area of environmental research is focused on the presence of pharmaceutical and personal care products (PPCPs) in the environment. PPCPs consist of commonly used prescription drugs and consumer products such as disinfectants, fragrances, insect repellants, etc. Several PPCPs are not easily degraded in the environment or filtered efficiently by wastewater treatment plants causing their accumulation in the environment. Specifically, *N*,*N*-diethyl-*m*-toluamide (DEET), the active ingredient found in most insect repellent products, has been detected in approximately 74% of streams surveyed in the United States. Studies have shown that DEET is especially toxic to children, causing DEET-induced encephalopathy and seizures upon exposure (Briassoulis, G. et al). Removal of DEET from the environment can occur through microbial biodegradation. However, there is little data regarding microbial degradation of DEET and very few known bacterial species utilize this compound as a primary carbon source. A study done by Rivera-Cancel et al found that *Pseudomonas putida* DTB metabolizes DEET with the aid of a hydrolase gene.

We isolated a bacterial species from activated sewage sludge with the ability to degrade DEET through enrichment. Amplification and sequencing of the 16s ribosomal RNA gene was performed in order to identify the bacteria as an Acinetobacter species. Polymerase Chain Reaction of the bacterial DNA confirmed the presence of a hydrolase gene that was 99% identical to the DTB hydrolase. Through the use of genome walking, regions located upstream and downstream of the hydrolase gene were identified and sequenced. This led to the discovery of a transposon upstream of the hydrolase gene. The presence of this transposon could explain how virtually identical hydrolase genes are present in both an Acinetobacter species and a Pseudomonas species. Future research will be aimed at developing a better understanding of how transposition may occur between species.

MONMOUTH UNIVERSITY

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DEPARTMENT OF CHEMISTRY, MEDICAL TECHNOLOGY, AND PHYSICS

SYNTHESIS OF NOVEL DNA G-QUADRAPLEX LIGANDS

Samantha Ebner, Wesley Cunningham, Jason Colmer

Department of Chemistry, Medical Technology, and Physics

Faculty Mentor: Dr. Massimiliano Lamberto

ABSTRACT

The reverse transcriptase enzyme telomerase is over-expressed in 80-85% of cancer cell types and has thus become an attractive target for the development of novel anticancer therapeutics. Inhibition of telomerase by small organic molecules induces cell senescence and death. In this work we present the synthesis of novel NDI ligands that could pave the way to the development of novel anticancer drugs.

DESIGNING THE NEXT GENERATION OF THE ENVIRONMENTALLY FRIENDLY DYE-SENSITIZED SOLAR CELLS

Nicole Famularo, Daniel Chang

Department of Chemistry, Medical Technology, and Physics

Faculty Mentor: Dr. Dmytro V. Kosenkov

ABSTRACT

The use of heavy metal pollutants such as Ruthenium in previous generations of solar cells has raised increasing concern due to their carcinogenic properties. Because of this, our dye-sensitized solar cells (DSSC) implement organic/biological non-toxic molecules. While it is important that the solar cells be environmentally friendly, they must maintain their energy efficiency. The efficiency of solar cells with regards electrical power is subject to the design of the solar cell. In order to maximize the efficiency of the cells, one of the possible variables being explored is the photosensitizing dye being used. The cells are constructed from Indium Tin oxide (ITO) electrodes covered with the Titanium(IV) oxide layer with embedded dye molecules. The varying dyes being examined are Eosin-Y, -B, Chrolophyllin, and β-carotene. Ethanol and acetonitrile based lithium iodide electrolytes have been used in the solar cells.

The relative efficiencies of the solar cells are assessed using a voltmeter to measure the electricity generated in the presence of LED light. The solar cells have previously been assessed based on the voltage produced by the cell. Currently, the fill factor and power conversion efficiency are being used to quantitatively calculate the relative efficiencies of the cells. The short circuit and maximum power current densities as well as the open circuit and maximum power voltage are obtained in order to calculate fill factor. The maximum power and the light intensity are then used to calculate the power conversion efficiency.

AN EXTENDED HÜCKEL APPROACH FOR MODELING ELECTRONIC EXCITED STATES IN LGHT HARVESTING COMPLEXES

Kristen Flynn, Erik Braunstein, Philip Donahue

Department of Chemistry, Medical Technology, and Physics

Faculty Mentor: Dr. Dmytro V. Kosenkov

ABSTRACT

An understanding of the high efficiency of the solar energy utilization by the peridinin-chlorophyll-protein (PCP) light harvesting complexes is an important step towards designing novel types of solar cells. In the present study, electronic excited states of separate chromophores (chlorophylls and carotenoids) constituting the PCP complex are estimated using the time-dependent density functional theory (TD-DFT). The interactions (coupling) of the excited states of the chromophores are obtained using the Förster dipole-dipole approximation. Finally, the extended Hückel approach is employed to reconstruct the electronic excitations in the PCP complex from the electronic excitations of separate chromophores. The software implementing the proposed computational methodology and taking advantage of the modern hardware architectures (Graphics Processing Units—GPUs) is discussed.

THE BINDING OF TOXIC HEAVY METALS AND METALLOIDS BY CAPTOPRIL UNDER SIMULATED GASTRIC CONDITIONS

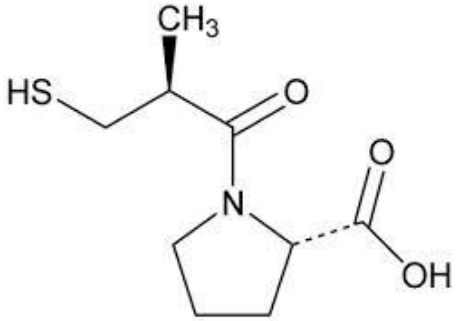
Taylor Johnson, Emily Caputo

Department of Chemistry, Medical Technology, and Physics

Faculty Mentor: Dr. Tsanangurayi Tongesayi

ABSTRACT

Hypertension is a chronic medical condition in which the blood pressure in the arteries is elevated resulting in stroke, heart attack, heart failure and kidney disease. High blood pressure is treated with antihypertensive drugs such as angiotensin-converting enzyme (ACE) inhibitors and can be controlled by lifestyle changes. ACE converts angiotensin I to angiotensin II, a potent vasopressor. Angiotensin I and II are part of the renin-angiotensin system (RAS) which controls blood pressure by regulating the volume of fluids in the body. Although the system is important in regulating fluids in the body, the role of ACE in constricting blood vessels is a major cause of hypertension which is why it has become a target for drugs designed to treat high blood pressure. Captopril, (2S)-1-[(2S)-2-methyl-3-sulfanylpropanoyl]pyrrolidine-2-carboxylic acid, is an angiotensin-converting enzyme inhibitor that prevents the conversion of angiotensin I to angiotensin II by binding to the Zn-active site on ACE via its thiol functional group. The thiol group is, however, extremely reactive and can bind trace metals found in the body and other metal(loid)s intentionally or inadvertently ingested together with contaminated food, beverages, and dust. The binding of metal(loid)s by captopril in the physiological system can induce deficiencies as well as toxicity. In addition to potentially inducing toxicity or deficiencies, the binding of metal(loid)s by captopril can potentially reduce its efficacy. The primary objective of this study is to investigate the binding of toxic metal (loid)s by captopril under simulated gastric conditions. Our working hypothesis is that, because of its high affinity for metal(loid)s, the thiol functional group on captopril can transport toxic metal(loid)s from the human gut to the vascular system through complexation, inducing toxicity and degrading its efficacy in the process. The work is ongoing, and results will be updated as we get them.



(2S)-1-[(2S)-2-methyl-3-sulfanylpropanoyl]pyrrolidine-2-carboxylic acid

MONITORING RNA FOLDING VIA FLUORESCENCE

Shreeja Kadakia

Department of Chemistry, Medical Technology & Physics

Faculty Mentor: Dr. Jonathan Ouellet

ABSTRACT

The folding of the Twister Ribozyme is to be quantitatively analyzed using fluorescence spectroscopy. The twister ribozyme is the latest member of the select group of self-cleaving ribozymes. These RNA enzymes (ribozymes) have the ability to specifically self-cleave their own RNA using metal ions as the sole cofactor. This knowledge was applied of many fields of research, such as gene therapy, RNAi, riboswitches and synthetic biology. However, it is still extremely difficult to predict the 3D structure from RNA sequences.

Our goal in this project is to better understand how RNA folds with the use of the twister ribozyme as a model. We hypothesize for the twister ribozyme to undergo a conformational change upon binding of divalent cation, leading to its active conformation. We will use the fluorescent properties of Terbium to monitor the folding of the RNA via fluorescence spectroscopy under a magnesium titration. Once a fluorescence pattern is found for the natural twister ribozyme, specific and rational-driven substitution of nucleotides from the natural sequence will be made to discover which nucleotides modify the fluorescence pattern. This will identify essential nucleotides involved in non-covalent interactions that cause a conformational change. Furthermore, an analysis will be performed to investigate how specific cation(s) leads to structural changes within the RNA molecule itself.

The study is aimed to provide fundamental details about the folding patterns of the twister ribozyme. Increased knowledge of RNA folding will provide further insight into the functioning of various RNA viral genomes. Many viruses such as HIV, HCV and influenza rely on RNA as being their primary genetic material; the RNA found within viruses folds to achieve their function. Information about the Twister ribozyme's folding patterns therefore, will lead to improved understanding of how viruses pass on their genetic material and how their reproduction can be inhibited.

FUNCTIONALIZED GOLD NANOPARTICLES FOR ENVIRONMENTAL CHEMICAL SEPARATIONS

Lauren Lechner, Christopher Wells, Shaharyar Ahmad

Department of Chemistry, Medical Technology and Physics

Faculty Mentor: Dr. Tsananguraayi Tongesayi

ABSTRACT

Gold nanoparticles (AuNPs) have the potential to significantly revolutionize applications in the areas of biology, chemistry, material science, medicine, and physics, due to their attractive catalytic, electronic, optical, and thermal properties. The primary objective of this work is to synthesize functionalized AuNPs and explore their potential applications in environmental chemical separations. We have, at this point in the study, synthesized functionalized AuNPs using a published method and obtained nanoparticles with a size range of 1 to 2 nm. We modified the method with our ligand of interest and obtained nanoparticles with a uniform size of 5 nm. The measurements were carried out with an MFP-3D AFM (Asylum Research Corp., Goleta, CA) operated in tapping mode. Imaging was performed with a silicon conductive cantilever probe, model AC160TS, from Olympus Corp. (Tokyo, Japan). The AFM data was later analyzed with the free, open source application Gwyddion (http://gwyddion.net) to extract the nanoparticle dimension information. We are in the process of further characterizing the nanoparticles.

NATURAL BOND ORBITAL ANALYSIS OF PENTAHYDRIDO-3-METHYLPYRIDINE BIS(TRIPHENYLPHOSPHINE)RHENIUM(V)

Omkaran Menon

Department of Chemistry, Medical Technology, and Physics

Faculty Mentors: Dr. Dmytro V. Kosenkov, Dr. Gregory Moehring

ABSTRACT

A complex ordered motion of atoms during isomerization of eight-coordinate rhenium complexes has multiple potential applications in nano-mechanics and nano-electronics. In the current research, Natural Bond Orbital (NBO) analysis was employed to gain an insight into the charge transfer between the nitrogen and rhenium atoms in the pentahydrido-3-methylpyridine-bis(triphenylphosphine)rhenium(V) [$ReH_5(PPh_3)_2(CH_3)C_5N$] complex. NBO analysis provides the information about plausible mechanisms of the isomerization of the metal complex. The molecular orbitals of the complex used for the NBO analysis are obtained using B3LYP and PBE1PBE density functionals with the effective core potential (ECP) triple zeta basis set LANL2TZ(f) on the rhenium atom.

TARGETED GENE DELIVERY TO HT-29 CELLS USING HYALURONIC ACID MODIFIED PLGA NANOPARTICLES

Aban Nikoonezhad

Department of Chemistry, Medical Technology, and Physics

Faculty Mentors: Dr. Xudong Yuan, Dr. Jia Luo

ABSTRACT

The objective of this research project is to successfully transfect 293T and HT-29 cells with modified PLGA nanoparticles loaded with GFP pDNA, in order to set up a biomarker for a future gene therapy experiment. PLGA nanoparticles, which are biodegradable and nontoxic, have been proven to effectively de- liver GFP pDNA and anti-cancer drugs to HT-29 human colorectal adenocarcinoma cell lines. In this study, pDNA delivery system was set up by using PLGA polymers of varying sizes and conjugating them with PEG and hyaluronic acid to form a block polymer with varying efficiency. The hyaluronic acid in the block polymer was used for its targeting capacity to the CD -44 receptors on the cell surface of the HT-29 cells. Based on the results of this research thus far, PLGA nanoparticles were able to transfect both GFP pDNA and anti-cancer drugs to both 293T and HT-29 cells without modification. However, transfection using modified PLGA nanoparticles has not yet been con- ducted. In the next step, the goal is to use this nanoparticle carrier system to improve targeted transfection to HT-29 in or- der to help treat the disease in a new and novel way.

DEVELOPMENT OF AN APTAMER AGAINST AN ONCOMETABOLITE

Krima Patel

Department of Chemistry, Medical Technology & Physics

Faculty Mentor: Dr. Jonathan Ouellet

ABSTRACT

With the increase of diseases and various other pathogens, there is a great need of a new generation of medicines. Today, antibiotics are becoming less useful due to antibiotic resistance. With life threatening diseases such as cancer, it becomes important to develop a safer treatment – than the current ones. The ultimate goal of this research is to find a way to destroy specific cells using an aptamer. The underlying hypothesis for this project is to develop an aptamer with enough specificity to use it as a biosensor against an oncometabolite.

For my project, there are several goals that I hope to achieve. The main goal is to make an aptamer which will have enough specificity that it will not bind to the metabolite in absence 2-HG and will bind in the presence of 2-HG. Once bound to the metabolite, the aptamer will activate the cleavage for the hammerhead ribozyme. So far, I have designed the oligonucleotides that will be used in PCR reaction and then transcribed *in-vitro*. When an aptamer of such specificity is developed, the long-term goal is to regulate the expression of the toxic protein such as snake venom SV-LAAO via the aptamer. After that, the most important long-term is to ultimately experiment with cancer cells and see if this method works on cancer cells.

The hope is to use this research to develop a new treatment for cancer while having little side effects. As stated before, the long term goal is to hopefully design a new way of treatment that will offset the need of antibiotics and chemotherapy which sometimes have unpleasant side effects. As the research furthers with time, more conclusions will be drawn to see if this RNA-metabolite binding strategy for cell-targeted therapy is viable.

COMPUTATIONAL EXAMINATION OF G-QUADRUPLEX THERMODYNAMIC STABILIZATION THROUGH LIGAND BINDING

Sammy Saka, Gary Prato, Samantha Silvent

Department of Chemistry, Medical Technology, and Physics

Faculty Mentors: Dr. Massimiliano Lamberto, Dr. Dmytro V. Kosenkov

ABSTRACT

Application of the quantum mechanics to discern specific interactions between atoms of large biomolecular systems requires large amounts of computational power and may still be too complicated for modern computers to solve. Fragment Molecular Orbital Theory (FMO) offers an alternative approach that operates under the assumption that large molecular systems can be divided into smaller fragments then computed using traditional molecular orbital theories and then recombined. Using FMO theory we are able to predict how Naphthalene Diimide ligands with cationic substituents are able to non-covalently bind and thermodynamically stabilize a telomeric G-quadruplex, thereby inhibiting telomerase and providing a targeted approach to chemotherapeutic treatment. The binding energies and interactions with the G-quadruplex are predicted for the theoretical ligands in this study. The results of our calculations on the specific binding interactions between ligands and G-quadruplex will help to optimize ligand binding and further develop alternate ligands. Using thermodynamic modeling, a change in melting temperature of the G-quadruplex DNA after introduction of ligands will be predicted using information obtained from free binding energies. This information will be compared with the experimental results and used to validate our methods.

MAGNETIC IRON OXIDE NANOPARTICLES: ENVIRONMENTAL IMPACTS AND POTENTIAL APPLICATIONS

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Faculty Mentor: Dr. Tsanangurayi Tongesayi

ABSTRACT

The potential applications of synthetic nanoparticles (SNP) have been extensively explored yet their fundamental properties and environmental impacts are largely assumed and unknown. Magnetic iron oxide nanoparticles (MNP) have been reported to be very effective for biomolecular separations in environmental and biomedical samples and have shown significant potential in drug delivery and gene therapy. The main goal of this study is to investigate the size and ligand-dependent physicochemical and electrochemical properties of MNP, and their environmental impacts and potential applications. We have synthesized unfunctionalized MNP with a size range of 2 to 4 nm. The measurements were carried out with a MFP-3D AFM (Asylum Research Corp., Goleta, CA) operated in tapping mode. Imaging was performed with a silicon conductive cantilever probe, model AC160TS, from Olympus Corp. (Tokyo, Japan). The AFM data was later analyzed with the free, open source application Gwyddion (http://gwyddion.net) to extract the nanoparticle dimension information. We are in the process of further characterizing the MNPs and functionalizing them.

THEORETICAL STUDY OF MECHANISMS OF SOLVATOCHROMIC SHIFTS IN SOLVENTS OF VARYING POLARIY

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ABSTRACT

The purpose of this research project is to study the interactions between non-symmetrical bipyridinium derivatives of 4,4' bipyridyl (viologens)[1] and varying polarity/basicity organic solvents (dimethylacetamide (DMAC), formamide (FA), n-methylformamide (NMF) and pyridine (Py)). Recently, viologen molecules have been of great interest due to their use as molecular sensors and as pigments in numerous electrochromic displays. In order to fully understand the mechanisms of solvent effect on the ultraviolet–visible (UV-Vis) spectra of the molecules, time-dependent density functional theory (TD-DFT) methods coupled with the polarized continuum model (PCM) of solvation were employed. It was found that a large change in the net dipole moment from the ground to excited state confirms a charge transfer occurring during excitation in the molecules and the solvatochromic behavior of the molecules is activated by solvents acting as hydrogen-bond accepting (HBA) bases.

References

[1] Papadakis, R.; Deligkiozi, I.; Tsolomitis, A. *Dyes and Pigments* 95 (**2012**) p. 478

MONMOUTH UNIVERSITY

SCHOOL OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

AND

SOFTWARE ENGINEERING

SCRIPTA: A LIGHT GRADING TOOL

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Department of Computer Science & Software Engineering

Faculty Mentor: Dr. Cui Yu

ABSTRACT

One of the most time consuming tasks for teachers is grading and giving feedback to the students. Scripta is an application that can help. It is convenient, efficient, light and smart. Scripta is an improved version of Marker, the last year's prototype. It not only has the ability to convert common types of files to basic PDF format and allow text comments, it also allows highlighting, drawing (free marking), and quick commenting. Further, teachers can use it to collect and manage grades easily with this new prototype.

The major design philosophy of Scripta is being easy-to-use and saving teachers' time. In this application, uploaded files are automatically converted to PDF format and allow the user to comment anywhere being viewed. Users can click anywhere on a file and type their comments; can highlight, underline, circle, mark anywhere on the file; can put quick comments, such as "Awesome", "Good Job!", smiling face. Moreover, teachers can get an automatically updated grading book, which is available to use right after grading.

The objective of this project is to create an application that can better assist teachers in grading processes, while a more general audience may find it useful for commenting documents of various forms too.

HAWK TALK – ATHLETIC COMMUNICATION SYSTEM

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Hawk Talk is a web based application that will facilitate the communication between coaches and various sports teams. The first release will be used by Monmouth University's football team. The Hawk Talk system will allow its users to have a calendar to keep track of their class and training schedule, a profile page for athletes contact information, and view documents generated by coaches. The calendar feature also allows users to see a free time schedule of when members have nothing scheduled. This feature will allow coaches to better schedule practice times. The system will allow its users to send messages to the whole team, groups of athletes, or individuals. Coaches will be able to communicate with players via text, email and message board. Currently, the system is available on a laptop environment. In the future, we plan to release a mobile version, to increase the usability of the application. The system is designed with a high degree of flexibility, to allow other sports teams to schedule practices, and easily communicate with all the athletes.

HORIZON INTEGRATED DEVELOPMENT ENVIRONMENT

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Faculty Mentor: Dr. Daniela Rosca

ABSTRACT

HorizonIDE is a basic Integrated Development Environment (IDE) with additional features for better integration of inexperienced users into a software development world. The intent of this program is to assist new or inexperienced programmers in learning the syntax and knowledge of multiple programming languages. Assistance is provided through a system of Guides focusing on common program control structures, which a user would write in any particular programming language. Explanations of terms are given, as well as psuedocode and non-psuedocode examples, which help the user better understand what he or she is actually writing. The program uses minimal input from the user in order to generate proper expressions for each type of control structure, and allows a user to place the expressions logically in their code. For ease of use, the program will contain multiple menus for the user to select which enables them to do certain actions such as save, edit, compile, run and even ask for help. In addition, the user can modify the view of the program, such as collapsing the file manager to provide optimal space for the coding section. The program will run on multiple operating systems (Mac, Windows, Linux, etc.) in order for the project to expand to a greater user base. Currently, HorizonIDE supports only Java programming language, but it will support a multitude of languages for different types of users in the coming releases. The program will be intended to bridge the gap between computer science and software engineering by allowing the ability to generate UML diagrams from current code, and transform a UML diagram to the essential building blocks of the user's program.

KANE BREWERY MANAGEMENT SYSTEM

Gary Kagan, James Reid Cooper, Sidhdhesh Patel

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Daniela Rosca

ABSTRACT

Kane Brewing Company is a new craft brewery located on the coast of New Jersey. They are an expanding business, and are rapidly outpacing the systems and procedures they have in place. They are looking to acquire a system that would save them time for inventory management and tax preparation. Software Engineering seniors Gary Kagan, James Reid Cooper, and Sidhdhesh Patel will develop this system as their Senior Practicum project.

Kane has reached the point where their current procedures and systems take away useful production time. Currently a large amount of time is taken on manual inventory management and preparing excise taxes for local and federal government requirements. There exist currently two major competitors for brewery management systems, OrchestratratedBEER (OB) and BeerRun. Both offer full enterprise system from supply chain management to inventory and sales. The proposed Kane Brewery Management System (KBMS) offers two main benefits over OB and BeerRun. First, the development will be cost free. Second, instead of Kane adapting their procedures to the two competitors, KBMS will be tailored around their practices.

Kane Brewing Company wishes to reduce the time it takes to execute their business processes. The Kane Brewing Management System is a full stack brewery management system that will increase productivity by keeping track of in-progress and finished products. Unlike the current manual system, which requires redundant paper records and consumes time, it will save Kane Brewing Company time and money.

A FAST WAY TO PRODUCE SOCIAL NETWORKING WEBSITES

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Faculty Mentor: Dr. Cui Yu

ABSTRACT

Social networking is a big topic. The social networking via Facebook is a widely recognized example. It's huge; it's general; and it's complicated. Our attention is however on building light social networks. If Facebook is a supermarket, then our goal is to facilitate small boutiques, which are customized and easy on technical support.

This project is to prototype a portable approach that can quickly produces social networking websites, each of which is built to hold a community of common or relevant interests, mixing elements of e-commerce and social networking. In particular, we will build a sample community website which is to bring together one or several producers, related topics, interested users, and potential-consumers of one or several products marketed. In our experiment, the project shall consist of one or more computers providing the following services: Web server (HTTP), Database server (MySQL) and a server capable of generating dynamic web pages based on content stored in the database (PHP) from the users.

THE PUT-A-TAG THAT RUNS ON TWO MEDIUMS

Patrick McDonald

Department of Computer Science and Software Engineering

Faculty Mentor: Professor Cui Yu

ABSTRACT

Put-A-Tag had three major prototypes in the past three years. This is the last version with some major improvement made recently. In general, Put-A-Tag is a flexible "tag" tool, which is unique because it can tag almost any type and any piece of information being viewed. Further, the tags can be managed, searched, and shared with others.

With the new addition, current Put-A-Tag can run on two different mediums. Users can launch Put-A-Tag on local machine for tagging static content such as Excel, Word, or even music files. If a user is on a guest machine viewing websites, he or she can launch Put-A-Tag from the browser for quick website tagging.

Put-a-tag has been redesigned to use Apache Tomcat as Application-Programming-Interface because it provides more flexibility and less security concerns over the previous PHP version we used. Put-A-Tag also takes advantage of a relatively new feature and web-standard called "Websockets" which allows for faster communication between server and clients. To accommodate the amount of traffic and data processing, Put-A-Tag is now powered by RESTful API which interacts with a Tomcat application to serve requests and responses between the mediums.

RELATIONSHIP BETWEEN INCOME AND HEALTH

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ABSTRACT

This paper discusses the potential impacts of income on health and provides detailed explanations by analyzing the various types of data published by government and agencies at global level. Many factors combine together to affect the health of individuals and communities. To a larger extent, the income of the individuals and communities has considerable impacts on health. The greatest gap between the richest and poorest people, the greatest the impacts on health. Computer-based technologies are applied to address the existing research issues and obtain new knowledge in the field.

C.R.S.-COURSE REGISTRATION SYSTEM

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Faculty Mentor: Dr. Daniela Rosca

ABSTRACT

Registering for your classes in college can be a daunting and tiresome task. The registration process at Monmouth University, in particular, is very complicated and time consuming. As of right now, the registration consists of a 3-step process that is not user-friendly and often confusing. The current process requires students to search for the courses they need to register for, and manually record the results of their course searches. After manually determining if there is a scheduling conflict, the students move to the next step of the registration, where they have to type in the course information of the previously selected list of courses. After submitting this data the students are taken to the final step of the registration where they have to actually register for the courses on their list. Finally, after this lengthy process students are registered for their classes.

Since September 2013, the idea for a new, user-friendly course registration system came to light during a brainstorming session in the first day of Software Engineering Practicum. The objective of this project is to take away the stress involved with registering for classes, by giving students an easy, clean, and user-friendly system. The system is designed using the Agile Software Development Life Cycle, where each and every piece of the system is carefully planned out, designed, coded and tested.

MONMOUTH UNIVERSITY

SCHOOL OF SCIENCE

DEPARTMENT OF MATHEMATICS

QUEEN CONCH OF SOUTHERN ELEUTHERA

Nicodemo Agostino, Erin Borodunovich, Jessie Reive

Department of Mathematics

Faculty Mentors: Dr. Richard Bastian, Asst. Dean John A. Tiedemann

ABSTRACT

Caribbean Queen Conch, while being a major export, is solely fished on the southern part of the island Eleuthera of the Bahamas to supply the local restaurants and families. Local laws restrict the fishing of non-fully matured queen conch; this, however, does not stop the fisheries. In this small fishing town, piles, or middens, have accumulated with the skeletal shells of the mollusk once the meat has been removed. Dr. Tiedemann and his team have collected data every two years since 2007 from three of these midden piles to analyze.

The Inactive Midden has not had any shells added to it by fisherman for 20 years. Similarly, the Recent Midden has not had shells added in 10 years. The final pile, referred to as the Active Midden still has shells added to it to this day. One hundred or so shells were randomly collected from each pile every year the study was conducted and classified into six age subclasses based upon their length and skeletal features.

Dr. Tiedemann collected this data with a question in mind: how was the fishing of juvenile queen conch changing over time? With the use of statistical software and chi-square tests of equal distributions, we were able to aid him with the solution: the distribution of juvenile conch shells was significantly changing over time. More specifically, juvenile conchs were being overfished more recently compared to previous years. In fact, the non-matured mollusks accounted for about 40% of the data. Dr. Tiedemann plans to use our research to raise awareness of the illegalities going on in this region by way of formal presentations.

STATISTICAL ANALYSIS OF MACROZOOPLANKTON POPULATION DATA

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Department of Mathematics

Faculty Mentors: Asst. Dean John A. Tiedemann, Dr. Richard Bastian

ABSTRACT

Macrozooplankton are an essential component of estuarine food webs as they intermediate between the microorganisms we do not see and the macroorganisms we do, feeding on the former and feeding the latter. This in turn makes macrozooplankton central to the sustenance and recreation of all coastal life, despite their diminutive size. Furthermore, because they are so important to the equilibrium of their ecosystem they are an excellent indicator of its overall health. This fact, along with the dearth of research done for the area, motivated the Monmouth University Urban Coast Institute to perform a macrozooplankton population study of Upper Barnegat Bay in 2010. Following its conclusion, we were tasked with evaluating and analyzing the resultant data.

The data, compiled over four years, the first of which only intended to produce nominal presence vs. absence data for each planktonic organism. The three years of statistically relevant data were gathered from six stations spread across Barnegat Bay once-weekly and showed the numeracy and relative abundance per meter^3 of each identified organism.

The analysis took the form of three sub-projects. The most basic was a diagnostic comparison of each well-represented taxonomic Order available in the data. ANOVA testing was performed to contrast changes over time and differences between groups and stations. The second project entailed three species of gelatinous zooplankton (*Mnemiopsis leidyi, Beroe ovate* and *Chrysaora quinquecirrha*) thought to have an interdependent predator/prey web between them. The gelatinous organisms have been shown to feed on each other in laboratory conditions, but it remains to be seen if they do so in the environment of Barnegat Bay. Using ANOVA testing the populations of these three organisms were compared over the course of the study. The final project entailed producing a predator-prey model of these organisms based on research done of similar non-linear food-webs in marine ecosystems.

ANALYSIS OF ANIMAL TRAUMA TRIAGE, MORTALITY RATES, AND HOSPITAL VISIT COSTS ACROSS DIFFERENT PET NAMES: HOW "LUCKY" IS LUCKY?

Jessica Cobb, Thomas Darlington, Taylor Krenzke, Krista Varanyak

Department of Mathematics

Faculty Mentor: Dr. Richard Bastian

ABSTRACT

In the veterinary field, it is believed that animals named Lucky, are not actually "lucky", meaning they are more likely to have a worse visit than animals not named Lucky. Dr. Katherine Palmer, a veterinarian at Garden State Veterinary Hospital, wanted to determine if this common assumption about the "luckiness" of animals named Lucky held any statistical significance. In order to test "luckiness", an observational study was conducted based on data collected at the Garden State Veterinary Hospital. Data was collected on animals named Lucky, Cody, and Lola that entered the hospital between 2011 and 2013. "Luckiness" was measured based on three different scales: cost of the visit, mortality rate, and the Animal Trauma Triage (ATT) score.

Forty cases for each name were randomly selected out of the total number of cases that occurred during the time period. The mean values of each of these three measurements were compared in an ANOVA test, testing for differences across each of the three names. Assumptions about the normal distribution of the data and equality of variances across each name and measurement were tested in order to determine the validity of the results of the testing. Depending on the measurement of luckiness that was used, results of the ANOVA varied in significance and whether or not those results supported the original assumption.

DETERMINING DIFFERENCES IN MANGROVE VOLUMES BY LOCATION

Kaitlyn Kramer, Lauren Johnson, Alex Moncman, Rachel DeStefano

Department of Mathematics

Faculty Mentors: Dr. Richard Bastian, Dr. Pedram Daneshgar

ABSTRACT

This study involves an experiment with Dr. Daneshgar from the Department of Biology at Monmouth University to determine the differences of mangrove volumes between four sites and two transects. The four sites are Broad Creek, Deep Creek, Kemps Creek, and Wemyss Creek, which are located in Cape Eleuthera, Bahamas. There are two parallel transects per site. The mangrove volumes were estimated using the height and diameter of the trunk and treating the mangrove as a cylinder. We have begun analysis on the data the biology students have collected thus far and have statistically significant results that are relevant clinically as well.

The statistical tests used for the analysis of the mangrove data were t-tests and ANOVAs. T-tests compare mean mangrove volumes of the two transects to each other. The ANOVAs compare the mean mangrove volumes of the four sites to each other and determine which sites differ from another. The assumptions of normality and equal variances are required to use these tests. Transformations of the data were used in order to pass these two assumptions. Non-parametric tests were also used on the original data, which do not assume a distribution of the data. Mann-Whitney tests were used to compare the two transects and Kruskal Wallis tests were used to compare the four sites. This poster will present the results of these tests.