MONMOUTH UNIVERSITY
SCHOOL OF SCIENCE

MONMOUTH UNIVERSITY
STUDENT SCHOLARSHIP WEEK

MONMOUTH UNIVERSITY
SCHOOL OF SCIENCE
16TH ANNUAL
STUDENT RESEARCH CONFERENCE

Wednesday, April 19, 2017

Science Building

Multipurpose Room and Lobby

Poster Presentations of Student Research in

Biology

Chemistry and Physics

Computer Science and Software Engineering

Mathematics

MONMOUTH UNIVERSITY
SCHOOL OF SCIENCE

MONMOUTH UNIVERSITY
STUDENT SCHOLARSHIP WEEK

16th Annual
School of Science Student Research Conference

Wednesday, April 19, 2017
Science Building
Multipurpose Room and Lobby

AGENDA

1:00 pm – 2:00 pm	Registration and Poster Set-up Science Building Multipurpose Room
2:10 pm – 2:30 pm	Keynote Presentation Science Building Lobby
	Mr. Bruce Kratz '89 Vice President for R & D, Sparta Systems
	"Why It's Never Been A Better Time To Be An Inventor"
2:30 pm – 4:30 pm	Poster Session Science Building Multipurpose Room
	Welcome by Assistant Dean John Tiedemann
4:30 pm – 5:00 pm	Wrap-up and Closing Remarks
5:00 pm – 5:15 pm	Break
5:15 pm – 6:30 pm	Reception Science Building Lobby
	Dean's Awards for Excellence in Research Presented by Dean Steven Bachrach

KEYNOTE ABSTRACT

WHY IT'S NEVER BEEN A BETTER TIME TO BE AN INVENTOR

Mr. Bruce Kratz '89
Vice President for R & D, Sparta Systems

Universities teach you how to learn, think, and conduct research. Research tests your thinking and leads to inventions... and inventions change our world. World changing research and inventions used to be reserved for large corporations with deep R&D pockets, but the democratization of technology has opened the door for small teams and individuals to have a huge impact. In addition to that, the way work is done, including research, has also changed dramatically. Companies are becoming more progressive and finding ways to cultivate ideas from everyone - the "smartest" people are not always the ones in charge!

Learn how *today*, more than ever, your work in the sciences can be directed into the research and development community to literally change the world!

16th ANNUAL STUDENT RESEARCH CONFERENCE
WEDNESDAY, APRIL 19, 2017

Department of Biology

A-1 **A Rapid Assessment Approach to Understanding the Physiology and Behavior of Angled and Air-Exposed Striped Bass (*Morone saxatilis*)**
Cash Bleier
Faculty Mentor: Assistant Dean John Tiedemann

A-2 **Effectiveness of Certain Essential Oils and Methylglyoxal as Bactericides for Antibiotic Resistant *Acinetobacter Baumannii***
Karla Clavelo
Faculty Mentor: Dr. James P. Mack

A-3 **Diet of Atlantic Sturgeon in a Coastal Marine Aggregation**
Marissa C. DeTorre
Faculty Mentor: Dr. Keith J. Dunton

A-4 **Engineering of an Immunogenic Pre-*Trans*-Splicing RNA (iPTR) to Block Growth and Reactivate the Immune System in Glioblastoma**
Sarah Falotico, Peter Nekrasov, and Nicole Sivetz
Faculty Mentor: Dr. Martin J. Hicks

A-5 **Engineering of an Immunogenic Pre-Trans-Splicing RNA (iPTR) to Block Growth and Express a Glioblastoma Specific Epitope**
Sarah C. Falotico, Nicole Sivetz, Peter Nekrasov
Faculty Mentor: Dr. Martin J. Hicks

A-6 **Impacts of Elevated Salinity on Photosynthesis Rates of Dwarf Red Mangrove *(Rhizophora mangle)* in the Bahamas**
Kristina Guarino
***Faculty Mentor: Dr. Pedram* Daneshgar**

A-7 The Effect of Increasing Alcohol Concentrations on the Viability of Neuro2a Cells

Olivia Higson

Faculty Mentor: Dr. Catherine Kubera

A-8 Examining the Role of Fascin in Primary Brain Cancers

Syed Mehdi Husaini and Faraz Jamal

Faculty Mentor: Dr. Catherine Kubera

A-9 Impacts of Increased Salinity on Red Mangrove (*Rhizophora mangle*) Sediment Respiration Rates

Kristen Jezycki

***Faculty Mentor: Dr. Pedram* Daneshgar**

A-10 Essential Oils and Methylglyoxal: A Possible Treatment for Inhibiting the Growth of the Extended Spectrum Beta-Lactamase Producing *Escherichia Coli (Esbl-Ec)*

Joseph B. Kellett

Faculty Mentor: Dr. James P. Mack

A-11 Community Succession after Cranberry Bog Abandonment within the New Jersey Pinelands

Rebecca Klee

Faculty Mentors: Dr. Pedram Daneshgar and Professor Kelly Zimmerman

A-12 Assessing the Occurrence of Ectoparasites in Killifish Populations within New Jersey Estuaries

Shannon M. Lavelle

Faculty Mentor: Dr. Keith J. Dunton

A-13 Conchology Analysis of Monmouth University Mollusca Collection

Christine Mlynaryk

Faculty Mentor: Dr. Tiffany Medley

A-14 Synthesis of Mini-Reporter Construct to Test Gene Transfer of RNA Therapeutics

Koushik Muralidharan, Kerianne Fuoco and Hemangi Patel

Faculty Mentor: Dr. Martin J. Hicks

A-15 Design of a Gene Transfer Vector to Deliver a Stabilized Anti-EGFR RNA Molecule to the Glioblastoma Microenvironment

Sachin Parikh

Faculty Mentor: Dr. Martin J. Hicks

A-16 The Effect of Essential Oils and Methylglyoxal with Carrier Oils on Inhibiting the Growth of *Pseudomonas Aeruginosa*

Aashna Patel

Faculty Mentor: Dr. James P. Mack

A-17 Genetic Delivery of RNA Molecules to Alter Expression of EGFR in Brain Cancer Cells

Nicole Sivetz, Sarah Falotico, and Peter Nekrasov

Faculty Mentor: Dr. Martin J. Hicks

A-18 Wreck Pond Aquatic Vertebrate eDNA Project

Cayla Sullivan, Gina Badlowski, and Nikole Andre

Faculty Mentors: Dr. Martin Hicks and Dr. Tiffany Medley

A-19 The Effects of Anthropogenic Sourced Nitrogen Deposition on Salt Marshes

Cayla R. Sullivan

Faculty Mentor: Dr. Pedram Daneshgar

A-20 The Short and Long-Term Effects of Weather and Climate Variables on the Growth of *Pinus rigida* in New Jersey Maritime Forests

Jennifer Urmston

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

Department of Chemistry and Physics

A-21 Determination of the Ebola Virus 5'-UTR Secondary Structure

Stephan Andersen

Faculty Mentor: Dr. Jonathan Ouellet

A-22 Silver Nanoparticles: Fundamental and Potential Applications

Emily Beyer

Faculty Mentor: Dr. Tsanangurayi Tongesayi

A-23 Investigation into the Usefulness of the Immature Platelet Fraction in the Early Detection of Sepsis

Christina Culmone, Jessica Stanton, and Jamie Himmelreich

Faculty Mentor: Dr. William Schreiber

A-24 Development and Isolation of an Aptamer for 2-Hydroxyglutartate

Artiom Efimenko

Faculty Mentor: Dr. Jonathan Ouellet

A-25 Measurement and Analysis of Diminazene Binding Affinity to DNA

Grant Gillan and Sydney Lavan

Faculty Mentor: Dr. Dmytro Kosenkov

A-26 Evaluation of Selectivity of Binding of Diminazene and its Alkyne Analogs to DNA

Sydney Lavan, Grant Gillian, Katlynn Muratore, and Erin Hoag

Faculty Mentor: Dr. Dmytro Kosenkov

A-27 Adsorption of Lead and Zinc on Microplastics from Hand, Facial, and Body Cleansers

Andrea Mora, Chioma Gabriel, Hannah Hilbrandt, Kristel Gousse

Faculty Mentor: Dr. Tsanangurayi Tongesayi

A-28 Development and Isolation of an Aptamer for Glucose-6-Phosphate

Kushkumar Patel

Faculty Mentor: Dr. Jonathan Ouellet

A-29 Radioactivity-Free Kinetics

Shenin Siddiqui

Faculty Mentor: Dr. Jonathan Ouellet

A-30 Selection of an Aptamer that Binds Glucose

Emma Stowell

Faculty Mentor: Dr. Jonathan Ouellet

A-31 Cloning of a Fluorescent Reporter Gene as an Assay to Monitor Riboswitch Modulation

Toni Zangrilli

Faculty Mentor: Dr. Jonathan Ouellet

Department of Computer Science and Software Engineering

A-32 MU Clubs and Events
Kyle Blazier and Mary Menges
Faculty Mentor: Dr. Raman Lakshmanan

A-33 What's Good MU?
Taylor Campos, Casey Little, Giuseppe Licata, Tighe Blazier and Nicolas Sciolaro
Faculty Mentor: Dr. Cui Yu

A-34 Occupi Room at Monmouth University
Stephanie Cornick, Kenneth Magner, Christian Rebelo and David Walker
Faculty Mentor: Dr. Cui Yu

A-35 Smart Desk
Stephanie Cornick
Faculty Mentor: Dr. William Tepfenhart

A-36 GoodJob – A Job Finding Application
Phil DiMarco, Kristopher Horton, Darius Jenkins, and Alyssa DiRe
Faculty Mentor: Dr. Daniela Rosca

A-37 Monmouth University Augmented Reality Campus App
Veronica Granite, Giuseppe Stramandinoli, Andrew Barnes, and Yuhan Xue
Faculty Mentor: Dr. Daniela Rosca

A-38 Student Campus Location Tracker
Alex Kaczynski, Grady Jenkins, Kevin Meehl, Tejal Deshpande
Faculty Mentor: Dr. Daniela Rosca

A-39 A Robot to Improve Verbal Communication Skills of Children with Autism
Prashanthi Mallojula
Faculty Mentors: Dr. Richard Scherl and Dr. Patrizia Bonaventura

A-40 Improving Text Mining with Enhanced Named-Entity Recognition
Prashanthi Mallojula
Faculty Mentor: Dr. Richard Scherl

A-41 Roll Call
Brandon Shaw, Richard Kanson, James O'Donnell, and Connor Power
Faculty Mentor: Dr. Cui Yu

A-42 EZ Plan R

Harry E. Torrenegra, Jordan Liebling, Darnell Leslie, Paul Miceli, and Michael Sagan

Faculty Mentor: Dr. Daniela Rosca

A-43 Symptoms Tracker

Akhil Yaragangu

Faculty Mentor: Dr. Nafi Diallo

Department of Mathematics

A-44 Assessing the Characteristics and Recurrence of Hemangiopericytoma in Dogs at Red Bank Veterinary Hospital

Austin Alcott, Kelsey Fittipaldi, and Hailey Ruroede

Faculty Mentor: Dr. Richard Bastian

A-45 Analysis of State Choices under the Affordable Care Act

Christina Alexander, Joseph Govea and Anthony Hamill

Faculty Mentors: Dr. Richard Bastian and Dr. Stephan Chapman

A-46 Analysis of Post-Partum Depression and Possible Causing Factors

Brielle Forsthoffer and Hope Sonner

Faculty Mentor: Dr. Richard Bastian

A-47 Statistical Analysis of the Salinity Gradients of Mangrove Trees in the Bahamas

Jennifer Minot and Lindsay Weber

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

A-48 How Snail Shell Color Variations Affect Habitat Behavior

Alyssa Parker and Larissa Russo

Faculty Mentor: Dr. Richard Bastian

DEPARTMENT OF BIOLOGY

A RAPID ASSESSMENT APPROACH TO UNDERSTANDING THE PHYSIOLOGY AND BEHAVIOR OF ANGLED AND AIR EXPOSED STRIPED BASS (*Morone saxatilis*)

Cash Bleier

Department of Biology

Faculty Mentor: Assistant Dean John Tiedemann

ABSTRACT

Striped bass (*Morone saxatilis*) support an extremely valuable recreational fishery along the US east coast. Managed through implementation of minimum size restrictions and possession limits, fish not meeting the regulatory criteria for harvest must be released. Many anglers also voluntarily practice catch-and-release of striped bass as a conservation measure. Unfortunately, despite angler's best intentions, managers estimate that 8% of striped bass caught and released in saltwater die, which may be due to a general lack of understanding regarding how angling techniques can injure and physiologically stress fish. Many anglers assume that fish that appear healthy and swim away survive, unaware that capture and handling practices could result in sublethal impacts or post-release mortality.

Post-capture air exposure is an important stressor across gear types and locations in the striped bass fishery. The duration of air exposure influences recovery time of released fish and can lead to behavioral impairments or mortality. To evaluate the effects of angling and air exposure on striped bass intended to be released we are employing Reflex Action Mortality Predictor Assessment (RAMP) and Physiological Stress Assessment (PSA) procedures during surf fishing outings with fishing clubs. The RAMP includes an Injury Symptom Assessment which uses easily observed injury symptoms as indicators of stress and a Reflex Impairment Assessment which uses observations of reflex actions typically present in unstressed fish. The PSA analyzes blood lactate, glucose, and pH levels. Our goal is to develop scientifically-based recommendations on maximum time out of water for striped bass intended to be released.

EFFECTIVENESS OF CERTAIN ESSENTIAL OILS AND METHYLGLYOXAL AS BACTERICIDES FOR ANTIBIOTIC RESISTANT *ACINETOBACTER BAUMANNII*

Karla Clavelo

Department of Biology

Faculty Mentor: Dr. James P Mack

ABSTRACT

The time has come when health care professionals are unable to treat many diseases with traditional medications. Antibiotics are losing their effectiveness on infections such as *Acinetobacter baumannii*. Because this infection is commonly found in hospital settings, both healthcare professionals and the public should be concerned about the overuse of antibiotics that has led to this worrisome and worsening situation. New alternative effective methods of treating these infections should now be explored.

This research explores how essential oils and methylglyoxal compare in effectiveness with currently used antibiotics to address the dangers of antibiotic resistant bacteria. The research was conducted using the biology facilities at Monmouth University in West Long Branch, NJ and the microbiology lab at Jersey Shore University Medical Center (JSUMC) in Neptune City, NJ. Emollients of the essential oils (Cassia, Cinnamon Bark, Thyme White, and Oregano) and methylglyoxal (the key component in Manuka Honey) were made in conjunction with common carrier oils (Jojoba, Coconut, Olive, and Aloe Vera) to determine their efficacy in inhibiting *Acinetobacter baumannii*. These essential oils were chosen because of their proven effectiveness against other bacteria in previous research at Monmouth University.

Since there is a potential for skin irritation from the concentrated essential oils if applied directly, they were diluted using carrier oils. The Minimum Inhibitory Concentration (MIC) for the emollients was determined for each of the four essential oils and methylglyoxal. It was determined that a concentration of 10% was the MIC for each essential oil and methylglyoxal. At the 10% concentration, the tested emollients worked better than colistin, an antibiotic commonly used in treating *Acinetobacter baumannii* infections. In the past year, the rate of inhibition was also determined to check not just overall efficacy but also which of the emollients would inhibit bacteria the quickest. This was done by checking the zones of inhibition hourly in addition to overnight. The results indicate that the emollients made with the essential oils and with methylglyoxal at the MIC using the tested carrier oils could potentially be used as an alternative treatment for the infections from multidrug resistant *A. baumannii*.

DIET OF ATLANTIC STURGEON IN A COASTAL MARINE AGGREGATION

Marissa C. DeTorre

Department of Biology

Faculty Mentor: Dr. Keith J. Dunton

ABSTRACT

Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus*, is a federally protected species that undergoes large coastal migrations. Aggregations of Atlantic Sturgeon are known to occur in several coastal locations, including large seasonal aggregations in the spring and fall off the coast of New York. This New York aggregation is known to consist of sub-adults largely from the Hudson River.

To understand potential reasons why sturgeon aggregate, temporal changes in diet were examined from sub-adult fish within these coastal aggregations. The prey of the Atlantic Sturgeon was determined through stomach contents, collected through non-lethal gastric lavage in both the Spring (n=28) and Fall (n=39) of 2013. Thirteen unique prey taxa were identified with Atlantic Sturgeon ingesting large numbers of Gammarid amphipod spp. in both seasons. In addition to gammarids, the sturgeon diet included considerable numbers of *Glycera dibranchiata, Leitoscoloplos fragilis, Squilla empusa* and other various polychaete, oligochate and crustacean species. Concurrent studies indicate that this area is important for migrating Atlantic Sturgeon, and the high abundance of prey resources indicates an important feeding habitat. This might explain temporal aggregations in this region.

ENGINEERING OF AN IMMUNOGENIC PRE-*TRANS*-SPLICING RNA (iPTR) TO BLOCK GROWTH AND REACTIVATE THE IMMUNE SYSTEM IN GLIOBLASTOMA

Sarah Falotico, Peter Nekrasov, and Nicole Sivetz

Department of Biology

Faculty Mentor: Dr. Martin J. Hicks

ABSTRACT

The most common and lethal malignancy of the central nervous system (CNS) is glioblastoma multiforme (GBM). Due to the blood brain barrier and the relatively immunologically privileged status of the CNS, clinical strategies have not improved the standard of care. Epidermal growth factor receptor (EGFR), a type of tyrosine kinase receptor, has been found to be overexpressed in as much as 60% of GBM tumors. Upon binding of its cognate ligand, EGFR promotes tumor growth and proliferation. The cytokine, interleukin-13 receptor alpha variant 2 (IL13Rα2) is an isoform selectively expressed in GBM. It is highly immunogenic, attracting cytotoxic T-cells to the tumor microenvironment. Therapeutically, this cytokine has the potential reactivate the immune system toward GBM. In the current study, we have designed and cloned an immunogenic pre-*trans* splicing RNA molecule (iPTR) against EGFR. The iPTR has the potential to synergistically block growth and reactivate the immune system toward the tumor microenvironment. In a GBM tissue culture model, we use RT-PCR to detect changes in IL13Rα2 peptide expression. In addition, we are developing assays to use western blot and ELISA to measure changes in EGFR protein localization. Genetic delivery of our highly immunogenic IL13Rα2 peptide using the iPTR has the potential to redirect the immune system to recognize and induce apoptosis in GBM cells.

ENGINEERING OF AN IMMUNOGENIC PRE-TRANS-SPLICING RNA (iPTR) TO BLOCK GROWTH AND EXPRESS A GLIOBLASTOMA SPECIFIC EPITOPE

Sarah C. Falotico, Nicole Sivetz, and Peter Nekrasov

Depart of Biology

Faculty Mentor: Dr. Martin J. Hicks

ABSTRACT

The most common and lethal malignancy of the central nervous system (CNS) is glioblastoma multiforme (GBM). Due to the blood brain barrier and the relatively immunologically privileged status of the CNS, clinical strategies have not improved the standard of care. Epidermal growth factor receptor (EGFR), a type of tyrosine kinase receptor, has been found to be overexpressed in as much as 60% of GBM tumors. Upon binding of its cognate ligand, EGFR promotes tumor growth and proliferation. The cytokine, interleukin-13 receptor alpha variant 2 (IL13Rα2) is an isoform selectively expressed in GBM. It is highly immunogenic, attracting cytotoxic T-cells to the tumor microenvironment. Therapeutically, this cytokine has the potential reactivate the immune system toward GBM. In the current study, we have designed and cloned an immunogenic pre-trans splicing RNA molecule (iPTR) against EGFR. The iPTR has the potential to synergistically block growth and reactivate the immune system toward the tumor microenvironment by generation of a GBM-specific epitope. In a GBM tissue culture model, we use RT-PCR to detect changes in IL13Rα2 peptide expression. In addition, we use western blot and ELISA to measure changes in EGFR protein localization. Genetic delivery of our highly immunogenic IL13Rα2 peptide using the iPTR has the potential to redirect the immune system to recognize and induce apoptosis in GBM cells.

IMPACTS OF ELEVATED SALINITY ON PHOTOSYNTHESIS RATES OF DWARF RED MANGROVE *(Rhizophora mangle)* IN THE BAHAMAS

Kristina Guarino

Department of Biology

Faculty Mentor: Dr. Pedram Daneshgar

ABSTRACT

This study explored the impact of elevated salinity levels on light-saturated photosynthesis rates of red mangrove (*Rhizophora mangle*) in tidal creeks in The Bahamas. As a result of climate change induced higher rates of evaporative loss, salinity in the Caribbean is expected to rise, potentially having an impact on the photosynthesis rates and productivity of red mangroves. It was hypothesized that there would be natural salinity gradients within tidal creeks due to decreases in depth, changes in tidal flow, and increased evaporative loss in shallow areas, causing differences in photosynthesis rates of red mangrove trees within creeks. Red mangrove photosynthesis rates were measured at four mangrove tidal creeks in Eleuthera, The Bahamas where salinity ranges from ambient ocean levels at creek mouths to hypersaline along naturally occurring salinity gradients using an infrared gas analyzer. Results showed that elevated salinity has an impact on photosynthesis rates of red mangroves in some tidal creeks, however, it is not the only factor effecting this process. In order to understand how climate change will impact mangrove productivity within these ecosystems a number of other parameters need to be examined in addition to elevated salinity including creek structure, hydrology and nutrient influences.

THE EFFECT OF INCREASING ALCOHOL CONCENTRATIONS ON THE VIABILITY OF NEURO2A CELLS

Olivia Higson

Department of Biology

Faculty Mentor: Dr. Cathryn Kubera

ABSTRACT

Alcohol is the most frequently abused drug in modern day society and abuse during pregnancy can lead to Fetal Alcohol Syndrome (FAS). FAS affects individuals from birth and throughout their lifetime, with the central nervous system being largely affected. Evidence has shown that GABAA receptors have an extremely important role in the long and short-term effects that ethanol has within the central nervous system. Exposure to alcohol has led to adaptations in GABAA receptor mRNA and protein levels. GABA binds to GABA receptors and acts as an inhibitory neurotransmitter in the mature brain, and as an excitatory neurotransmitter during CNS development. Specifically, during development, binding of GABA with GABAA receptors increases the excitability of neurons. Neuro2a (N2a) cells are a mouse neuroblastoma cell line that remains undifferentiated under normal culture conditions. The purpose of the experiment was to determine the effect of alcohol on the viability of Neuro2a cells and identify if increasing concentrations of ethanol lead to an increase in the number of dead cells identified. This information can be used to determine effective concentrations of alcohol leading to cell death in an in vitro model of developing neurons. Using the Cytation5 plate imager, fluorescence imaging was used in order to calculate the number of live or dead cells at various ethanol concentrations. The results show that an increase in ethanol concentration does lead to an increase in cell death. Additionally, this information could potentially be used for further research into the effects of alcohol on the development of the central nervous system in embryonic structures.

EXAMINING THE ROLE OF FASCIN IN PRIMARY BRAIN CANCERS

Syed Mehdi Husaini and Faraz Jamal

Department of Biology

Faculty Mentor: Dr. Cathryn Kubera

ABSTRACT

As one of the main actin bundling proteins found in the body, Fascin plays an important role in maintaining many regulatory behaviors. It is vital for proper cell-cell adhesion through cytoskeletal structures and has been shown to play a role in a cell's motile and invasive properties. In particular, Fascin is an important protein to study because its overexpression is seen in various cancers. Previous literature has shown that upregulation of Fascin increased the metastatic and invasive properties of colorectal cancer cell lines. Additionally, Fascin has been previously identified in a set of genes that mediated breast cancer metastasis to the lungs and has been implicated in gallbladder, pancreatic, and prostate cancer as well. Primary brain cancers, which can be very aggressive, also seem to have elevated Fascin levels that correlate with tumor grade. In this project we examine the role of Fascin in neural cancers like neuroblastoma and glioblastoma. We characterized Fascin gene expression in brain cancer cell lines using RT-qPCR to assess mRNA levels, and immunocytochemistry to determine relative protein abundance. Preliminary results show robust Fascin mRNA expression in Neuro2a neuroblastoma and A-172 glioblastoma cells. Furthermore, immunostaining of both total Fascin and phosphorylated Fascin was elevated in mouse Neuro2a neuroblastoma cells when compared to Human Embryonic Kidney cells (HEK-293), which have reportedly low Fascin expression levels. A-172 cells also exhibit distinct Fascin immunostaining.

Following analysis of Fascin expression in additional brain cancer cell lines, we will evaluate whether overexpression of Fascin increases motile properties of neuroblastoma and glioma cells in culture using a scratch invasion assay technique.

IMPACTS OF INCREASED SALINITY ON RED MANGROVE (*Rhizophora mangle*) SEDIMENT RESPIRATION RATES

Kristen Jezycki

Department of Biology

Faculty Mentor: Dr. Pedram Daneshgar

ABSTRACT

The aim of this study was to explore how climate change and increases in salinity will affect the sediment respiration rates of red mangroves in The Bahamas. The salinity of marine ecosystems in tropical areas is expected to rise as a result of increased surface water evaporation due to warming. As fluctuations in salinity occur, mangroves are susceptible to change as their productivity is closely linked to salinity, exemplified by the presence of dwarfed mangroves in the Caribbean. Mangroves have been shown to be important carbon sinks and so it is important to assess how their productivity will be impacted in the changing climate. Four tidal creeks on the island of Eleuthera in The Bahamas were chosen as part of this study due to their natural salinity gradients ranging from ambient ocean levels near the mouth of the creeks to hypersaline in the upper portions of the creeks. Sediment samples were taken along this salinity gradient and incubated in two different salinity treatments, ambient and hypersaline. Each sample was then examined using an infrared gas analyzer to assess its respiration. Results showed that although the salinity treatments showed significant differences in respiration rates of three of the four creeks, more information needs to be gathered on these vital ecosystems to ensure that they will still remain productive despite creek physical differences and the changing climate.

ESSENTIAL OILS AND METHYLGLYOXAL: A POSSIBLE TREATMENT FOR INHIBITING THE GROWTH OF THE EXTENDED SPECTRUM BETA-LACTAMASE PRODUCING *ESCHERICHIA COLI (ESBL-EC)*

Joseph Kellett

Department of Biology

Faculty Mentor: Dr. James P. Mack

ABSTRACT

The overuse and misuse of antibiotics have produced antibiotic resistant bacteria. Infections from these bacteria are therefore difficult to treat. Recent problems in healthcare settings include infections of patients with certain antibiotic resistant bacteria which do not respond to traditional antibiotic treatment. Natural products, including essential oils, derived from plants show promise as strong bactericides which may be useful for effectively combating the infections from these antibiotic resistant bacteria. *Escherichia coli* is part of the normal flora of the intestines, however, some strains can cause an intestinal infection causing abdominal pain, fever, as well as bloody diarrhea. Other strains of Escherichia coli can also cause urinary tract infections. In this research, the essential oils cassia, cinnamon bark, oregano, as well as methylglyoxal (main ingredient in Manuka honey) were used in conjunction with three carrier oils (olive oil, jojoba oil, and coconut oil) to determine their efficacy in inhibiting the growth of *ESBL-EC.* Cassia, cinnamon bark, oregano, and methylglyoxal were chosen because they were used in previous studies at Monmouth University and showed to be effective in inhibiting the growth of MRSA and MSSA. The essential oils were diluted to lower concentrations to determine their minimal inhibitory concentration (MIC) because most essential oils are irritating to the skin in high concentrations. The results were then compared to traditional antibiotics, including colistin, tetracycline, ciprofloxacin, fosfomycin, azithromycin, and nitrofurantoin, to determine their effectiveness. It was determined that the MIC of the essential oils cassia and cinnamon bark to effectively inhibit ESBL-EC is 33%, the MIC of essential oil oregano is 50%, and the MIC of methylglyoxal is 12.5%. The dilutions were made using the carrier oils listed above, which are known to be safe on the skin. The effectiveness of essential oils and methylglyoxal emollients in carrier oils in inhibiting the bacterial growth was better than the currently used antibiotics for treating ESBL-EC. It was determined that the essential oils and the antibiotics took 7 hours to achieve maximum inhibition of the growth of ESBL-EC. Multidrug-resistant bacteria have become a significant global health threat and the possible treatment of multidrug-resistant bacterial infections with proven bactericidal essential oils may help alleviate this problem.

COMMUNITY SUCCESSION AFTER CRANBERRY BOG ABANDONMENT WITHIN THE NEW JERSEY PINELANDS

Rebecca Klee

Department of Biology

Faculty Mentors: Dr. Pedram Daneshgar and Professor Kelly Zimmerman

ABSTRACT

Since the 1860's, the cultivation of the native American cranberry, *Vaccinium macrocarpon*, has been a major agricultural practice in the New Jersey pinelands. The pinelands have been well suited for cranberry production due to the sandy, organically rich soil and abundant sources of freshwater. Cranberry bog agriculture includes the clearing and leveling of land, usually wetlands, to create bogs. Water flow and drainage is controlled by diversion canals and channelized stream segments. These manipulations can cause significant changes in the structure and function of wetland communities. Although cranberry agriculture can represent over a third of wetlands in the pinelands, the industry has been on the decline as it has moved to other regions of the country. As a result, many bogs have been abandoned. The effects of abandonment have not been investigated thoroughly.

In this study, we explored the fate of bogs and examined bog succession after abandonment from time zero (an active cranberry bog) to 60 years abandoned in flooded and unflooded communities. We hypothesized that the fate of community succession would be heavily influenced by the original agricultural practice and whether or not the bog was kept flooded. A full inventory of plant and invertebrate species were collected from cranberry bogs of different ages from three locations. Community diversity and structure were determined from the inventories and a chronosequence for bog succession was developed. When a cranberry bog was left to dry, conversion from a wet savanna to either a mesic hardwood forest or wooded swamp was observed. A cranberry bog that remained flooded transitioned to a lake, spung, or pond. There was a significant difference in groundcover and functional diversity over time. With this information, recommendations can be made onto how the lands should be managed in the future in order to maintain healthy and native communities.

ASSESSING THE OCCURRENCE OF ECTOPARASITES IN KILLIFISH POPULATIONS WITHIN NEW JERSEY ESTUARIES

Shannon M. Lavelle

Department of Biology

Faculty Mentor: Dr. Keith J. Dunton

ABSTRACT

Parasites are commonly found on striped killifish (*Fundulus majalis* and *Fundulus heteroclitus*) in New Jersey estuaries. This study investigated the impact of parasites on the health of individual fish, identified any ectoparasites found, and assessed the health of populations sampled. Specimens were collected weekly or bi-weekly from three water systems. The fish were weighed (nearest 0.01 g), measured (nearest mm), sexed, and examined for ectoparasites. Fulton's condition factor ($K=100(W/L^3)$) was calculated as an index of health. A total of 471 fish were captured. A total of 116 male and 103 female *F. heteroclitus* specimens were caught, and *F. majalis* yielded 30 males and 48 females. Only 2% of the fish were found to be infected with ectoparasites; about 55% of these fish were from one system, Shark River. This in conjunction with the non-migratory behavior of *F. heteroclitus* and *F. majalis* indicates that other populations of fish in the Shark River may be heavily infected with parasites as well. Seasonal temperature changes may have had an impact on the abundance of parasites present during this investigation.

CONCHOLOGY ANALYSIS OF MONMOUTH UNIVERSITY MOLLUSCA COLLECTION

Christine Mlynaryk

Department of Biology

Faculty Mentor: Dr. Tiffany Medley

ABSTRACT

Molluscs are the largest animal group with documented extinctions and many included in the International Union for the Conservation of Nature Red List are listed as vulnerable, threatened or endangered. Molluscs have been impacted by human actions such as habitat loss and marine molluscs are especially sensitive to overharvesting and environmental threats such as global warming and ocean acidification. The shells left behind from many of these animals are evidence of their existence and are of interest to novice shell collectors and well as taxonomists and other scientists.

Conchology is the study of mollusc shells which are primarily formed from four molluscan clades: Gastropoda, Bivalvia, Polyplacophora, and Scaphopoda. A preliminary conchology analysis was conducted to begin to document the extent of the diversity and abundance of a large shell collection that was deposited at Monmouth University. Aspects of the shell morphology were analyzed to confirm the identity of the shells and create a record of the species, number of shells collected, classification and conservation status. Once the entire shell collection has been assessed, the extent of the diversity of rare, endangered or extinct species included in the collection will be known and decisions can be made as to their permanent storage or display in the new Edison Science Building.

.

SYNTHESIS OF MINI-REPORTER CONSTRUCT TO TEST GENE TRANSFER OF RNA THERAPEUTICS

Koushik Muralidharan, Kerianne Fuoco, and Hemangi Patel

Department of Biology

Faculty Mentor: Dr. Martin J. Hicks

ABSTRACT

Glioblastoma multiforme (GBM), a grade IV tumor of the central nervous system, is the most common malignant primary brain tumor in adults, with a median survival of only 14 months. This poor survival rate is due to a lack of efficacy in current therapies, including chemotherapy and radiation, which are limited by the blood-brain barrier. GBM survival depends on tumor cells creating vasculature around themselves for necessary exchange of wastes and nutrients. To synthesize this vasculature, tumor cells activate a membrane receptor that drives the recruitment of endothelial cells which connect with each other and form the walls of new blood vessels, connecting the growing tumor mass with the established vasculature of the circulatory system. The membrane receptor that activates this growth is termed vascular endothelial growth factor receptor 2 (VEGFR2). In our lab, we are developing a novel therapy to alter the VEGFR2 receptor so that it is released from the membrane, unbound and soluble. Alteration in VEGFR2, disconnecting it from the membrane would disrupt its activation and inhibit growth of new blood vessels. We are developing therapies to deliver the sequences of RNA therapy molecules to alter the splicing pattern and expression of VEGFR2 transcript, creating a soluble VEGFR2 decoy. To test this approach, we have designed mini-reporter gene constructs that contain the targeted regulatory elements, including the 5’ and 3’ splices sites as well as the intronic region of interest of the tyrosine kinase reception (TKR), VEGFR2. This mini-reporter construct will test the efficacy of RNA anti-sense therapeutics to block the pre-mRNA splicing event leading to intron retention and alternative polyadenylation signal recognition. Using fluorophores as visual markers, eukaryotic green fluorescent protein (eGFP) will be used to detect the natural exon splicing product, whereas the monomeric red fluorescent protein, mCherry will detect RNA anti-sense mediated intron retention. In this manner, the mini-reporter construct provides a quick and visually measurable test to optimize RNA anti-sense therapies against VEGFR2. In addition to VEGFR2, we will use this mini-reporter design to test the efficacy of RNA therapies directed toward alternative TKRs known to be upregulated in GBM.

DESIGN OF A GENE TRANSFER VECTOR TO DELIVER A STABILIZED ANTI-EGFR RNA MOLECULE TO THE GLIOBLASTOMA MICROENVIRONMENT

Sachin Parikh

Department of Biology

Faculty Mentor: Dr. Martin J. Hicks

ABSTRACT

Glioblastoma multiforme (GBM) is an incurable and aggressive type of brain tumor. It is the most common central nervous system (CNS) malignancy with a median survival of only 14 months. The epidermal growth factor receptor (EGFR) is a type of tyrosine kinase receptor (TKR) dysregulated in about 60% of GBM tumors. EGFR amplification and over-expression leads to angiogenesis and uncontrolled growth and proliferation of GBM. Although a great deal is known about the biology exhibited by EGFR-activated GBM, the application of therapies against the biologic processes is limited by the blood-brain barrier, which restricts systemically administered therapies from reaching the brain. We have created an *in vivo* tissue culture model to develop a novel strategy to bypass these barriers by developing a gene transfer vector to deliver the genetic sequences of a verified anti-EGFR RNA therapy aptamer that binds with high affinity to EGFR. To stabilize the structure, we have added inactivated hammerhead ribozymes, and to promote extracellular movement of the aptamer, we use an extracellular RNA "exRNA" localization element. Methodologies include RNA isolation, reverse-transcription and PCR to detect changes in EGFR transcript expression, as well as development of an ELISA assay to measure changes in the phosphorylated and active form of EGFR. With the revelation that GBM leads to an abundant increase in exosomes and microvesicles, this strategy may have implications for future therapies directed against GBM.

THE EFFECT OF ESSENTIAL OILS AND METHYLGLYOXAL WITH CARRIER OILS ON INHIBITING THE GROWTH OF *Pseudomonas aeruginosa*

Aashna Patel

Department of Biology

Faculty Mentor: Dr. James P. Mack

ABSTRACT

Due to global overuse of antibiotics, some bacteria have evolved to become resistant to antibiotics. Alternative methods are sought to combat the emergence of these bacteria, such as the use of natural products derived from plants to effectively inhibit the growth of multidrug-resistant bacteria. Essential oils from plants are known to be highly potent and have natural antibacterial properties that may be useful to treat infections due to drug resistant bacteria.

In this experimentation, three highly potent essential oils, cassia, cinnamon bark, and the aldehyde methylglyoxal (the main active antibacterial ingredient in Manuka Honey), were used in conjunction with three carrier oils (olive oil, jojoba oil, and lanolin) to determine their efficacy in inhibiting the growth of *Pseudomonas aeruginosa*, a multidrug-resistant bacterium. *Pseudomonas aeruginosa* is a gram-negative, aerobic, and coccobacillus bacterium that infects open airways and wounds. *Pseudomonas aeruginosa* infections have become a serious problem for patients who have weakened immune systems. The Kirby-Bauer disk-diffusion method was used to test the efficacy of the essential oil and carrier oil mixture. The essential oils used were diluted to lower concentrations with carrier oils to determine their minimal inhibitory concentration (MIC) as essential oils can be irritating if used independently. The results were compared to colistin, which is an antibiotic that can be used to treat *Pseudomonas aeruginosa* infections.

The essential oils and methylglyoxal were diluted and tested at 100%, 75%, 50%, 25%, and 12.5% concentrations in carrier oils. The results were compared to the colistin for relative effectiveness. It was determined that at a 25% concentration, the essential oils and methylglyoxal were more effective than colistin in inhibiting the growth of *Pseudomonas aeruginosa* in the Petri dish experiments. The results show a potential topical treatment that can be used in health care facilities to effectively treat infections caused by this bacterium.

GENETIC DELIVERY OF RNA MOLECULES TO ALTER EXPRESSION OF EGFR IN BRAIN CANCER CELLS

Nicole Sivetz, Sarah Falotico, and Peter Nekraso

Department of Biology

Faculty Mentor: Dr. Martin J. Hicks

ABSTRACT

Glioblastoma multiforme (GBM) is a highly prevalent and aggressive central nervous system malignancy currently with ineffective treatment options. The blood-brain barrier (BBB), which isolates the brain, prevents traditional systemic therapies from entering the tumor microenvironment. 60% of GBM cases are also characterized by increased activation of epidermal growth factor receptor (EGFR) which drives the proliferation of tumor cells. The amplification and overexpression of the EGFR gene makes it a primary target for alternative therapies, such as those which affect biological pathways on a transcriptional level. In our current approach, we have designed and assembled an adeno-associated viral plasmid vector encoding a pre-trans-splicing RNA (PTR). Through anti-sense targeting, the therapeutic PTR delivers a polyadenylation signal into the EGFR pre-mRNA transcript upstream of the native region coding for the transmembrane domain of the full-length EGFR protein. This strategy leads to the translation of a short, non-membrane bound soluble peptide. The PTR was transfected in GBM cell lines, and isolated RNA was analyzed using various PCR primer sets to confirm expression of our therapy vector and changes in EGFR. To optimize the PTR, we are currently testing alternative antisense binding sequences and assembling a new construct to fluorescently tag EGFR via trans-splicing. In addition, we are developing a novel approach which utilizes an EGFR-specific biotinylated oligo mRNA pull-down assay which will also allow analysis of alternative and trans-spliced isoforms of EGFR from tissue culture extracts. Trans-splicing as an alternative therapy is at the forefront of genetic strategies with the potential for leading to the discovery of new methods for studying cellular splicing and creating more successful cancer treatments.

WRECK POND AQUATIC VERTEBRATE eDNA PROJECT

Cayla Sullivan, Gina Badlowski, and Nikole Andre

Department of Biology

Faculty Mentors: Dr. Martin J. Hicks and Dr. Tiffany Medley

ABSTRACT

The aquatic vertebrate environmental DNA (eDNA) project enables the detection of various fish and mammal species found in marine and freshwater habitats. With this technique, specific species inhabiting the water bodies can be identified based on DNA shed into the water without causing stress to the organisms themselves.

Wreck Pond is a semi-enclosed estuarine system currently undergoing a restoration project directed by the American Littoral Society (ALS) to facilitate anadromous fish passage into the pond from the open ocean. From March 2016 through June 2016, twice monthly water samples were taken from four locations throughout Wreck Pond and the adjacent ocean. After collection, water samples undergo vacuum filtration, DNA extraction, and vertebrate DNA is amplified using a 12S mitochondrial DNA primer. Next Generation sequencing is the final step to enumerate specific vertebrate DNA signatures from each sample. Sequence results are compared to known vertebrate 12S sequences to determine species present in Wreck Pond at the time of sampling.

Sequencing results from the March samples revealed that white sucker, four-spined stickleback, American eel, and mummichog DNA are present in the samples as well as DNA from waterfowl. Samples from April to June are currently in the processes of being sequenced. Results from the NanoDrop 3000 reveal there is an increase in eDNA amounts in the ocean and pipe sample locations from March to June. It is expected that results will show a positive correlation between species diversity and abundance as the months progress, since the water temperature is more favorable. A better understanding of fish passage through Wreck Pond will enable further restoration and management for these species in this area. With eDNA identification, these essential species can be protected, conserved, and better understood by the public.

THE EFFECTS OF ANTHROPOGENIC SOURCED NITROGEN DEPOSITION ON SALT MARSHES

Cayla R. Sullivan

Department of Biology

Faculty Mentor: Dr. Pedram Daneshgar

ABSTRACT

Nitrogen deposition, a naturally occurring process, has been increasing particularly in metropolitan areas due to anthropogenic factors. The specific effects of increasing nitrogen deposition on salt marshes, ecologically and economically important coastal ecosystems, are unknown. Through the use of isotopic enriched fertilizer additions, the impacts of rising nitrogen deposition on salt marshes can be assessed. Six salt marsh locations along the coast of New Jersey and Long Island, New York were analyzed to determine the fate of nitrogen added through deposition using nitrogen isotope tracers. At these sites, five different treatments were assigned to 1-square meter plots of salt marsh: a) a control, b) nitrogen isotope enriched fertilizer added in amounts equivalent to one year of N deposition, c) non-enriched fertilizer added in amounts equivalent to one year of N deposition, d) an isotope enriched doubling of current annuals values of N deposition and e) a non-enriched doubling of current annual values of N deposition. After a month, all plant biomass was harvested and separated by species. Soils were sampled with an auger. All biomass and soils were dried and weighed and subsamples were ground and sent to stable isotope laboratory for analysis. Our results suggest that there are a lot of site to site differences in marsh composition and productivity. Overall, salt marsh productivity increased with deposition, but allocation of nitrogen and biomass was different from site to site. This project provides a better understanding of the potential degradation of salt marshes and may help provide insight to develop management plans to conserve and restore the salt marsh ecosystems for the future.

THE SHORT AND LONG-TERM EFFECTS OF WEATHER AND CLIMATE VARIABLES ON THE GROWTH OF *Pinus rigida* IN NEW JERSEY MARITIME FORESTS

Jennifer Urmston

Department of Biology

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

ABSTRACT

Trees in maritime forests are adapted to withstand sandy soil, strong winds, and salt spray from the ocean. How these highly adapted species are responding to annual weather fluctuations and climate change is still unknown. This study aimed to observe the effects of short-term and long-term weather and climate patterns on the growth of pitch pines (*Pinus rigida*) in New Jersey maritime forests using dendrochronological methods. It was hypothesized that annual tree growth would be correlated with annual rainfall, and factors affecting the length of the growing season including date of last frost and daily temperature. It was also hypothesized that tree growth would be affected by long-term climate patterns such as increasing atmospheric CO_2. Core samples were extracted from pitch pines in Island Beach State Park, New Jersey. Cores were measured using a velmex measurement system and chronologies were developed using COFECHA software. A multiple regression was used to determine trends between the weather variables and tree ring width by year, and the following year by using lag variables. Long-term trends were examined by converting annual ring widths into basal area increments and correlating tree growth to long-term data trends such as increasing atmospheric CO_2. The relevance of this experiment is to examine the effect of climactic variables on the annual growth of trees in maritime forests, which can be useful in forest management practices. In addition, the information gained through this experiment can help to further understand the impact that climate change is having on ecosystem health in maritime forests.

DEPARTMENT OF CHEMISTRY AND PHYSICS

DETERMINATION OF THE EBOLA VIRUS 5′-UTR SECONDARY STRUCTURE

Stephan Andersen

Department of Chemistry and Physics

Faculty Mentor: Dr. Jonathan Ouellet

ABSTRACT

Ebola is a single stranded RNA virus that has affected about 28,000 people since last year, mostly in the North West African countries. The outbreaks in Africa are getting under control but without a current vaccine or an established method of treatment for Ebola, it is only a matter of time until the next one.

Like any other RNA strand of genetic material, Ebola's RNA genome consists of coding regions and non-coding regions. The coding regions encode for the proteins of the virus, both structural and non-structural (such as enzymes). The non-coding regions on the virus, which are located at the 5′- and 3′-ends of the RNA, are responsible for the maintenance and replication regulation of the virus. These untranslated regions (UTR) fold into a secondary structure independently from the coding regions of the RNA strand.

The goal of this project is determining the secondary structures of the UTR at the 5′-end. Ebola's UTRs has specific secondary structure features such as base-paired stems and single-stranded regions. To determine the secondary structure of RNA, the selective 2′-hydroxyl acylation analyzed by primer extension (SHAPE) experiment has been shown to be effective. This experiment works by partially acylating the single stranded areas of the RNA while it is in its secondary structure. Next, reverse transcription is done which stops at the points where acylation has occurred. The varying lengths of DNA created are used to determine where the stem and loop structures are.

A consensus sequence of the first 80 nucleotides was determined out of 160 Ebola sequenced genomes. DNA oligonucleotides were purchased and amplified through PCR and transcribed. The RNA includes an extra sequence where a fluorescent primer can bind for reverse transcription initiation. The next step is to perform the SHAPE experiment on the RNA to determine the secondary structure of the 5′-UTR. The following step of the project will be to perform this process on a different strand of Ebola and compare the structures. Moreover, incubation of the RNA with cell extracts before the SHAPE experiment may be envisaged to monitor potential protein binding to the Ebola 5′-UTR.

SILVER NANOPARTICLES: FUNDAMENTAL PROPERTIES AND POTENTIAL APPLICATIONS

Emily Beyer

Department of Chemistry and Physics

Faculty Mentor: Dr. Tsanangurayi Tongesayi

ABSTRACT

Nanoparticles (NPs) are small particles with a size range of one to 100nm metal that can be synthesized by either top-down methods or bottom-up methods. Top-down methods involve cutting larger materials into nanomaterials using lithographic techniques or etching while bottom-up methods involve growing the NPs from simple molecules or ions. Nanoparticle-based research has largely focused of technological applications of NPs at the expense of their fundamental properties and environmental impacts. We believe that a complete understanding of the physicochemical properties and environmental impacts of the NPs should precede their utilization in consumer products. Silver NP, for instance, have shown tremendous potential in the biomedical field particularly in anticancer treatments. The NPs have immense antimicrobial properties and have potential applications as disinfectants on medical tools and other medical surfaces. However, their electrochemical behaviors, ecotoxicity, and cytotoxity among a slew of physicochemical properties have not been extensively studied. The major goal of this project is therefore to study the size- and ligand-dependent physiochemical and electrochemical properties of silver-NPs, their environmental impacts and potential applications. Specific objectives are to: 1) develop methods to synthesize silver-NPs for specific functions, 2) fully characterize the synthesized NPs with respect to key physicochemical features such as size, shape, surface area, solubility, surface functionalities, zeta potential, and electron microscope images in solution, 3) use electrochemical techniques to study the redox behavior of the NPs, 4) use the mobility of selected heavy metals under natural conditions to study the adsorption properties of the NPs, and 5) develop silver NP-based technologies for environmental remediation and water treatment. To date, we have explored various reducing and stabilizing agents in the synthesis of silver-NPs, and we are in the process of characterizing the NPs.

INVESTIGATION INTO THE USEFULNESS OF THE IMMATURE PLATELET FRACTION IN THE EARLY DETECTION OF SEPSIS

Christina Culmone, Jessica Stanton, and Jamie Himmelreich

Department of Chemistry and Physics

Faculty Mentor: **Dr. William Schreiber**

Collaborators: Mariah Egerter[1], Patricia Greenberg, MS[2], Yen-Hong Kuo, PhD[2], Brian Erler MD, PhD[3], Albert Rojtman, MD[4], Susan Sable BSMT (ASCP)[4], Mary Jane C. Schaefer, MS, MPA[1]

[1]Florence M. Cook School of Medical Laboratory Science, [2] Office of Research Administration, [3]Pathology Department, [4]Microbiology Department, Jersey Shore University Medical Center

ABSTRACT

Early diagnosis of sepsis is a critical challenge, as delays increase the likelihood of progression to severe sepsis, septic shock, and sepsis-related mortality. Therefore, discerning optimal biomarkers capable of identifying patients at risk for sepsis is crucial. Elevated lactic acid levels (>2.0mmol/L) and positive blood cultures have traditionally been used as indicators of sepsis. However, Di Mario et al., 2009, and De Blasi et al., 2013, have proposed the use of the immature platelet fraction (IPF) as a predictor for sepsis. In response, the purpose of this study was to assess the efficacy of the IPF as a biomarker for the early detection of sepsis. This observational study was conducted at Jersey Shore University Medical Center (JSUMC) utilizing in-patient specimens in January and February of 2017. All samples were run in the JSUMC clinical laboratory on various chemical and microbiological analyzers, which were used to measure the lactic acid levels, IPF values, and blood culture results for each patient. The data were then accessed via the Laboratory Information System (LIS). A descriptive statistical analysis was conducted, and elevated lactic acid levels were compared with the IPF values in septic patients.

DEVELOPMENT AND ISOLATION OF AN APTAMER FOR 2-HYDROXYGLUTARTATE

Artiom Efimenko

Department of Chemistry and Physics

Faculty Mentor: Dr. Jonathan Ouellet

ABSTRACT

Currently, one of the most effective ways of diagnosing cancer is through examination of intracellular components to determine whether or not the cell contains specific molecules, known as oncometabolites. These oncometabolites, which are produced only in the aftermath of metabolic events taking place within the cancerous cell, serve as biological markers for cancerous cells. These biomarkers set the basis of our research project, which is developing an RNA aptamer against the oncometabolite 2-hydroxyglutarate, a molecule derived from the Krebs's cycle of certain glioblastomas and lymphomas. The RNA aptamer complexes with a hammerhead ribozyme to form a molecule capable of catalyzing self-cleavage upon binding to 2-hydroxyglutarate. The ribozyme, which is then inserted within human DNA, can function as a bioswitch, regulating gene expression for a cellular toxin to ultimately destroy the cancerous cell. In order to generate a functional aptamer for 2-hydroxyglutarate, the RNA is subjected to stringent selection by introducing a method of Systematic Evolution of Ligand by Exponential Enrichment, or commonly referred to as the SELEX cycle. With SELEX, we are able to narrow down the wide range of RNA combinations to those that are selected for to be the most effective aptamers. As of right now, the project has successfully completed nine cycles of SELEX and are proceeding with the tenth cycle. The next step of the project after selection is to insert the RNA within a bacterial plasmid and perform bacterial cloning to select for the most effective aptamer.

MEASUREMENT AND ANALYSIS OF DIMINAZENE BINDING AFFINITY TO DNA

Grant Gillan and Sydney Lavan

Department of Chemistry and Physics

Faculty Mentor: Dr. Dmytro Kosenkov

ABSTRACT

The stabilization of G-Quadruplex DNA (gqDNA) through ligand intervention has been a popular subject of anticancer research study in recent years. In order to properly stabilize gqDNA, thus inhibiting cancerous telomerase activity, these ligands must display a significantly higher binding affinity for gqDNA as opposed to double stranded DNA. In addition to an inability to display the desired anticancer activities, ligands with a higher binding affinity for double stranded DNA could also drastically affect double stranded DNA's ability to efficiently execute the vital gene replication process. Gas-phase optimization, molecular docking, and fragment molecular orbital calculations were carried out to simulate binding of promising potential therapeutic ligand diminazene[1] to DNA.

References:
[1]Wang, C., et al. *Eur. J. Med. Chem*. 2016, **118**, 266-275.

EVALUATION OF SELECTIVITY OF BINDING OF DIMINAZENE AND ITS ALKYNE ANALOGS TO DNA

Sydney Lavan, Grant Gillian, Katlynn Muratore, and Erin Hoag

Department of Chemistry and Physics

Faculty Mentor: Dr. Dmytro Kosenkov

ABSTRACT

The binding of organic ligands to telomeric G-quadruplex DNA (gqDNA) may act as an anti-cancer therapy. The stabilization of gqDNA using polycyclic aromatic ligands, in particular, diminazene (DMZ) and its alkyne analogs, has been shown to prevent the rapid cell division that ultimately leads to cancer.[1] However, these ligands, when placed into an environment that contains double stranded DNA (dsDNA) and gqDNA, have displayed possible toxic effects due to their high affinity to dsDNA. A higher binding affinity to dsDNA may interfere with gene replication depending on the place of binding. The modeling presented here has been to test the relative affinities (binding energies) of DNA-ligand binding in order to establish the ligand structure that will provide the best selectivity for gqDNA. By simulating a natural molecular environment, an efficient assessment can be made using several computational trials conducted through various methodologies (e.g. molecular docking, molecular dynamics simulations). This work is focused on the testing of interactions of recently synthesized polycyclic aromatic ligands, namely DMZ and three of its analogs.

References

[1]Wang C, Carter-Cooper B, Du Y, Zhou J, Saeed MA, Liu J, Guo M, Roembke B, Mikek C, Lewis EA, Lapidus RG, Sintim HO. *Eur. J. Med. Chem.* 118 (2016): 266-275.

ADSORPTION OF LEAD AND ZINC ON MICROPLASTICS FROM HAND, FACIAL, AND BODY CLEANSERS

Andrea Mora, Chioma Gabriel, Hannah Hilbrandt, Kristel Gousse

Department of Chemistry and Physics

Faculty Mentor: Dr. Tsanangurayi Tongesayi

ABSTRACT

Consumer products such as hand, facial, and body cleansers are some of the major sources of microplastics in the natural aquatic system. Besides being water contaminants, microplastics transport chemical and biological pollutants from wastewater to natural aquatic environments through adsorption. By adsorbing chemical pollutants and microorganisms on their surfaces, mircoplastics can also influence the biogeochemistry of metal(loid)s and hence the speciation, mobility, bioavailability, and toxicity of the chemical pollutants in water. In this study, we investigated the adsorption of lead and zinc by microplastics extracted from various hand, facial and body cleansers to determine conditions and mechanisms of binding under simulated natural conditions. Our data shows significant binding of both heavy metals under conditions investigated.

DEVELOPMENT AND ISOLATION OF AN APTAMER FOR GLUCOSE-6-PHOSPHATE

Kushkumar Patel

Department of Chemistry and Physics

Faculty Mentor: Dr. Jonathan Ouellet

ABSTRACT

Once glucose had entered the cell, it is phosphorylated on the carbon 6, which is catalyzed by the hexokinase enzyme, to produce glucose-6-phosphate. Glucose-6-Phosphate is used in the glycolysis to produce fructose-6-phoshate in preparation for phosphorylation to fructose-6-bisphosphate. The goal of this project is to isolate an aptamer for glucose-6-phosphate through SELEX using a hammerhead ribozyme, a self-cleaving single strand RNA that has a ligand binding site. For my project, I have designed a DNA strands by randomizing thirty nucleotides which produces 4^{30} strands of DNA that can be transcribed into RNA and potential aptamers. To develop this aptamer, the technique that will be used is the SELEX (Systematic Evolution of Ligands by Exponential Enrichment) cycle. There are multiple steps involved in the SELEX cycle, such as PCR (Polymerase Chain Reaction), transcription, negative & positive selection, reverse transcription, etc. By performing PCR on the DNA, the number of RNA can be amplified which then can be put through a selection process. The cleavage of the aptazymes and binding effectiveness can be identified by a Polyacrylamide Gel Electrophoresis (PAGE) which can allow the desired length of RNA strand to be recognized before and after cleavage. The desired RNA is then eluted from the gel and then reverse transcription is done and the cycle is repeated. By completing multiple cycles, impurities and undesired DNA and RNA strands will be removed and will, overall, develop a better aptamer under harsh conditions. After an aptamer is developed, the next step is to transform the aptamer into a riboswitch to control gene expression. Throughout the semester, the first generation of DNA was run through the SELEX cycle and is currently at the positive selection. Through multiple cycles, we hope to isolate an aptamer for glucose-6-phosphate.

RADIOACTIVITY-FREE KINETICS

Shenin Siddiqui

Department of Chemistry and Physics

Faculty Mentor: Dr. Jonathan Ouellet

ABSTRACT

Currently, DNA kinetics is observed mainly through the use of radioactivity. However, using radioactivity raises safety concerns and heavy regulations. Therefore, this project will be focused on determining which dye is best fitted to resolve small quantity of short DNA fragments on acrylamide gels. To understand the structure/function relationship of many nucleic acids, kinetics of the DNA is monitored over time and separated on acrylamide gels using radioisotope phosphorus-32. To observe the DNA fragments, various DNA lengths are separated by a polyacrylamide gel. Next, the DNA in the gel is fixated and saturated with different dyes. Afterwards, the gel is de-stained in a manner that would allow only the DNA to be stained and the rest of the gel to remain clear. This method would allow the DNA to be detected under white light, colored light, or ultra violet light. With the help of the dye, DNA at different concentrations could be observed and quantified using the software image to do densitometry analysis on a picture of the gel. Many different dyes would be used to find the ultimate dye that would give the best result to visually observe DNA and observe the function and structure of nucleic acids. Once set with DNA, this technique could be used to monitor kinetics of DNA cleavage. More importantly, it could be used in the field of RNA kinetics to monitor the RNA cleavage of ribozymes. As of now, DNAs (70 nucleotides) have been observed with Methylene blue and SybrGold dyes. In the future, more dyes with DNAs (70 nucleotides) as well as other different lengths of DNAs will be used for observation.

SELECTION OF AN APTAMER THAT BINDS GLUCOSE

Emma Stowell

Department of Chemistry and Physics

Faculty Mentor: Dr. Jonathan Ouellet

ABSTRACT

Type 1 diabetes mellitus is a metabolic disease which occurs when the pancreas does not produce enough insulin, resulting in high blood sugar levels. While not life-threatening with proper management, type 1 diabetes continues to affect millions of people. It can be a debilitating and inconvenient condition, as the most popular treatment involves regular injection of insulin.

My project will eventually lead to developing a new form of treatment for diabetes that would be pain free for patients, as opposed to injection. This will be done by converting an aptamer that strictly binds glucose into a riboswitch, which will regulate the production of insulin in the presence of glucose.

To select an aptamer which binds tightly and specifically to glucose, I have used systematic evolution of ligands by exponential enrichment (SELEX). This method begins with amplification of DNA by polymerase chain reaction (PCR). The amplified DNA is then transcribed to RNA to perform both negative and positive selection. Negative selection consists of incubating the RNA with the glucose analogues and magnesium. After incubation, the selection product is analyzed using polyacrylamide gel electrophoresis. Any RNA that has cleaved at this stage is removed, as the aptamer should not cleave without glucose. The next step is positive selection, which consists of incubating the RNA with glucose. At this point, the RNA should cleave because glucose is present, and any RNA that does not cleave is eliminated. Finally, reverse transcription is performed on the positive selection product to prepare for another round of SELEX, starting with PCR.

Ultimately, the goal is to isolate an aptamer which only cleaves in the presence of glucose, then convert it to a riboswitch. Using this technology, blood sugar could be maintained in a less invasive manner, making the lives of diabetes patients substantially easier.

CLONING OF A FLUORESCENT REPORTER GENE AS AN ASSAY TO MONITOR RIBOSWITCH MODULATION

Toni Zangrilli

Department of Chemistry and Physics

Faculty Mentor: Dr. Jonathan Ouellet

ABSTRACT

This project has been attempted by a previous student where the sequencing returned with missing genetic information. Therefore, I restarted the project with the same goal of creating a biosensor system using the pHL 1278 plasmid for the theophylline aptamer. Theophylline is a molecule that is similar to but differs from caffeine by only one methyl group. It is used in inhalers as a bronchodilator for those who suffer from asthma. An aptamer is RNA that binds to a specific molecule in this case the aptamer we are focusing on is the one for theophylline and the project will also further prove the concept of the theophylline aptamer. In order to test this theory, an expression platform, riboswitch, needs to be created to pair with the aptamer. This riboswitch is a section of the DNA that will have the gene expression paired and a specific aptamer with which it binds, the theophylline aptamer.

A riboswitch that is known to bind to theophylline was inserted into the pHL plasmid that was isolated through a series of purifications and replications. The insert was isolated with two enzymes and the plasmid was as well, using the same two enzymes. In theory, once cloning has taken place, the final plasmid structure will consist of a single promoter, the mCherry gene, the riboswitch, and the GFP gene. In this gene expression system, mCherry will always be translated as the protein. GFP translation will be regulated by the presence of theophylline. In the absence of theophylline, the sequence of DNA necessary to translate GFP is inaccessible and will prevent the translating of GFP. Therefore, to test for the success of the ligated plasmid and the effectiveness of the riboswitch as a biosensor, a ratio of the mCherry vs. GFP will be used.

DEPARTMENT OF
COMPUTER SCIENCE AND SOFTWARE ENGINEERING

MU CLUBS & EVENTS

Kyle Blazier and Mary Menges

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Raman Lakshmanan

ABSTRACT

MU Clubs & Events is a mobile app for Monmouth students to manage their interests in various campus clubs and activities. Campus clubs and organizations post events as public (for all subscribers to the club) or private (for members of the club). The events information is presented to the students on the phone, watch and their electronic calendar on the phone. The events can be quickly shared with other students using messaging services. Advanced analytics gathers usage patterns, effectiveness of the app user interface, time of usage, and number of subscribers and members in clubs and their activities.

WHAT'S GOOD MU?

Taylor Campos, Casey Little, Giuseppe Licata, Tighe Blazier, and Nicolas Sciolaro

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Cui Yu

ABSTRACT

University students have a number of social opportunities via activities organized by school, department, student clubs, etc. However, many students like to socialize more casually at the places they go, without it being so formal or organized. With the intention of supporting more student social opportunities and bringing the Monmouth twenty-one-plus community together, we created an Android application that helps students decide where to go each night based on where their fellow students are going for fun.

As the first version of development, we created What's Good MU, which helps MU students find which students are attending which local bar, and then decide whether or not they want to join them that evening. This app allows for MU students to make friends, find people who share a common interest, and have a great time after busy days of studying.

This application also allows bars and clubs within a fifteen-mile radius of the university to gain recognition amongst the students, therefore promoting local businesses. This application is college specific and only the students at particular university/college will be able to communicate with each other within this app. Our app provides a safe and reliable platform for student socialization.

OCCUPI ROOM AT MONMOUTH UNIVERSITY

Stephanie Cornick, Kenneth Magner, Christian Rebelo and David Walker

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Cui Yu

ABSTRACT

As members of the Monmouth University community for the last several years, our four group members realized a problem on campus. When in need of a quiet room to study, a student could find themselves jumping from classroom to classroom, thanks to classes coming and going every hour or so. We have all grown sick of this hassle and ventured out to solve the problem. This is what led to the birth of OccuPi Room at Monmouth University. OccuPi Room has two elements. First, the website, which is open to the public. It offers a page for each academic building, showing students and faculty which rooms are currently occupied and are not. If a classroom is taken, it will display the class that is in there and until what time. It also uses a red and green color coding system. This allows for students to find an open area to do their studying before even coming to campus. There is no more need to play the guessing game when coming to campus in regards to where you can study. If you are already on campus, you can also make use of the second feature, which is the raspberry pi devices that would be located on each floor of each academic building. This device displays a map of the current floor a student is on, and offers the same green and red color scheme to showcase which rooms are open. The goal of this project was to make life easier for students and faculty, and we feel it accomplishes that mission.

SMART DESK

Stephanie Cornick

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. William Tepfenhart

ABSTRACT

This thesis explores the development of a Smart Desk, a computer system set up to allow people to communicate and collaborate in a work environment from remote locations. In general, this project achieved the development of a Smart Desk through installation and use of software and accessories on an existing operating system in a computer. First, the introduction sheds light on where the idea originated and the history of office work, what was expected to be the end result, and a general overview of how the approach to creating the Smart Desk went. Following that, the overview of the technical approach is used as a template for the body of the thesis, the research results. Each step of the process of researching and building the Smart Desk is described in this section, from establishing needs through reengineering of a prototype, as well as the results of all research or testing done along the way. In the end, after all the development and testing of the prototypes have been built and evaluated, what can be conclusively said is that most of the capabilities needed exist, though there are some limitations in what is available and gaps in functionality that have not been satisfactorily filled.

GOODJOB – A JOB FINDING APPLICATION

Phil DiMarco, Kristopher Horton, Darius Jenkins, Alyssa DiRe

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Daniela Rosca

ABSTRACT

GoodJob is a job finding application that will allow users to quickly find jobs that are relevant to their interests. Currently on the market, job seekers use applications like Monster, Indeed, Switch, and Jobr. These applications have been on the market for over two years and have a combined total of over a half-million downloads. The reviews for these applications are subpar and their users are mostly dissatisfied. This presents a massive opportunity for innovation and improvement in this category. GoodJob makes the process of finding and applying for jobs simple and easy, with one swipe a user is able to apply for any job they are interested in. With GoodJob, businesses are able to quickly post jobs, chat with potential candidates, and hire the right fit. GoodJob aims to simplify both the job finding process and the hiring process, for both job seekers and employers. GoodJob consists of a smartphone application for job seekers, and a web application/portal for businesses. The smartphone portion of our application is currently only avalible for Android users. This application has been implemented using the trendiest software tools and languages to deliver the best user experience possible (Amazon Web Services, CouchDB, Elixir/Phoenix, AngularJS 2.0, HTML5, Android SDK).

MONMOUTH UNIVERSITY AUGMENTED REALITY CAMPUS APP

Veronica Granite, Giuseppe Stramandinoli, Andrew Barnes, and Yuhan Xue

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Daniela Rosca

ABSTRACT

The Monmouth University Augmented Reality Campus Application allows users to navigate to specific buildings using the A* algorithm, which calculates a visible path for users to follow. Users can navigate from their GPS location while on the Monmouth University campus, or through selecting which buildings they would like to navigate from and to. The app will also display building information when buildings are selected to help users learn more about the campus. Additionally, the users can also find out where parking, cafeterias, and sport facilities are through filters that will mark where any of the mentioned categories are on campus.

The Monmouth University Augmented Reality Campus App (MU AR Campus App) was designed to help students, faculty, and visitors interactively navigate and learn about the Monmouth University campus. The app was developed with the Unity game engine to produce scripts and attach them to assets (where the assets are created in Unity or Autodesk's Maya software) and the Vuforia AR plugin. The Vuforia plugin turns the Unity scene into Augmented Reality. All scripts were programed in C# to provide extra dynamic functionality. Using augmented reality (AR) technology allows users to explore Monmouth University in a visual 3D space. The app advertises MU's technological and educational advancements by providing a functional tool and "wow-factor" with AR technology.

The production of the application was made with the Agile process model, where the length of development was divided into three sprints, across three months. We divided the contents of each sprint based around the functionality, where functionalities built off of each other. We also wanted core functionalities to get completed within the first two sprints, where the final sprint just add additional features, such as sounds. The application's first release will be available on the Google Play Store for android devices.

STUDENT CAMPUS LOCATION TRACKER

Alex Kaczynski, Grady Jenkins, Kevin Meehl, and Tejal Deshpande

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Daniela Rosca

ABSTRACT

The Campus Location Tracker project was developed to provide the students of Monmouth University an application to improve safety conditions on campus. Students can use this application to request assistance from MUPD, track friends, and provide the school police department with crucial information that can be used to improve the Monmouth University campus as a whole. This is a service goal, hoping to help Monmouth grow and make the school safer, proving better piece of mind to the student body. With the recent trend of security concerning events at colleges around the world, safety on campuses has never been a bigger concern than right now. This application will give the students a safer environment and allow parents additional peace of mind once this is implemented.

Around popular locations on campus, Radius Network beacons are installed. These beacons will allow students to pass through locations and ping their location to their allowed “friends.” This will allow for friends to track friends on their commutes around campus making sure their safety is never in danger. If a student fails to arrive at a location, either the student or the “friend” will have the ability to take a step by step process to alert the local police department. Altering MUPD will disclose the location of the troubled user and their cell phone number to the dispatcher. Further actions can then be arranged by the police department.

Our team used the Agile process model for development. Solutions for our project evolved through collaboration between self-organizing, cross-functional teams utilizing the appropriate practices while moving though each iteration. Our team of 4 has development the location tracker has been though the Xcode environment for the front and back end, with the inclusion of the Radius Network API. The database is hosted by the Google Firebase for storing all student, sensor, and location information. The application is strictly limited to iOS devices for implementation.

A ROBOT TO IMPROVE VERBAL COMMUNICATION SKILLS OF CHILDREN WITH AUTISM

Prashanthi Mallojula

Department of Computer Science and Software Engineering

Faculty Mentors: Dr. Richard Scherl and Dr. Patrizia Bonaventura

ABSTRACT

Children diagnosed with autism typically display difficulty in the areas of social interaction and verbal communication. Various studies suggest that children with autism respond better to robots than to humans. We have been experimenting with various types of robots. Here we report on our work with the GoPiGo robot.

Because the GoPiGo robot is based on the Raspberry Pi, it allows for flexible programming in Python. The robot is programmed to elicit verbal social interaction. Sensors are used to calculate the child's position and determine when to deliver speech. The children's response to the robot's questions are recorded and then analyzed.

A-40

IMPROVING TEXT MINING WITH ENHANCED NAMED-ENTITY RECOGNITION

Prashanthi Mallojula

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Richard Scherl

ABSTRACT

Text mining methods, such as classification and clustering, all work by first converting each text into a vector. Our approach adds to these features, some that are not overtly present in the text. The hope is that this will lead to improvement in the text mining methods.

Named-entity recognition identifies words or phrases in the text that are names of people, organizations, or locations. We use the Stanford Core NLP parser to perform this step. Next, we match the identified entities with those in the DBpedia archives. DBpedia is a semantically organized database that is automatically created from the structured content of Wikipedia. In accordance with the principles of the Semantic Web, DBpedia has a large ontology that further categorizes people, organizations and locations. For example, DBpedia provides the profession of the person, the location as a county or state in the US, etc. It is hoped that this added information will improve the quality of the output of clustering and classification algorithms. Future experimentation, will address this question.

The project is developed using Python and various libraries for handling text and large amounts of data. Much work has been directed to efficiency because of the size of the DBpedia archives.

ROLL CALL

Brandon Shaw, Richard Kanson, James O'Donnell, and Connor Power

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Cui Yu

ABSTRACT

With the booming progression of technology that has occurred in the past decades, people have had the ability to utilize computer systems to make their study, work and daily life much easier. For example, students from elementary schools to graduate school are using computers to do homework assignments, prepare for exams, and write research papers, etc. There are certainly a lot more applications that we can build to further explore and assist students in various activities and events.

Through the school years, most students are busy doing assignments and projects to keep up academically. Many don't have much time to attend clubs or event meetings. As a result, they would have to skip many student activities. The application we built is a web-based system, called Roll Call, which allows students to create and sign in groups, which could be for clubs, special events, or just study teams. They can make announcements, view notices, attend on-line meetings, and, most importantly, all the meeting records will be kept in calendar to view, even if someone has to be absent. The goal is to avoid having students take extra time out of their busy schedules to attend every meeting by physically going, when they can easily do it online.

This application is currently being developed for students to use, so that they can do their school work as well as participate in different activities and events without the hassle of actually going to the meetings. However, faculty, staff, and probably anyone, can make use of it to organize meeting notes and look up meeting records whenever needed. HTML, CSS, JAVASCRIPT, BOOTSTRAP, and MONGO DATABASE are used in our implementation.

E ZPLAN R

Harry E. Torrenegra, Jordan Liebling, Darnell Leslie, Paul Miceli, and Michael Sagan

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Daniela Rosca

ABSTRACT

EZPlanR is a clean, easy to use solution for schools to keep track of student's grades. EZPlanR will also make it easy to view grades as a parent or guardian. For the teaching staff at school, EZPlanR will provide an accessible, and easy to use tool for keeping track of student progress. The system should provide teachers with the ability to describe their graded work for users, giving each task (test, assignment, homework, etc.) attributes like names, due dates, weights, and more.

SYMPTOMS TRACKER

Akhil Yaragangu

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Nafi Diallo

ABSTRACT

Symptoms Tracker is an application designed to track health condition symptoms such as dizziness. When a patient suffers from a condition, it helps his or her physician to know about accompanying symptoms for more adequate treatment options. However, it is generally noticed that patients find it difficult to track the symptoms of that condition every time they go through it. It is even a bigger challenge to submit complete information to the doctor.

With Symptoms Tracker, we hope to design an app which will help symptom tracking and monitoring easy. Doctors can have instant and continuous access to their patient data so as to be able to provide more adequate and timely advice to the patient for treatment options. The app is design such that minimal input is required from the user to track a symptom. Because this is storing patient health data, it also designed with security in mind.

Symptoms tracker is an IOS-based app. IOS provides a sleek and simple interface and has ease of use controls to display to it. 7 out of 10 people uses Apple phones.

DEPARTMENT OF MATHEMATICS

ASSESSING THE CHARACTERISTICS AND RECURRENCE OF HEMANGIOPERICYTOMA IN DOGS AT RED BANK VETERINARY HOSPITAL

Austin Alcott, Kelsey Fittipaldi, and Hailey Ruroede

Department of Mathematics

Faculty Mentor: Dr. Richard Bastian

ABSTRACT

The focus of this study is to analyze the characteristics and recurrence rate of Hemangiopericytoma tumors in dogs at Red Bank Veterinary Hospital in Monmouth County, New Jersey. Hemangiopericytoma tumors are a type of soft tissue sarcoma, which are locally invasive and have a low metastasis rate, meaning that they mostly grow in size rather than spread to other areas of the body. There are few studies on Hemangiopericytomas, as most studies are on soft tissue tumors in general.

Dr. Ariel Kravitz, a veterinarian at Red Bank Veterinary Hospital, compiled data on dogs who have undergone surgery for Hemangiopericytomas between 2011 and 2016. Characteristics of each tumor, such as location, size, grade, and margin were recorded, along with characteristics of each dog. Recurrence was counted if a dog returned for a second, non-revisional, surgery or if the dog's cause of the death was tumor-related. Survival analysis was used to see which characteristics had an effect on the time to recurrence of Hemangiopericytoma.

ANALYSIS OF STATE CHOICES UNDER THE AFFORDABLE CARE ACT

Christina Alexander, Joseph Govea, and Anthony Hamill

Department of Mathematics

Faculty Mentors: Dr. Richard Bastian and Dr. Stephan Chapman

ABSTRACT

Approved in 2010, the Affordable Care Act was a comprehensive piece of legislation that transformed our health insurance system. With such an intricate policy, it is important to understand whether or not the democratic theory is fulfilled – where the wishes of the people are represented accurately by elected officials. This research project tries to shed light on this point, by focusing on three aspects of policy output: citizen ideology, partisan control, and socioeconomics effects. The premise is that a rational politician will want to retain their power through re-election. Thus, they must account for the views of their citizens, their constraints of the party, and their unique state situations. Most of the socioeconomic effects were obtained from the 2010 census, with the Kaiser Family Foundation as the main database of information. Data in this project will be analyzed through binary and multinomial logistical regression. Interactions between the three categories will be the main focus, while still allowing for individual factors to be tested on an individual level. Thus, this research hopes to prove effect beyond a single variable within each aspect of policy output. Previous research has analyzed single factors on policy output. However, what sets this research apart is the understanding that multiple factors, even interactions between the factors, may play a major role in accurate representation of citizen ideology in government.

A-46

ANALYSIS OF POST-PARTUM DEPRESSION AND POSSIBLE CAUSING FACTORS

Brielle Forsthoffer and Hope Sonner

Department of Mathematics

Faculty Mentor: Dr. Richard Bastian

ABSTRACT

Data was collected from women who gave birth at Monmouth Medical Center. After a woman gives birth they are required to fill out a questionnaire regarding post-partum depression before they are able to be discharged. The questionnaire consists of 10 questions, and the scores could range from 0-30. If a woman is to have a high score on the questionnaire or answer “yes” to question 10 (which asks about suicidal thoughts), she is to be referred for a psychological evaluation. The possible predictors used in this study were timing of epidural placement, age, religion, hours in labor, and delivery type. Analysis revealed that patients who received an epidural after being at least six centimeters dilated, which is considered active labor, are less likely to report a score of 5 or higher. Also, if a patient is of the specific religion, they are more likely to report a score of 4 or less. If a patient is having a cesarean section rather than delivering vaginally, they are more likely to report a score of 10 or higher. Women over the age of 35, advanced maternal age are reported to have a score of 5 or higher. The results of the tests are reported in percentages as requested by the client. These tests were performed using chi-square cross tabulation tables.

STATISTICAL ANALYSIS OF THE SALINITY GRADIENTS OF MANGROVE TREES IN THE BAHAMAS

Jennifer Minor and Lindsay Weber

Department of Mathematics

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

ABSTRACT

Mangrove trees store carbon-dioxide and release carbon back into the soil. Dr. Pedram Daneshgar and Kristen Jezycki are looking at soil respiration of mangrove trees in the Bahamas. Together they collected 88 soil samples from four different creeks, taking one from each of the three zones of the creek as well as one from each type of salinity treatment, hypersaline and ambient. They measured the soil respiration of each and want to know, does the location (creek) and environment (water salinity) of mangrove trees affect soil respiration (carbon dioxide absorption)?

To statistically analyze our research question various steps had to be taken. The data had to be checked for normality before any further tests were conducted. Since the cumulative carbon per hour data collected was not normal, we transformed the data in order to run ANOVA (Analysis of Variance) interactions. We did a reciprocal transformation, in which we put each value into a fraction as 1/[x], and a logarithm transformation, in which we took the log (x) of each value, in order to get more accurate results. After normality assumptions passed One-Way and Univariate ANOVAs were ran. These tests would show if there were any significant difference between the locations, water salinity and carbon absorption. The results show significant differences between the two salinity treatments, between the fours sites and between the zones of the sites. The Univariate ANOVA also told us that there was an interaction between the sites and the zones of the creeks. We also ran a Non-Parametric Test on the cumulative carbon per hour, on the original data without normality. This test, an independent samples Kruskal-Wallis Test showed the same results as the ANOVAs on the transformed data. Concluding that the location and environment of mangrove tress does affect the soil respiration.

HOW SNAIL SHELL COLOR VARIATIONS AFFECT HABITAT BEHAVIOR

Alyssa Parker and Larissa Russo

Department of Mathematics

Faculty Mentor: Dr. Richard Bastian

ABSTRACT

Dr. Phifer-Rixey is an evolutionary biologist and biology professor at Monmouth University who is currently studying flat periwinkle snails, *Littorina obtusata*, on the Gulf of Maine. Her previous research showed that lighter snail shells absorbed less heat, thus allowing them to survive in hot and sunny conditions better than darker shelled snails. These results lead her to conduct a new study regarding the snails' behavior in their environment. She hypothesizes that since lighter snails have higher survival rates, they utilize the entire tidal area while darker snails stay toward the lower tidal region where the environmental conditions are less extreme. A second hypothesis is that darker shelled snails will be found more frequently than lighter snails under an algae known as Ascophyllum (rockweed), especially on hot, sunny days. Because of the way the data was collected, each of the hypotheses have their own data set. The response variable for the first set of data shows each snail's location in terms of tidal area, either high or low. The predictors for this data include shell color (light, olive, or dark), size (small, medium, or large), sex (male, female, or undetermined), and region (upper river, middle river, or coast). For the second set of data the response variable shows each snail's location relative to the rockweed, either on the surface or underneath. This data's predictors include shell color (light, olive, or dark), environmental condition, surface temperature, air temperature, and flux (incident light). To test this data, a series of chi-squared tests and logistic regressions were run. The results of this analysis will show how snail shell color variations affect their behavior within their habitat.