MONMOUTH UNIVERSITY
SCHOOL OF SCIENCE

MONMOUTH UNIVERSITY
STUDENT SCHOLARSHIP WEEK

School of Science Student Research Conference

Friday April 26, 2019

Agenda

1:00 pm – 2:00 pm	**Registration and Poster Set-up**
	Lobby – Science Building
2:05 pm – 2:10 pm	**Welcome**
	Assistant Dean John Tiedemann
2:10 pm – 2:25 pm	**Opening Remarks**
	Georgiana Syby, MPH {MU BS Biology '03} **Head of Clinical Services** **AlcheraBio LLC**
	Lobby – Science Building
2:30 pm – 4:30 pm	**Poster Session**
	Room 201, Lobby & Main Level – Science Building
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 and Student Awards**
	Dean's Awards for Excellence in Research
	School of Science Departmental Awards
	• **Biology** • **Computer Science & Software Engineering**
	Main Lobby – Science Building

MONMOUTH UNIVERSITY

SCHOOL OF SCIENCE

18th ANNUAL STUDENT RESEARCH CONFERENCE

APRIL 26, 2019

Department of Biology

BY-1 TOXIC BENTHIC DINOFLAGELLATES IN BAHAMIAN INTERTIDAL CREEKS ON THE ISLAND OF ELEUTHERA

Gina Badlowski

Faculty Mentor: Dr. Jason Adolf

BY-2 CAN A HANDHELD CYANOFLOUR MEASURE CYANOBACTERIA ABUNDANCE IN COASTAL LAKES?

Erin Conlon

Faculty Mentor: Dr. Jason Adolf

BY-3 APPLYING FLOW CYTOMETRIC METHODS TO MEASURE MIXOTROPHIC GRAZING IN *Karlodinium veneficum* UNDER VARYING TEMPERATURES

Skyler Post and Mia Collucci

*Faculty Mentor: Dr. Jason Adol*f

BY-4 EXPLORING THE ABUNDANCE OF *Diadema antillarum* ON A CORAL REEF IN THE BAHAMAS

Katrina Brooks, Abigail Urbanak and Geoffrey Schaefer

Faculty Mentor: Dr. Pedram Daneshgar

BY-5 DETERMINING MANGROVE PROPAGULE DISPERSAL DISTANCE IN PAGE CREEK, ELEUTHERA, THE BAHAMAS

Erin Conlon, Hunter Hostage and James Murphy

Faculty Mentor: Dr. Pedram Daneshgar

BY-6 CHARACTERIZING NORTHERN DIAMONDBACK TERRAPIN NEST SITE SELECTION WITH RESPECT TO VEGETATION IN SOUTHERN NEW JERSEY

Taylor Donovan

Faculty Mentor: Dr. Pedram Daneshgar

BY-7 INVESTIGATING THE IMPACTS OF *Casuarina equisetifolia* ON FOREST UNDERSTORY COMMUNITIES IN CAPE ELEUTHERA, THE BAHAMAS

Ashley Keating and Nikole Andre

Faculty Mentor: Dr. Pedram Daneshgar

BY-8 THE IMPACTS OF FIRE SUPPRESSION ON PITCH PINE POPULATIONS OF A MARITIME FOREST IN NEW JERSEY

Grace Roeder

Faculty Mentor: Dr. Pedram Daneshgar

BY-9 THE USE OF CONCH MIDDEN ASSESSMENTS AS EVIDENCE OF THE OVERHARVEST OF JUVENILE QUEEN CONCH (*Stombus gigas*) IN CAPE ELUETHERA, BAHAMAS

Charles Vasas, Kayla Rosado and Tyler Stoner

Faculty Mentor: Dr. Pedram Daneshgar

BY-10 EVALUATING THE TEMPORAL AND SPATIAL DISTRIBUTIONS OF ENDANGERED ATLANTIC STURGEON (*Acipenser oxyrinchus*) WITHIN SANDY HOOK AND RARITAN BAY

Lauren Kelly, Charles Vasas and Troy Ohntrup

Faculty Mentor: Dr. Keith Dunton

BY-11 EVALUATING THE SPECIES COMPOSITION AND SURVIVAL OF SHARKS CAPTURED IN THE NEW JERSEY RECREATIONAL LAND-BASED SURF FISHERY

Charles Vasas, Lauren Kelly and Troy Ohntrup

Faculty Mentor: Dr. Keith Dunton

BY-12 SECONDARY STRUCTURE ANALYSIS BY SHAPE-MAP OF THE EGFR AND VEGFR2 PRE-MRNA TRANSCRIPTS: UNCOVERING NOVEL REGIONS FOR RNA ANTI-SENSE TARGETED THERAPY

Ryan Fink

Faculty Mentor: Dr. Martin Hicks

BY-13 DESIGNING AND TESTING RNA THERAPEUTICS TO BLOCK VEGFR2 AND EGFR ACTIVATION IN HUMAN GLIOBLASTOMA

Flobater Gawargi and Kristel V. Gousse
Faculty Mentor: Dr. Martin Hicks

BY-14 INTEGRATION OF AUTHENTIC RESEARCH INTO AN UNDERGRADUATE LABORATORY COURSE: DESIGN AND SYNTHESIS OF A GENE THERAPY VECTOR

Kristel V. Gousse, Flobater I. Gawargi and Koushik Muralidharan
Faculty Mentor: Dr. Martin Hicks

BY-15 THERAPY RNA INTERACTION WITH HNRNPS AND EGFR/VEGFR2 MRNA TO INDUCE ALTERNATIVE SPLICING IN GBM

Michael R. Mazzucco, Flobater I. Gawargi, Koushik Muralidharan, Ryan N. Fink, Sawyer M. Hicks, Kevin Gallagher and Sarah Falotico
Faculty Mentor: Dr. Martin Hicks

BY-16 RNA THERAPEUTIC STRATEGIES TO BLOCK VEGFR2 EXPRESSION AND ANGIOGENESIS IN GLIOBLASTOMA MULTIFORME

Koushik Muralidharan, Flobater I. Gawargi, Kerianne Fuoco and Hemangi Patel
Faculty Mentor: Dr. Martin Hicks

BY-17 ANALYSIS OF GENE EXPRESSION IN *Mus musculus* NEURO2A CELLS FOLLOWING MTOR OVER-ACTIVATION

Tugba Akilli, Brianna DeBlois, Caitlin Dowling, Ryan Fink, Flobater Gawargi, David Grossi, Jive Jacob, Nadine Khalil, Tiffany Longo and Tyler Roth
Faculty Mentor: Dr. Cathryn Kubera

BY-18 EXAMINING THE ROLE OF FASCIN IN PRIMARY BRAIN CANCERS

Syed Mehdi Husaini and Esra Celik
Faculty Mentor: Dr. Cathryn Kubera

BY-19 USE OF ENZYMATIC ETHANOL ASSAY TO EVALUATE A *Gallus gallus* MODEL OF FETAL ALCOHOL SYNDROME

Nadine Khalil and Samantha M Perez
Faculty Mentor: Dr. Cathryn Kubera

BY-20 ANALYZING THE EXPRESSION LEVEL OF GABA RECEPTOR GENES IN *Gallus gallus* CHICK TISSUES THROUGH EMBRYONIC DEVELOPMENT

Taylor Nason

Faculty Mentor: Dr. Cathryn Kubera

BY-21 MANUKA ESSENTIAL OIL DECREASES THE PROLIFERATION OF HUMAN CANCER CELL LINES

Jive Jacob and Subah Soni

Faculty Mentor: Dr. Dorothy Lobo

BY-22 KUMQUAT ESSENTIAL OIL DECREASES THE PROLIFERATION AND VIABILITY OF BOTH NORMAL HUMAN FIBROBLASTS AND CANCER CELL LINES

Subah Soni and Jive Jacob

Faculty Mentor: Dr. Dorothy Lobo

BY-23 THE INHIBITING EFFECTS OF THYMOL, CARVACROL, AND CINNAMALDEHYDE ON METHICILLIN-RESISTANT *Staphylococcus aureus* (MRSA) AND METHICILLIN-SENSITIVE *Staphylococcus aureus* (MSSA)

Anadi Saini

Faculty Mentor: Dr. James P. Mack

BY-24 EXAMINING SOIL BACTERIA FROM ISLAND BEACH STATE PARK AS A BIOINDICATORS OF POLLUTION

Bailey Tully

Faculty Mentor: Dr. Karen Pesce

BY-25 VARIATION IN REPRODUCTIVE TRAITS AMONG MICE ADAPTED TO DIFFERENT REGIONS OF THE AMERICAS

Tiffany Longo and Jesse Bragger

Faculty Mentor: Dr. Megan Phifer-Rixey

BY-26 THE EFFECTS OF DIET ON ASPECTS OF BODY SIZE IN MICE FROM DIFFERENT CLIMATES

Sebastian Vera and Summer Shaheed

Faculty Mentor: Dr. Megan Phifer-Rixey

BY-27 BEHAVIORAL OUTCOMES OF CO-USE OF ALCOHOL AND AMPHETAMINE IN A RAT MODEL FOR ADHD

Jessica N. Baals, Nicholas R. Pillarella, and Pooja M. Shah

Faculty Mentor: Dr. Dennis E. Rhoads

BY-28 MODELING TREATMENT OF ADOLESCENT ALCOHOL DEPENDENCY WITH THE ATYPICAL ANTIDEPRESSANT TIANEPTINE

Natalie Negroni

Faculty Mentor: Dr. Dennis E. Rhoads

BY-29 GLUTAMATE RECEPTOR EXPRESSION IN MEMBRANE RAFT FRACTIONS FROM ADOLESCENT BRAIN: INFLUENCE OF ALCOHOL AND STIMULANTS

Marta Telatin

Faculty Mentor: Dr. Dennis E. Rhoads

BY-30 EVALUATING THE DIET SHIFT OF FEMALE BARBOUR'S MAP TURTLE (*Graptemys barbouri*) FOLLOWING THE INVASION OF A BIVALVE

Travis J. Kirk

Mentor: Dr. Sean Sterrett

BY-31 USING MICROSATELLITE GENOTYPING TO CHARACTERIZE MIGRATION PATTERNS IN STRIPED BASS

Nikole Andre, Carleigh Engstrom, Katherine Banfitch and Anjali Tampy

Faculty Mentors: Assistant Dean John Tiedemann and Dr. Megan Phifer-Rixey

Department of Chemistry and Physics

CE-1 UNRAVELING THE B TO A CONFORMATIONAL TRANSITION IN DUPLEX DNA CONSTRUCTS AT SINGLE BASE PAIR RESOLUTION

Kirsten P. Lawson and Michal M. Kalisz

Faculty Mentor: Dr. Davis Jose

CE-2 PEPTOID MACROCYCLES AS POTENTIAL ANTICANCER AGENTS: THE ROLE OF IONS IN CONFORMATIONAL EQUILIBRIUM

Amanda Prascsak, Omar Shah, Santino Timpani, Thomas Melfi and Roxy Nicoletti

Faculty Mentors: Dr. Yana Kholod Kosenkov and Dr. Dmitri Kosenkov

CE-3 MODELING IMPACT OF INTERMOLECULAR INTERACTIONS OF LPG—ALCOHOL MIXTURES ON STABILITY OF PHYLLOSILICATES: TOWARDS IMPROVEMENT OF DRILLING FLUIDS

Santino Timpani, Amanda Prascsak and Thomas Melfi

Faculty Mentors: Dr. Yana Kholod Kosenkov and Dr. Dmitri Kosenkov

CE-4 THE EFFECT OF SMALL MOLECULES ON THE STABILITY OF G-QUADRUPLEXES

Christopher Bentsen

Faculty Mentors: Dr. Massimiliano Lamberto and Dr. Davis Jose

CE-5 TWO-PHASE FLOW IN A HYDROTHERMAL VENT SYSTEM

Miranda Halpern

Faculty Mentor: Dr. Kayla Lewis

CE-6 ACIDOLYSIS PRODUCTS OF RHENIUM(I) ALKYLCARBONATO COMPLEXES TO TREAT AND INHIBIT INFLAMMATION IN CANCERS OF THE BREAST AND ORAL CAVITY

Arbaz M. Khan

Faculty Mentors: Dr. Gregory A. Moehring, Dr. Datta V. Naik and Dr. Jeffrey H. Weisburg

CE-7 QUANTIFYING SMALL DNA FRAGMENTS WITH ACRYLAMIDE GEL STAINING

Julia Bagisnki

Faculty Mentor: Dr. Jonathan Ouellet

CE-8 SELECTION OF AN APTAMER TO BIND 2-HYDROXYGLUTARATE THROUGH SELEX

Danielle Guillen, Artiom Efimenko, Krima Patel and Jennifer Lee

Faculty Mentor: Dr. Jonathan Ouellet

CE-9 THE THEOPHYLLINE RIBOSWITCH; ITS DESIGN AND IMPLEMENTATION

Mika Schievelbein

Faculty Mentor: Dr. Jonathan Ouellet

CE-10 SYNTHESIS OF SILVER NANOPARTICLES FOR ENVIRONMENTAL REMEDIATIONS

Angelique Ithier and Alexandra M. Tamburri

Faculty Mentor: Dr. Tsanangurayi Tongesayi

CE-11 IMPACT OF MICROPLASTICS ON THE MOBILITY, SPECIATION, AND TOXICITY OF HEAVY META(LOIDS) IN THE AQUATIC ENVIRONMENT

Olenka Mallqui

Faculty Mentor: Dr. Tsanangurayi Tongesayi

Department of Computer Science and Software Engineering

CSSE-1 OUTLOOK MOBILE APP
Jimmy Duong and Anthony Vives
Faculty Mentor: Dr. Raman Lakshmanan

CSSE-2 CONSEAERGE: A BEACH VALET MOBILE APP FOR THE JERSEY SHORE
Bradley Gougler, Sandley Guo and Jessica Zemartis
Faculty Mentor: Dr. Raman Lakshmanan

CSSE-3 RACIAL POPULATION DISTRIBUTION OF THE UNITED STATES 1790 – 2010
Michael Karolewicz and Kalyna Reda
Faculty Mentor: Dr. Raman Lakshmanan

CSSE-4 CORRELATING TWEETS WITH THE METOO HASHTAG TO GEOGRAPHICAL LOCATIONS
John Neppel and Thomas McHugh
Faculty Mentor: Dr. Raman Lakshmanan

CSSE-5 RETICLE SOLUTIONS APP: LAW ENFORCEMENT CASE REPORT ANALYSIS AND VIDEO PLAYBACK SERVICE IN OFFICER TRAINING
Claudia Ondecker and Peter Montella
Faculty Mentor: Dr. Raman Lakshmanan

CSSE-6 DMAVA: DEPARTMENT OF MILITARY AND VETERANS AFFAIRS VETERANS OUTREACH APP
Joshua Schlanger and William Jones
Faculty Mentor: Dr. Raman Lakshmanan

CSSE-7 SCAN-SEARCH DICTIONARY
Darius Howe, Kyle Mueller, Matt Shober, Greg Stickle and Nianqi Tian
Faculty Mentor: Dr. Cui Yu

Department of Mathematics

MA-1 STATISTICAL ANALYSIS OF WHITE BLOOD CELL COUNT AND CCL TEARS IN CANINES

Samantha Cavalli and Kristen Marzano
Faculty Mentor: Dr. Richard Bastian
Client: Dr. Lindsay Nussbaum, DVM, Red Bank Veterinary Hospital

MA-2 ANALYSIS OF SUTURE MATERIALS FOR VETERINARY MEDICINE

Catherine Crawford and Melissa Culmone
Faculty Mentor: Dr. Richard Bastian
Client: Dr. Allison Newgent, Garden State Veterinary Specialists

MA-3 PREVALENCE OF OBESITY IN DACHSHUNDS WITH INTERVERTEBRAL DISC DISEASE (IVDD)

Taylor O'Rourke and Conor Tuturice
Faculty Mentor: Dr. Richard Bastian
Client: Dr. Martha Cline, Red Bank Veterinary Hospital

MA-4 STATISTICAL ANALYSIS OF THE RELATIONSHIP BETWEEN WATER QUALITY PARAMETERS OF THE NAVESINK AND SHREWSBURY ESTUARIES

Kimberly Bianchi and Hunter Hostage
Faculty Mentors: Dr. Richard Bastian and Dr. Jason Adolf

MA-5 STATISTICAL ANALYSIS OF MANGROVE CREEK DISPERSAL THROUGHOUT STREAM LOCATION AND TIDE CHANGES IN THE BAHAMAS

Yanhaorui Fang and Anthony Sarbello
Faculty Mentors: Dr. Richard Bastian and Dr. Pedram Daneshgar

MA-6 HOW DIFFERENT PLAYGROUPS EFFECT SALIVARY CORTISOL LEVELS OF SHELTER DOGS

Anna Lazur and Mike McGuigan
Faculty Mentors: Dr. Richard Bastian and Dr. Lindsay Mehrkam

DEPARTMENT OF BIOLOGY

BY-1

TOXIC BENTHIC DINOFLAGELLATES IN BAHAMIAN INTERTIDAL CREEKS ON THE ISLAND OF ELEUTHERA

Gina Badlowski

Department of Biology

Faculty Mentor: Dr. Jason Adolf

ABSTRACT

Prorocentrum lima is a toxic ovate shaped, epiphytic, and benthic dinoflagellate that is commonly found on substrates such as algae and coral within tropical and subtropical environments. This dinoflagellate commonly co-occurs with other toxic dinoflagellates such as *Gambierdiscus* species. *P. lima* is known to produce okadaic acid (OA) and dinophysitoxins (DTXs) which when ingested by fish is harmless. However, as the toxins become biomagnified in fish and subsequently consumed by humans, the biotoxins can cause Diarrhetic Shellfish Poisoning (DSP). Intertidal creeks throughout South Eleuthera play a major role in complex food webs for aquatic life. Juvenile and sub-adult fish species commonly use these areas and patch reefs for protection and foraging grounds. These environments provide optimal conditions for algal growth and can allow for the presence of this harmful dinoflagellate. To determine the presence of *P. lima,* algae samples were collected from two creeks located on opposite sides of South Eleuthera: Rollins Creek and Page Creek. These samples were collected at varying locations within each creek starting deep inside the creek leading out to the mouth of the creek, and patch reefs located further from the creek mouth. These samples were then processed to determine the number of cells per gram of algae. Results show that there is *P. lima* present in the creeks and waters of South Eleuthera. Continuous sampling within different creeks around Eleuthera will allow for better monitoring of this dinoflagellate and can provide better knowledge to local Bahamians about the conditions of the fish that they rely heavily on as a food source.

BY-2

CAN A HANDHELD CYANOFLOUR MEAUSRE CYANOBACTERIA ABUNDANCE IN COASTAL LAKES?

Erin Conlon

Department of Biology

Faculty Mentor: Dr. Jason E. Adolf

ABSTRACT

Cyanobacteria are photosynthesizing microscopic aquatic organisms that can cause algal blooms when conditions are warm and nutrient rich. Some species of cyanobacteria can be toxic, leading to harmful algal blooms (HABs). This can be detrimental not only to water quality, but also to any species that encounter it. Traditionally, a specialized cyanobacteria taxonomist will examine samples under a microscope to get a cell count, which takes time and skill. New technologies have allowed a quick way to determine these cell counts; a Cyanoflour. This device is used in the field to determine the cyanobacteria abundance, can be used by anyone and takes less than a minute. Environmental protection agencies monitor coastal lakes that are susceptible to these HABs. They are interested in cyanobacteria cell counts as they can cause HABs. They will close a lake for recreational use if measurements reach 20 cells per microliter, but base this closure off microscope counts alone, not on Cyanoflour measurements. The goal of this study was to determine if the handheld Cyanoflour is an accurate tool to measure cyanobacteria. To do this, samples and data from a Deal Lake Study from summer 2018 were used. Three types of cyanobacteria (M*icrocystis, Pseudanabeana* and *Merismopedia)* were counted under a microscope by clumps and compared to their Cyanoflour readings. Scatterplots were made comparing Cyanoflour measurements to each species of cyanobacteria, and then to total cyanobacteria. Overall, the sum of cyanobateria cells was statistically significant (P>0.001) with Cyanoflour measurements. Using this method to measure cyanobacteria can offer a new HAB monitoring technique, allowing for quicker results and the ability for anyone, not just a scientist, to conduct these readings.

BY-3

APPLYING FLOW CYTOMETRIC METHODS TO MEASURE MIXOTROPHIC GRAZING IN *Karlodinium veneficum* UNDER VARYING TEMPERATURES

Skyler Post and Mia Collucci

Department of Biology

Faculty Mentor: Dr. Jason E. Adolf

ABSTRACT

Karlodinium veneficum strain 1975 is a mixotrophic protist (photosynthetic and phagotrophic) that is responsible for a number of harmful algal blooms (HABs) and fish kills in coastal ecosystems. Their mixotrophic nature is aided by a toxin, karlotoxin (KmTx), that immobilizes prey and deters grazers that might predate on *K. veneficum*. The goal of this study was to utilize a simple flow cytometric method, which was previously developed for last year's research, to measure mixotrophic grazing of *K. veneficum* on cryptophyte prey species (*Storeatula major*) under various temperatures (10° and 20° Celsius), which will indicate how heterotrophic growth rates vs. autotrophic growth rates are affected by temperature. Experiments were set up in 24-well plates by establishing three different triplicated treatments (*K. veneficum* alone, prey alone, *K. veneficum* and prey together) at each temperature, for a total of 18 wells. Cells were counted on a BD Accuri C6 flow cytometer and distinguished on biplots of forward angle scatter and green fluorescence after cells were stained with a nuclear stain. Cells were also counted using microscopy to ensure validity of data. Mixotrophic feeding experiments analyzed by flow cytometry showed growth curves and grazing in *K. veneficum* under 10°C and 20°C conditions. Our findings provide a critical understanding of temperature effects on prey interactions with *K. veneficum*, and will lead to further study of its impact on fish kills in coastal waters and ecological responses to climate and seasonal changes.

BY-4

EXPLORING THE ABUNDANCE OF *Diadema antillarum* ON A CORAL REEF IN THE BAHAMAS

Katrina Brooks, Abigail Urbanak and Geoffrey Schaefer

Department of Biology

Faculty Mentor: Dr. Pedram Daneshgar

ABSTRACT

This study was designed to investigate the state of the population of *Diadema antillarum* on 4thhole reef in Eleuthera, The Bahamas, along with relative algal abundance. Due to corals reefs' inherit complexity they serve as a very good indicator of various surrounding ecosystem health. Coral reefs also provide abundant habitat and food sources for a wide assortment of marine organisms. With an increase in seawater temperatures within the past few decades, it is important to understand how severely these communities are being affected. Data was collected using a transect and quadrat sampling method. To determine population numbers, teams of two swam in two, 150 meter transects and tallied *D. antillarum* that were openly spotted. Following this count, teams also estimated percent algal cover per square meter using a 1x1 meter quadrat. A total of 12 transects were run, along with 18 quadrat samples. The transect data was averaged out to achieve an average of 77.8 *Diadema antillarum* per transect, while the quadrat data was averaged out to achieve an average of 1.83 *Diadema antillarum* per square meter. The average percent cover of algal cover was 31%. It was hypothesized that the number of sea urchins at this reef would be less than the previously recorded years due to increase in seawater temperatures; the results proved this to be true. This experiment proves to be relevant as it is imperative to constantly better an understanding of the effects that a rise in sea surface temperatures pose. With this we can better manage and educate the costs of sea temperature rise and how humans may contribute to these increases.

BY-5

DETERMINING MANGROVE PROPAGULE DISPERSAL DISTANCE IN PAGE CREEK, ELEUTHERA, THE BAHAMAS

Erin Conlon, Hunter Hostage and James Murphy

Department of Biology

Faculty Mentor: Dr. Pedram Daneshgar

ABSTRACT

In the Caribbean, mangrove ecosystems play an important role ecologically as habitat for fish, providing shore protection from storms and storing carbon. Unfortunately, due to several anthropogenic factors, mangrove ecosystems are in decline and as a result, as little as seven percent of original mangroves still exist today. In order to understand further implications of this declining habitat, the life history of mangroves has to be better understood. One life history aspect of red mangroves (*Rhizophora mangle*) that is not well understood is the dispersal range of their viviparous propagules that are able to survive in a free-floating stage for a month or longer. This allows for dispersal distance of mangroves to have very far potential. This study explored how tidal cycle as well propagule drop points determine how far propagules travel. Propagules were dropped at three different drop zones throughout a mangrove tidal creek at both high and low tide. Eleven days later, GPS coordinates were recorded of all propagules that were found and the distance traveled was estimated using GIS. The results show that the back of the creek had the farthest dispersal distance (61.4 meters), while the center of the creek had much less distance (26.7 meters). The mouth of the mangrove had few found propagules, but the distance found was slightly under the distance of the upper creek (60.6 meters). Using this dataset, it can be inferred that propagules at the mouth of the creek travel out of the creek and the upper creek propagules travel farther into the creek.

BY-6

CHARACTERIZING NORTHERN DIAMONDBACK TERRAPIN NEST SITE SELECTION WITH RESPECT TO VEGETATION IN SOUTHERN NEW JERSEY

Taylor Donovan

Department of Biology

Faculty Mentor: Dr. Pedram Daneshgar

ABSTRACT

Malaclemys terrapin terrapin (Northern Diamondback Terrapin), a unique species found within estuarine systems of the Atlantic coast, have been listed as a species of concern in New Jersey due to evidence of decline. While several factors, both natural and anthropogenic, are to blame for these declines, nest site degradation and loss may be the most detrimental to the success of future populations because of the strong nest site fidelity exhibited by terrapins. Disturbances, land alteration and the invasion of problematic species such as *Phragmites australis* (Common Reed) seem to be driving nest site degradation, but definitive impacts to nest site selection have yet to be explored. In this study, we investigated the plant communities associated with newly laid terrapin nests along the New Jersey coast in an attempt to characterize nest site selection. It was hypothesized that site alterations and plant invasions have made sites less suitable for nesting and for the success of future populations. At each nesting site, the plant community was surveyed, and the habitat was described in regard to disturbance and invasions. To determine the impacts of the plant community on nest temperature, iButtons were installed in each nest within the 24 hours of the nest establishment. Results suggest that terrapins do not select sites based on the existing plant communities and that site fidelity rules selection. In nests with higher percent cover, average daily nest temperatures were cooler, which supports the idea that vegetation does influence nests. Identifying the effects of different parameters on nest conditions facilitates our understanding of how disturbance, land alteration, and invasion may impact future populations. Characterizing nesting habitat is an essential step in ensuring that *M. terrapin terrapin* populations have adequate and appropriate space to sustain themselves for years to come.

BY-7

INVESTIGATING THE IMPACTS OF *Casuarina equisetifolia* ON FOREST UNDERSTORY COMMUNITIES IN CAPE ELEUTHERA, THE BAHAMAS

Ashley Keating and Nikole Andre

Department of Biology

Faculty Mentor: Dr. Pedram Daneshgar

ABSTRACT

Casuarina equisetifolia is an invasive tree species that was introduced throughout Eleuthera, The Bahamas, as a wind buffer and to help stabilize the sandy-rocky shorelines. The species occurs in subtropical and tropical climates in a variety of environmental conditions. We investigated the litter accumulation of *C. Equisetifolia* and its effect on understory plant community growth. We measured the *C. equisetifolia* tree diameter, identified and counted different plant species in the plotted area, a percent cover was then estimated, and litter depth was measured last. We hypothesized that greater litter accumulation would lead the less understory plant diversity and abundance. Litter accumulation varied between all four sites. Across four sites, it was observed that as trees grew in size (greater tree diameter) and accumulated more litter depth, the less understory species were observed. The data showed a decrease in average species richness as the average diameter increased. In general, the presence of *C. Equisetifolia* contributes to diversity and abundance declines in native species.

BY-8

THE IMPACTS OF FIRE SUPPRESSION ON PITCH PINE POPULATIONS OF A MARITIME FOREST IN NEW JERSEY

Grace Roeder

Department of Biology

Faculty Mentor: Dr. Pedram Daneshgar

ABSTRACT

Since the mid-1900s, the New Jersey Forest Fire Service has utilized prescribed burns in the Pinelands as methods of preemptive wildfire control and a source of ecosystem regulation. The Pinelands experience frequent forest fires which prevent the succession of a hardwood climax forest. Pitch pine (*Pinus rigida)* is a dominant species throughout the Pinelands that benefits from the disturbance of forest fires. The pitch pines require extreme heat and fire to successfully release seeds from serrotinous cones and reproduce. The intentional prescribed fires clear away competing species and provide pitch pines with suitable conditions for growth. The Pinelands National Reserve not only includes the Franklin Parker Preserve, but also the maritime forest of Island Beach State Park, where controlled burns are not implemented. To determine the differences in pitch pine populations due to fire suppression, the two populations were sampled using radius plots and quadrat sampling. The number of juvenile pitch pines were counted within a 10 meter radius of a mature tree sampled along with descriptive statistics of the populations such as height, age, and trunk diameter. Additional data was collected on the soil composition, litter depth, canopy cover and species diversity beneath the adult tree and 10 meters away. The results indicated that Franklin Parker Preserve had a greater population of juvenile pitch pines in comparison to Island Beach State Park. There was, on average, 7 juvenile trees found per tree sampled in the Pinelands versus only 2 juvenile trees found per tree sampled in the maritime forest site. The results also included taller trees, larger diameters and older trees in the Pinelands, justifying the difference in the ecosystems due to fire suppression. This study suggests that overtime, fire suppression in a maritime forest reduces the pitch pine population and alters the natural environment of the maritime forest.

BY-9

THE USE OF CONCH MIDDEN ASSESSMENTS AS EVIDENCE OF THE OVERHARVEST OF JUVENILE QUEEN CONCH (*Stombus gigas*) IN CAPE ELUETHERA, BAHAMAS

Charles Vasas, Kayla Rosado and Tyler Stoner

Department of Biology Monmouth University

Faculty Mentor: Dr. Pedram Daneshgar

ABSTRACT

Queen conch (*Stombus Gigas*) is a species of gastropod native to the Caribbean that has considerable commercial value. The commercial harvest as well as the local subsistence harvest of these organisms is widespread. In general, conch is harvested for uses such as human consumption, bait for fishing purposes, lime for mortar, the manufacture of porcelain and pharmaceutical research purposes. As the fishery expands to meet these demands, larger adults are removed from the population and smaller juveniles become the main target of fishing pressures. In order to determine if juveniles are truly facing increased fishing pressures, an experiment was undertaken that involved surveys of conch middens, large piles of previously harvested conch shells. A total of 400 shells were sampled at four different locations. At each location, samples were taken from either an inactive midden or a currently active midden, and specific measurements were taken on each sampled shell. Specifically, the measurements of the presence of a shell lip and shell lip thickness were used to indicate the age class of the shell. After the four different middens were sampled, more adults were found than juveniles; however, the percentage of juvenile shells increased as the survey shifted from inactive to active middens. The percentage split at the inactive sites was 11% juvenile and 89% adult while the percentage split at the active sites was 40.5% juvenile and 59.5% adult. This result suggests that overharvesting of adult conch has led to juveniles became the main target of the queen conch fishery. Overall, the data supports the claim that more and more juvenile conch are being harvested; moreover, increases in enforcement and new regulations are needed to protect this valuable species.

BY-10

EVALUATING THE TEMPORAL AND SPATIAL DISTRIBUTIONS OF ENDANGERED ATLANTIC STURGEON (*Acipenser oxyrinchus*) WITHIN SANDY HOOK AND RARITAN BAY

Lauren Kelly, Charles Vasas and Troy Ohntrup

Department of Biology

Faculty Mentor: Dr. Keith Dunton

Funding Source: Urban Coast Institute

ABSTRACT

Sandy Hook Bay (SHB) and Raritan Bay (RB) are urbanized waterbodies located within close proximity of known Atlantic sturgeon coastal aggregation and freshwater spawning sites. While Atlantic sturgeon have been historically documented to occur in SHB, no formal surveys have been conducted to identify their presence/absence. The purpose of this project was to determine the presence/absence and seasonality of sturgeon within SHB through the use of acoustic telemetry. Working cooperatively with Naval Weapons Station Earle, six acoustic receivers were deployed in spring of 2016 to cover a portion of SHB. The array was expanded in 2018 with ten acoustic receivers were deployed throughout RB and surrounding water bodies to monitor for previously tagged Atlantic Sturgeon. A total of 139 uniquely tagged individual Atlantic sturgeon were detected (n=68,344 detections). Sturgeon were detected in all months monitored but showed higher abundances in spring and fall. Some sturgeon displayed long residency times within the bay. Sturgeon largely came from the NYB Distinct Population segment but some came as far as south as Chesapeake Bay (MD) and Edisto River (SC), indicating that multiple DPSs utilize the area. This suggests that Sandy Hook Bay may be an important late spring – early summer habitat so proper protection may be needed to protect against localized anthropogenic threats (e.g., vessel interactions, commercial fishing, dredging) that may pose possible negative interactions with sturgeon.

BY-11

EVALUATING THE SPECIES COMPOSITION AND SURVIVAL OF SHARKS CAPTURED IN THE NEW JERSEY RECREATIONAL LAND-BASED SURF FISHERY

Charles Vasas, Lauren Kelly and Troy Ohntrup

Department of Biology

Faculty Mentor: Dr. Keith Dunton

ABSTRACT

With the increasing popularity of recreational land-based shark fishing, a greater understanding and characterization of the species captured and their demographics is needed. Along the coast of New Jersey, this land-based shark fishery occurs largely during the summer months. We worked directly with the professional guide industry to classify this shore based fishery. In 2017, 12 land-based excursions occurred, and 67 individual sharks were captured consisting of 20 Sand Tiger sharks (*Carcharias taurus)*, 45 Sandbar Sharks (*Carcharinus plumbius*), 1 Dusky Shark (*Carcharinus obscurus*), and 1 Spinner shark (*Carcharhinus brevipinna*). A sub-set of individuals (n=9 Sand Tiger and n=6 Sandbar shark) were surgically implanted with Vemco V-16 acoustic transmitters. In 2018, 117 individual sharks were captured consisting of 16 Sand Tiger sharks (*Carcharias taurus*), 10 Dusky sharks (*Carcharhinus obscurus*), 90 Sandbar sharks (*Carcharinus plumbius*) and 1 Spinner shark (*Carcharhinus brevipinna*). A sub-set of individuals (n=7 Sandbar sharks) were surgically implanted with Vemco V-16 acoustic Transmitters. All acoustic tagged sharks were detected post-release, some as far south as North Carolina, leading to a 100% post release survival rate for our captured sharks. This study's survival rate suggests high post release survival rates within the fishery. Additionally, this study's short term post release mortality rate of 0% contradicts the generally accepted rate of 6%. Our work on the classification of this recreational fishery and acoustic tagging to understanding post release survival and coastal movements will continue throughout the 2019 season. In addition, we will work with the guide service to develop the best and safest release practices. Further understanding of the population demographics of this specific shark fishery, as well as migratory pathways along the coast of New Jersey can be used to support management and conservation efforts for this coastal shark fishery.

BY-12

SECONDARY STRUCTURE ANALYSIS BY SHAPE-MAP OF THE EGFR AND VEGFR2 PRE-MRNA TRANSCRIPTS: UNCOVERING NOVEL REGIONS FOR RNA ANTI-SENSE TARGETED THERAPY

Ryan Fink

Department of Biology

Faculty Mentor: Dr. Martin Hicks

ABSTRACT

In order to therapeutically modify oncogenic transcripts in cancer, we are using tools to uncover the pre-mRNA structurome of epidermal growth factor receptor (EGFR). We have begun experiments to analyze the EGFR pre-mRNA structure using selective 2' hydroxyl acylation and primer extension followed by mutational profiling (SHAPE-MaP). The SHAPE reagent (1M7) reacts with the 2' hydroxyl of RNA molecules when the RNA molecule is in a conformationally flexible position creating a 2' O-adduct. The modified RNA is reverse transcribed, incorporating mismatches at the acylated positions; a comparison of unmodified to modified RNA will allow us to determine RNA nucleotides that are involved in secondary structure, part of RNA-binding-protein complexes, or single stranded. Single stranded RNAs and RNAs with minimal structure are a preferential target of our therapy. We hypothesize that the secondary structure of the RNA will determine the most effective way to therapeutically alter the splicing of the EGFR pre-mRNA. Also, the secondary structure of the pre-mRNA will give further insight into understanding the mechanism of alternative transcripts induced by nature.

SKMG-3 cells were grown in DMEM with 10% FBS, and subjected to 1M7, 5-NIA or DMSO (control) in cellular and cell-free conditions. RNA was isolated using Trizol. The RNA was treated with DNAse followed by reverse transcription under SHAPE conditions using a gene specific cocktail primer. Reverse transcription under SHAPE conditions includes the use of manganese chloride as the divalent ion for the RNA-dependent DNA polymerase subunit. It was determined that the most effective way to isolate pre-mRNA was to reverse transcribe with a gene specific cocktail primer mix. Primers were designed to target the EGFR transcript ranging from intron 15 to the 3' UTR. The cocktail consisted of 10 primers. cDNA was converted to double stranded DNA and prepared for Oxford Nanopore sequencing.

BY-13

DESIGNING AND TESTING RNA THERAPEUTICS TO BLOCK VEGFR2 AND EGFR ACTIVATION IN HUMAN GLIOBLASTOMA

Flobater Gawargi and Kristel V. Gousse

Department of Biology

Faculty Mentor: Dr. Martin J. Hicks

ABSTRACT

Glioblastoma multiforme (GBM), is the most common and aggressive malignant primary brain tumor with a median survival of 14 months. Current therapies are limited by the blood brain barrier. Epidermal growth factor (EGFR) and Vascular Endothelial Growth Factor receptor 2 (VEGFR2) are crucial for cancer cell survival. In our lab we are developing an innovative therapy that can bypass the blood brain barrier by developing RNA therapies to alter the splicing mechanism of the EGFR and VEGFR2 gene to reduce or block its activation, thus stop tumor cells from growing. Eleven Antisense sequences were designed to target the EGFR gene and nine Antisense sequences for VEGFR2, to potentially block their activation. The Antisense sequences were cloned into pAAV-U7-smOPT. In addition, multiple cloning strategies and protocols were used to clone the exonic splicing silencer 4G-quadruplex into our therapy vector. In addition, another aspect of this research is to isolate multiple tyrosine kinase receptors mRNA from GBM cancer cells, clone the cDNA into a T7 expression vector to transcribe control RNA to use in our high throughput sequencing experiments. Multiple cell lines including U87 and SK-MG cell line are being cultured and transfected with our novel therapies. Total proteins and mRNA are collected, analyzed, and compared to same cell lines without treatment. The collected data will allow the research to move toward a mouse model using adeno-associated virus (AAV) vector which was chosen based on its non-pathogenic and integrative features.

BY-14

INTEGRATION OF AUTHENTIC RESEARCH INTO AN UNDERGRADUATE LABORATORY COURSE: DESIGN AND SYNTHESIS OF A GENE THERAPY VECTOR

Kristel V. Gousse, Flobater I. Gawargi and Koushik Muralidharan

Department of Biology

Faculty Mentor: Martin J. Hicks

ABSTRACT

Undergraduate Biology students often graduate without exposure to authentic research. Techniques in molecular biology cover an array of skills that are essential to succeed in a biotechnological laboratory today. Can we design a lab course based on the teaching of concepts while imparting the skills and applications of modern techniques to undergraduate students? In our laboratory course, we focus on the implementation of genetics and molecular biology lab techniques, providing theoretical concepts and laboratory skills. Students immersed in a series of labs, carry-out molecular cloning protocols to make a gene therapy vector designed to inhibit the overexpression of oncogenes in brain tumors. Students learn NCBI databases, PubMed and Genbank, to research the background of the target gene. Students use DNA analysis software, Serial Cloner, as an interactive tool to evaluate DNA. Each student generates a therapy vector, beginning with DNA isolation and purification, followed by measurement of DNA quantity and quality and restriction enzyme digestion. Students make buffers and agarose gels, perform gel electrophoresis, cut-out the desired band, and purify DNA with magnetic beads. Students ligate DNA insert into backbone and transform into DH5-α competent cells. Students make Luria Broth ampicillin plates, spread transformed bacteria onto plates and measure efficiency by bacterial colony count. Students use colony PCR to verify ligated products. At the end of the series, students compile results and integrate learning from the lecture to create a comprehensive lab report. Student evaluation is based on connecting genetic concepts to laboratory experiments, including objectives, protocols in own words, results in notebook (in pen), figures, data analysis, and conclusion. Successful results contribute to authentic research projects. The goal of this lab course is to integrate research into the undergraduate learning experience, preparing students for graduate school and employment in a modern biotechnological lab; establishing the next generation of scientist.

BY-15

THERAPY RNA INTERACTION WITH HNRNPS AND EGFR/VEGFR2 MRNA TO INDUCE ALTERNATIVE SPLICING IN GBM

Michael R. Mazzucco, Flobater I. Gawargi, Koushik Muralidharan, Ryan N. Fink, Sawyer M. Hicks, Kevin Gallagher and Sarah Falotico

Department of Biology

Faculty Mentor: Martin J. Hicks

ABSTRACT

Glioblastoma multiforme (GBM) is the most common CNS malignancy, with a median survival of only 14 months. GBM tumors are characterized by rapid cell proliferation. To develop a new treatment, our lab has designed an RNA therapeutic vector directed against the pre-mRNA of the oncogenic transcripts, epidermal growth factor receptor (EGFR) and vascular endothelial growth factor (VEGFR2). This therapy induces alternative splicing leading to shortened mRNA transcripts, which translate into soluble decoy proteins as opposed to the canonically spliced full-length transmembrane receptor. These soluble decoys competitively bind the EGF or VEGF growth factors, without activation of pathway. We have designed a heterogeneous ribonucleoprotein (hnRNP) G-quadruplex binding domain within our antisense RNA therapeutic vector to hide key splicing elements, and effectively block the recognition of critical splice sites. We are developing methods to test the potential of hnRNP proteins to bind RNA G-quadruplex motifs within our RNA therapy molecules. I cultured, isolated and purified a recombinant hnRNP A1 poly-histidine tagged protein from a bacterial expression vector, tested different protein re-folding conditions, using an imidazole or pH gradient, followed by SDS-PAGE and western blots demonstrating hnRNP expression at too low a concentration. In order to optimize hnRNP protein folding and expression, I have switched to a mammalian expression system. Currently, I am expressing the recombinant hnRNP FLAG-tagged proteins in human embryonic kidney (HEK) 293T cells. In addition, using a T7 promoter, I have made a DNA template to transcribe and generate a pure sample of our therapeutic RNA molecule. After isolation of the FLAG-tagged proteins, I will use an electrophoretic mobility shift assay (EMSA) to test efficacy of the synthetically transcribed therapeutic RNA molecule to bind hnRNPs. This experiment protocol evaluates the mechanism of our therapeutic RNA molecule to bind and induce alternative spicing of our target oncogenic transcripts, EGFR and VEGFR2.

BY-16

RNA THERAPEUTIC STRATEGIES TO BLOCK VEGFR2 EXPRESSION AND ANGIOGENESIS IN GLIOBLASTOMA MULTIFORME

Koushik Muralidharan, Flobater I. Gawargi, Kerianne Fuoco and Hemangi Patel

Faculty Mentor: Dr. Martin Hicks

Department of Biology

ABSTRACT

Glioblastoma multiforme (GBM), a grade IV tumor of the central nervous system, is the most common malignant primary brain tumor, and has a median survival of only 14 months. Poor survival is due to a lack of efficacy in current therapies to pass the blood-brain barrier (BBB). GBM tumors are characterized by angiogenesis, which is essential for tumor growth and survival. Endothelial cells form the walls of new blood vessels, bridging the gap between the growing tumor and the established vasculature. The membrane receptor that activates tumors to recruit endothelial cells to promote neo-angiogenesis is vascular endothelial growth factor receptor 2 (VEGFR2). Changes in VEGFR2 expression to block its activation would inhibit the development of new blood vessels within the tumor microenvironment. We have designed novel therapies to bypass the BBB and deliver the genetic sequences of anti-sense RNA molecules to alter the splicing pattern and expression of the VEGFR2 transcript. Critical splice sites, enhancers, silencers and intronic polyadenylation signals within the VEGFR2 pre-mRNA transcript were analyzed using bioinformatics databases and RNA-modeling tools. Based on this, nine different antisense sequences were generated to target and block these elements and were cloned into our therapeutic platform vector, pAAV-U7-smOPT. This vector directs the antisense RNA therapeutic to the spliceosome machinery. GBM cells were cultured and transfected with the therapeutic vectors, and the total protein and RNA was collected and analyzed. A172 and U87 GBM cells treated with antisense therapy revealed a greater than two-fold reduction of VEGFR2. Current directions include direct delivery to the central nervous system using an adeno-associated viral (AAV) gene therapy vector. In addition, we are isolating AAV-exosomes with the potential to increase tropism toward the tumor microenvironment.

BY-17

ANALYSIS OF GENE EXPRESSION IN *Mus musculus* NEURO2A CELLS FOLLOWING MTOR OVER-ACTIVATION

Tugba Akilli, Brianna DeBlois, Caitlin Dowling, Ryan Fink, Flobater Gawargi, David Grossi, Jive Jacob, Nadine Khalil, Tiffany Longo and Tyler Roth

Department of Biology

Faculty Mentor: Dr. Cathryn Kubera

ABSTRACT

Mechanistic target of rapamycin (mTOR) is a serine/threonine kinase important for processes inside the cell such as transcription, translation, autophagy and cytoskeletal dynamics, among other things. Elevated mTOR activity has been found in pathophysiological conditions like cancer, or developmental disorders like Tuberous Sclerosis. Increased mTOR can be mimicked experimentally using a constitutively active form of the small GTPase Rheb, which stimulates mTOR activation.

In order to assess what effects increased mTOR activity has on expression of genes related to mTOR signaling, we transfected mouse Neuro2a neuroblastoma cells with a constitutively active Rheb plasmid (CA-Rheb) and reporter plasmids for GFP or Tomato fluorescent proteins. 48-hours post transfection, cells were lysed and tested for changes in protein or mRNA. Levels of both Total and Phospho protein of the downstream mTOR target p70 S6K were tested using an Enzyme-Linked Immunosorbent Assay (ELISA). PCR primers were designed to detect several genes related to mTOR signaling, and Reverse Transcription-quantitative PCR (RT-qPCR) was performed on isolated mRNA. Gel electrophoresis was then used to verify results of qPCR amplification.

Our data supports effective introduction of CA-Rheb and activation of mTOR signaling. Phospho:Total p70 S6K protein levels were higher in CA-Rheb transfected cells over N2a cells alone for three out of four trials. In RT-qPCR, lower Ct values for Rheb were detected in CA-Rheb-transfected cells than in control cells, indicating successful plasmid delivery and expression. The mTOR-related genes tested in RT-qPCR experiments were p53, Akt, CIB1, and CaBP2. For all four genes, an elevation of expression was detected in CA-Rheb-transfected cells compared to baseline conditions using a $\Delta\Delta$Ct calculation. In conclusion, addition of CA-Rheb to Neuro2a cells activates mTOR signaling resulting in increased phosphorylation of mTOR targets like p70 S6K, and increased expression of genes in the mTOR signaling pathway such as p53, Akt, CIB1 and CaBP2.

BY-18

EXAMINING THE ROLE OF FASCIN IN PRIMARY BRAIN CANCERS

Syed Mehdi Husaini and Esra Celik

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, such as proper cell-cell adhesion through cytoskeletal structures. It has been shown to play a role in a cell's motile and invasive properties, making it important to study in cancer cells due to their established overexpression of the protein. Upregulation of fascin in colorectal and breast cancer cells leads to increased metastatic and invasive properties, and the protein 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 but have not been studied to the degree of other cell lines, disrupting the traditional ideology behind the investigation.

We have previously presented the preliminary findings from this project regarding the role of fascin in neural cancers like neuroblastoma and glioblastoma. We characterized fascin gene expression in brain cancer cell lines using RT-qPCR and immunocytochemistry to determine relative protein abundance, where preliminary results show robust fascin mRNA and protein presence in Neuro2a neuroblastoma and A-172 glioblastoma cells when compared to controls such as Human Embryonic Kidney cells (HEK-293), which have reportedly low fascin expression levels.

Initial findings have allowed us to move into manipulating fascin expression to assess its effects on cell motility using a 2D invasion assay. Using a Biotek Cytation 5 multi-mode plate reader, we have accumulated extended time-lapse imaging of cancer cell invasion across varying fascin expression conditions. These video montages have allowed us to conduct computerized evaluation of whether fascin overexpression increases cell motility related to metastasis and invasion, while using the designed invasion assay to observe cell movement into unoccupied space in real time.

Fascin is an actin-bundling protein that is linked to cancer metastasis and aggression. This project builds upon a poster presentation from last year with visualization of the effect of varying fascin expression on the motile properties of primary brain cancer cell lines in hopes of identifying a therapeutic target.

BY-19

USE OF ENZYMATIC ETHANOL ASSAY TO EVALUATE A *Gallus gallus* MODEL OF FETAL ALCOHOL SYNDROME

Nadine Khalil and Samantha M Perez

Department of Biology

Faculty Mentor: Dr. Cathryn Kubera

ABSTRACT

Fetal Alcohol Spectrum Disorder (FASD) is a condition that results from prenatal exposure to alcohol. Distinctive craniofacial abnormalities and symptoms that develop from FASD include widening of the eyes, flat nose, thin upper lip, learning disabilities, and heart defects. This is a dominant disorder that affects every 2-5% of infants in the United States. This research focuses on *Gallus gallus* since studies have identified it as an effective model to study fetal alcohol spectrum disorder. On embryonic day 7 (E7), which is the time of onset for *G. gallus* cerebellum development, 20% ethanol or PBS was injected into the air sac of the egg. The cerebellum controls mobility, coordination, balance and speech, all of which may become impaired as a result cellular apoptosis in the cerebellum following embryonic alcohol exposure. In our FASD model, tissue and egg white samples were harvested on E9. An enzymatic Ethanol Assay (Megazyme) was performed on egg white samples to determine alcohol concentration present within eggs which was compared to eggs injected with PBS. The Ethanol Assay Kit measured reduction of NADH from nicotinamide-adenine dinucleotide (NAD+) through two separate enzymatic reactions: aldehyde dehydrogenase mediated oxidation of ethanol to acetaldehyde, followed by alcohol dehydrogenase mediated conversion of acetaldehyde to acetic acid. The Cytation 5 was used to collect readings of NADH absorbance of 340 nm, which is directly related to the amount of ethanol in the sample. Preliminary assay results indicate successful detection of ethanol in positive controls and standard curves, while the assay is still being developed for use with egg white samples. Harvested tissue has also been sectioned using a vibratome for histology slides to perform further experimentation such as immunostaining to quantify cell survival and apoptosis.

BY-20

ANALYZING THE EXPRESSION LEVEL OF GABA RECEPTOR GENES IN *Gallus gallus* CHICK TISSUES THROUGH EMBRYONIC DEVELOPMENT

Taylor Nason

Department of Biology

Faculty Mentor: Dr. Cathryn Kubera

ABSTRACT

Fetal Alcohol Spectrum Disorders (FASD), which arise from fetal ethanol exposure, are a prevalent group of disorders impacting as much as 5% of the US population. This ethanol-induced environment can lead to mental deficits and lack of motor skills in the developing fetus due to the activation of GABA neurotransmitter receptors within the developing granule cell precursors. The composition of these pentameric GABA receptors include a wide variety of subunit combinations that yield to different overall behaviors of the receptor. Because the subunit composition of GABA receptors changes depending on developmental time point and location in the brain, in this experiment we will characterize the expression level of different GABA receptor subunits in an embryonic chick model. The expression levels of nine different GABA subunits, including alpha types 1-6 and beta types 1-3, will be analyzed at six key time points in chick embryonic development (E7, E9, E11, E13, E15, E17) within four sample groups of the *Gallus gallus* chick species (cerebellum, fore brain, optic tectum, and liver). After RNA isolation, the GABA receptor transcripts will be assessed and quantified using RT-qPCR with specifically designed primers for each GABA subunit type. We hypothesize that the expression level of the different receptor genes will vary among the different time points, but compared to the liver tissue control samples, which lack these GABA receptor genes, the brain tissue samples will present with consistent GABA receptor genes. The conclusions made by the results of this experiment should yield a better understanding of the expression patterns for nine of the sixteen GABA receptor subunit genes in developing chicken that could potentially lead to a comparative understanding of such genes in humans.

BY-21

MANUKA ESSENTIAL OIL DECREASES THE PROLIFERATION OF HUMAN CANCER CELL LINES

Jive Jacob and Subah Soni

Department of Biology

Faculty Mentor: Dorothy Lobo

ABSTRACT

Since research on the effects of essential oils on human cell lines is limited, the goal of this project was to treat cancer cells lines with manuka essential oil at different concentrations and ascertain the effects on cell proliferation. The two cancer cell lines tested were fibrosarcoma (HT-1080) cells and cervical adenocarcinoma (HeLa) cells. Manuka oil is popular in many skincare products because of its antibacterial and anti-inflammatory properties that treat several skin conditions. However, manuka oil also contains an active ingredient that is commonly found in herbicides and is potentially toxic to human cells at certain concentrations. To conduct the experiment, both cell lines were grown on 24-well plates and subconfluent cultures were treated with varying concentrations of manuka oil for 24 hrs. The effect of the oil on proliferation was measured through direct cell counting using trypan blue dye exclusion and through the use of an MTT assay. A trend was found that as the concentration of oil increased, viability of both cell lines decreased. Fibrosarcoma (HT-1080) cells treated with 500 µg/ml manuka oil had significantly decreased proliferation, with a 55% decrease in viable cells compared to the control. MTT assay results also reflected this trend, with a significant decrease in MTT activity seen in cells treated with 250 and 500 µg/ml manuka oil. Increasing amounts of manuka also decreased proliferation of HeLa cells, with 500 µg/ml manuka oil resulting in a 46% decrease in viable cells compared to the control. To determine if the decreased cell number is the result of apoptosis, PARP cleavage assays will be performed.

BY-22

KUMQUAT ESSENTIAL OIL DECREASES THE PROLIFERATION AND VIABILITY OF BOTH NORMAL HUMAN FIBROBLASTS AND CANCER CELL LINES

Subah Soni and Jive Jacob

Department of Biology

Faculty Mentor: Dr. Dorothy Lobo

ABSTRACT

Kumquats are small citrus fruits produced by the *Fortunella japonica* tree. In addition to its aroma, kumquat essential oil may have anti-proliferative effects, however research on the effects of kumquat essential oil on human cell lines is limited. The goal of this project was to treat cancer cell lines with kumquat essential oil at different concentrations and ascertain the effects on cell proliferation. To conduct the experiment, HT-1080 fibrosarcoma cells and HeLa cervical adenocarcinoma cells were grown on 24-well plates and subconfluent cultures were treated with varying concentrations of kumquat essential oil for 24 hrs. For comparison, the proliferation of normal human fibroblasts (CUA-4), which display contact inhibition, was also tested after treatment with the oil. Proliferation was quantified by direct cell counting utilizing trypan blue dye exclusion, and viability was also measured using an MTT assay. As the concentration of essential oil increased, proliferation decreased, with a concentration of 500 μg/ml kumquat essential oil significantly decreasing the proliferation of all three cell lines tested. High concentrations of kumquat oil (500 μg/ml) also significantly decreased MTT activity in HT-1080 fibrosarcoma cells. The effect of this oil on MTT activity in other cell lines is currently being tested. To determine if the decreased cell number is the result of apoptosis, PARP cleavage assays will be performed. Other oils that are not well studied, including cypress and tangerine oils, may also be studied in future work.

BY-23

THE INHIBITING EFFECTS OF THYMOL, CARVACROL, AND CINNAMALDEHYDE ON METHICILLIN-RESISTANT *Staphylococcus aureus* (MRSA) AND METHICILLIN-SENSITIVE *Staphylococcus aureus* (MSSA)

Anadi Saini

Department of Biology

Faculty Mentor: Dr. James P. Mack

ABSTRACT

Antibiotics have revolutionized the way in which infectious diseases have been treated over the past century. Unfortunately, these microorganisms have evolved to become resistant to many of these antibiotics. According to the CDC, two million people are infected from drug-resistant bacteria in the United States every year; the most prevalent cases coming from Methicillin-resistant Staphylococcus aureus (MRSA) in healthcare facilities (CDC, 2018). Due to the indiscriminate and overuse of antibiotics, treatment options to control multidrug resistant bacterial infections have become limited.

Essential oils, which are metabolic products of many different plant species, have antimicrobial effects on many species of bacteria (Nazzaro, 2013). Of the many components found in several essential oils known to be bactericidal towards MRSA and MSSA, ten major components were chosen to test their individual activity against these bacteria. The ten components were carvacrol, carvediol, geraniol, eugenol, geranic acid, alpha-pinene, benzaldehyde, methyl salicylate, trans-Cinnamaldehyde, and thymol.

These components were tested on Mueller Hinton II agar using the Kirby Bauer Disk Diffusion Test to determine their effectiveness at inhibiting the growth of MRSA and MSSA. A series of emollients at different concentrations were prepared of each component using jojoba oil as the medium. These plates were incubated at 37 C for 24 hours to allow the bacteria to grow and the zones of inhibition to develop and be measured.

Three essential oil components worked significantly better than two of the leading antibiotics to treat patients with MRSA infections (vancomycin and trimethoprim-sulphamethoxazole): thymol, carvacrol, cinnamaldehyde. The minimum inhibitory concentrations (MIC's) of these three components were then determined. Thymol, carvacrol, and cinnamaldehyde were individually tested along with methylglyoxal to observe potential synergistic effects. The results show that emollients of thymol, carvacrol, and cinnamaldehyde in jojoba oil can successfully inhibit MSSA and MRSA in vitro growth better than the leading antibiotics.

BY-24

EXAMINING SOIL BACTERIA FROM ISLAND BEACH STATE PARK AS A BIOINDICATORS OF POLLUTION

Bailey Tully

Department of Biology

Faculty Mentor: Dr. Karen Pesce

ABSTRACT

Bacteria are the simplest form of life, made only of one cell, and can be found nearly everywhere on the planet including in the human body, within aquatic ecosystems, and in soil. The majority of bacteria present in the environment are harmless and actually benefit the natural ecosystem which they inhabit. This study examined bacteria in soil from Island Beach State Park. Island Beach State Park is a preserved barrier island in Ocean County which protects the shoreline and shore habitats. This park consists of ten miles of beach, including a shoreline along the Barnegat Bay, as well as maritime forests, sand dunes, and marshes. The majority of visitors take part in boating along the shore, swimming, and surfing. An unfortunate consequence of such activities is the release of pollutants into the environment such as hydrocarbons from boat fuel and phthalates from plastic litter. These chemicals can adversely affect both the microenvironments of the soil and human health. However, there are soil bacteria that have the ability to degrade these compounds. In fact, specific biodegradative genes for phthalates and hydrocarbons have been discovered and studied in a number of species. For this project, bacterial DNA was isolated directly from soil samples and 16s rDNA was amplified using PCR and then sequenced in order to identify species present in the soil. Identification of such bacteria along with future analysis of biodegradative genes will allow for the characterization of bacterial species as well as a better understanding of soil pollution at Island Beach State Park. In the future, bacteria may be used as a biomonitoring tool to better understand and track environmental pollution.

BY-25

VARIATION IN REPRODUCTIVE TRAITS AMONG MICE ADAPTED TO DIFFERENT REGIONS OF THE AMERICAS

Tiffany Longo and Jesse Bragger

Department of Biology

Faculty Mentor: Dr. Megan Phifer-Rixey

ABSTRACT

Although house mice, *Mus musculus domesticus*, are not native to the Americas, they have quickly adapted to a wide range of climates. For example, body size and nesting behavior are two traits linked to fitness that vary among populations from different latitudes, and those differences have been shown to have a genetic basis. Reproductive traits have a direct impact on fitness and life history theory predicts that both body size and climatic seasonality have the potential to affect reproductive investment. Here, we investigate whether litter size and pup weight vary among mice from different climates using new wild-derived mouse strains originating from New York, Brazil, Arizona, Florida, and Canada. We find significant differences in litter size among laboratory bred mice from these populations, both in early and middle late generations of inbreeding. Preliminary data also suggest differences in pup size among mice derived from these locations. Overall, mice from higher-latitude locations tend to have larger litters and larger pups. These findings suggest that reproductive parameters may be either directly or indirectly selected on as populations of house mice adapt to more seasonal, temperate climates.

BY-26

THE EFFECTS OF DIET ON ASPECTS OF BODY SIZE IN MICE FROM DIFFERENT CLIMATES

Sebastian Vera and Summer Shaheed

Department of Biology

Faculty Mentor: Megan Phifer-Rixey

ABSTRACT

Understanding diet induced obesity is an important research goal. Mice are the premier mammalian model for human biomedical research and mouse models of diet-induced obesity have become an essential tool for understanding the relationship between high fat diets and the development of obesity. However, classical inbred mice (typical laboratory mice) lack the genetic variation of wild mice. New wild-derived inbred strains of house mice from the Americas (Edmonton, New York, Florida, Brazil) are known to vary in body size. In particular, those derived from colder, higher latitudes are larger and fatter compared to those from warmer, lower latitudes. We are conducting a preliminary experiment to determine if these mice also show variation in response to high fat diets. Establishing new models for diet induced obesity that are more genetically diverse may improve our understanding of the risk for the disease in humans. In addition, this work will provide insight into environmental adaptation and phenotypic plasticity.

BY-27

BEHAVIORAL OUTCOMES OF CO-USE OF ALCOHOL AND AMPHETAMINE IN A RAT MODEL FOR ADHD

Jessica N. Baals, Nicholas R. Pillarella, and Pooja M. Shah

Department of Biology

Faculty Mentor: Dr. Dennis E. Rhoads

ABSTRACT

Non-medical use of amphetamine and other stimulants prescribed for treatment of attention deficit hyperactivity disorder (ADHD) peaks in adolescence and is of growing concern when combined with binge consumption of alcohol. Previous studies in our lab modeled chronic ethanol-amphetamine co-use in adolescent Long-Evans rats and provided evidence that amphetamine attenuates alcohol withdrawal symptoms in a manner that may lessen an individual's awareness of impending alcohol dependence. The current project was designed as a pilot study to test ethanol-amphetamine co-use in adolescent Spontaneously Hypertensive Rats (SHR), an experimental model for ADHD. How will a brain, for which amphetamine is potentially therapeutic, respond to co-administration of ethanol and amphetamine?

SHR adolescents were randomly assigned at P33 to liquid diets corresponding to one of four treatment groups: control (no drug), ethanol, amphetamine, or ethanol combined with amphetamine. Rats were withdrawn from treatment groups at three different time points: 5 days, 12 days, and 19 days and tested for alcohol withdrawal severity. Activity chambers were used to assess general locomotor activity and anxiety-like behavior. Overall withdrawal severity was also evaluated.

After 5 days consuming alcohol, SHR adolescents showed hypo-activity typical of alcohol withdrawal. However, hypo-activity declined with additional periods of ethanol administration and there was surprisingly low overall withdrawal severity after 19 days. The SHR adolescents appeared resistant to progressive signs of alcohol withdrawal used to gauge alcohol dependency in rodents. Moreover, amphetamine co-administration had no effect on withdrawal hypo-activity or overall withdrawal severity, but increased anxiety-like behavior at the 5-day time point. Amphetamine itself had an anorexic effect not seen previously. Thus, as a model for ADHD, adolescent SHR showed altered responses to alcohol, amphetamine, and the combined administration of both drugs. The results speak to the importance of better understanding alcohol-stimulant interactions in an ADHD population in developing educational and preventive strategies.

BY-28

MODELING TREATMENT OF ADOLESCENT ALCOHOL DEPENDENCY WITH THE ATYPICAL ANTIDEPRESSANT TIANEPTINE

Natalie Negroni

Department of Biology

Faculty Mentor: Dr. Dennis E. Rhoads

ABSTRACT

Adolescence is a critical period of development in which age-related modifications are occurring in the brain. It is also during this time that many individuals begin experimenting with drugs and alcohol. Our lab has shown that adolescent Long-Evans rats, consuming high levels of alcohol-containing liquid diet, achieve correspondingly high blood alcohol concentrations and develop a subsequent severe alcohol withdrawal syndrome. This provided a model for studying adolescent alcohol dependency. Unlike work done by others with adult rats, the atypical anti-depressant tianeptine was ineffective in preventing severe convulsive episodes typical of alcohol withdrawal after prolonged periods of adolescent alcohol consumption. Tianeptine appeared somewhat effective against adolescent anxiety-like motor behavior which develops with shorter periods of alcohol consumption.

This study was designed to analyze additional data collected on the effect of tianeptine on adolescent motor behavior during alcohol withdrawal. The analysis includes measures of hypoactivity, anxiety-like behavior and impulsivity during alcohol withdrawal. The data was collected using computer-controlled activity chambers following withdrawal of adolescent rats after 1-2 weeks of a liquid diet representing: control (no drug), tianeptine alone, ethanol alone, or ethanol and tianeptine in combination. Another part of this study determined if tianeptine is effective against the alcohol-induced decrease in the adenosine A_1 receptor. This part of the project completes earlier work characterizing the hyperglutamatergic state of the alcohol-dependent adolescent brain but not determining the effect of tianeptine on the brain's modulatory adenosine system. Western blotting was used to determine the expression levels of adolescent forebrain A_1 adenosine receptors after 3-4 weeks of alcohol consumption. Initial results indicated that tianeptine had no effect on alcohol-induced changes in A_1 receptor. Thus, the project contributes to understanding limitations on long term use of tianeptine as a treatment for adolescent alcohol dependency while also characterizing its efficacy against important early withdrawal behaviors.

BY-29

GLUTAMATE RECEPTOR EXPRESSION IN MEMBRANE RAFT FRACTIONS FROM ADOLESCENT BRAIN: INFLUENCE OF ALCOHOL AND STIMULANTS

Marta Telatin

Department of Biology

Faculty Mentor: Dr. Dennis E. Rhoads

ABSTRACT

Binge consumption of alcohol remains a serious problem, often associated with college students. Intensifying this problem is simultaneous consumption of alcohol with stimulants such as caffeine or amphetamine, the active ingredient in Adderall©. In previous behavioral studies from our lab, adolescent Long-Evans rats were used to model prolonged alcohol-stimulant co-use. Chronic administration of either stimulant with alcohol resulted in decreased severity of alcohol withdrawal symptoms. Thus, stimulants may lessen an individual's awareness of a growing dependence on alcohol. The goal of the present study was to examine the biochemical basis for these effects, specifically to determine if lipid raft dynamics play a role in the cellular mechanisms by which stimulants and ethanol interact in this model.

Lipid rafts were isolated as detergent resistant membrane fragments from forebrain regions of adolescent rats fed liquid diets containing ethanol, alone or in combination with caffeine or amphetamine. Western blotting was used to analyze fractions for the raft marker flotilin. Two fractions were found to contain flotilin with a relatively small percentage (<20%) of the marker found in the less buoyant of the two fractions. There was a highly significant 2-fold increase in this less buoyant raft (LBR) fraction derived from the ethanol-fed rats. This increase in the LBR fraction did not occur when rats were consuming caffeine or amphetamine along with alcohol under the same conditions where alcohol withdrawal severity was attenuated. The LBR fraction contained the endocytosis-associated protein caveolin, the scaffolding protein Homer, and the NMDA and mGluR1 subtypes of glutamate receptor. Thus, rafts contain proteins associated with the widely accepted hyperglutamatergic state of alcohol withdrawal and may help account for their upregulation during alcohol consumption. Moreover, the results suggest lipid raft dynamics are associated with the ability of stimulants to antagonize adaptive responses of the brain to chronic ethanol.

BY-30

EVALUATING THE DIET SHIFT OF FEMALE BARBOUR'S MAP TURTLE (*Graptemys barbouri*) FOLLOWING THE INVASION OF A BIVALVE

Travis J. Kirk

Department of Biology

Faculty Mentor: Dr. Sean Sterrett

ABSTRACT

The diet of female Barbour's map turtle (*Graptemys barbouri*) was quantified using fecal samples to evaluate how an invasive species, the Asian clam (*Corbicula fluminea*), contributed to their diet in the Appalachicola-Chattachoochee-Flint (ACF) River Basin of the southeastern United States. *Corbicula fluminea* is a prolific invasive species that was introduced to the U.S. in 1937, has spread through most of the U.S., and was first discovered in the ACF river basin around 1968. In this study, female *G. barbouri* were captured in Ichawaynochaway Creek (a tributary of the ACF) via snorkeling and fecal samples were collected from each individual. The fecal samples were then sorted, prey items were identified and analyzed for their contribution to the whole diet, using volumetric displacement. A variety of prey items were found in fecal samples, including native gastropods and bivalves, arthropods and invasive *C. fluminea*. However, *C. fluminea* made up 87.2% (range 40-100%) of female *G. barbouri* diets by volume. Additionally, *C. fluminea* had the highest index of relatively importance value of all prey items (94.3). A diet study from the Chipola River (A tributary of the ACF) suggested that *G. barbouri* historically fed on native gastropods prior to the invasion of *C fluminea*. This study demonstrates a major shift in the diet of *G. barbouri* towards *C. fluminea*, a highly available food source. *G. barbouri* is a threatened species throughout its range, due to habitat loss and modification; spurring conservation initiatives to determine the state of populations. It remains to be determined how this shift in diet will influence individual growth, population stability or ecosystem processing in the ACF basin.

BY-31

USING MICROSATELLITE GENOTYPING TO CHARACTERIZE MIGRATION PATTERNS IN STRIPED BASS

Nikole Andre, Carleigh Engstrom, Katherine Banfitch, and Anjali Tampy

Department of Biology

Faculty Mentors: Assistant Dean John Tiedemann, Dr. Megan Phifer-Rixey

ABSTRACT

Striped bass support a sport fishery with an estimated economic value in excess of $180 million per year in the U.S. There are three major spawning grounds for striped bass along the U.S. Atlantic Coast: the Hudson River, the Chesapeake Bay and its tributaries, and the Delaware River. Migratory populations along the Atlantic Coast include individuals from each of these stocks, although the relative contribution from each stock varies from year to year. Because of this, the coastal striped bass recreational fishery along the Atlantic Coast is considered a mixed-stock fishery, and anglers along the New Jersey coast may be harvesting fish from any of the geographically distinct spawning grounds. The goal of this study is to use microsatellite genotyping and population genetic analyses to identify the stock-specific origin of striped bass in the recreational fishery in northern Ocean County, New Jersey and estimate the relative contribution of individual stocks to the fishery centered on this region. To accomplish this, this study incorporates public participation in research by recruiting citizen anglers who provide fin clips and size data from striped bass angled throughout the region. Together, these data can be used to better understand the dynamics of migration in this fishery and to inform conservation and management strategies.

DEPARTMENT OF
CHEMISTRY AND PHYSICS

CE-1

UNRAVELING THE B TO A CONFORMATIONAL TRANSITION IN DUPLEX DNA CONSTRUCTS AT SINGLE BASE PAIR RESOLUTION

Kirsten P. Lawson and Michal M. Kalisz

Department of Chemistry and Physics

Faculty Mentor: Dr. Davis Jose

ABSTRACT

The transition of the standard B-form DNA helix to A-form DNA was first seen by X-ray imaging of DNA fibers. Over time, the structures of B and A DNA were further characterized with many higher resolution crystal structures. The transition of B-DNA double helix to A-form is essential for biological functions as recognized by the presence of A-form DNA in many protein-DNA complexes. While it is known that the B to A conformational transition occurs, the specifics, like where in the DNA it originates, how it propagates, and detailed step-by-step mechanism involved are still unknown. By using site specifically positioned fluorescent oligonucleotides, our aim is to explore the local and global conformational changes in this highly biologically relevant transition. Further, the local conformational tracking using fluorescent probes allows us to compare the A-form conformation in DNA duplexes with that found in DNA-RNA hybrid as well as DNA-protein complexes. Eventually we will introduce small organic molecules to enhance the stability of these structures and will use computational modeling to support our observations. Our results showed that using 2-Aminopurine (2-AP), a fluorescent analogue of Adenine, we could monitor the local as well as global conformational change simultaneously. Additionally we found that spermidine, a poly cationic amine, found in living cells can drive the duplex DNA into an alternative conformation in presence of ethanol. Our hypothesis is that spermidine binds to the grooves of the DNA and induce a conformational change that is neither A nor B form, but something similar to a triple helix. Currently we are exploring various ethanol and spermidine concentrations to characterize this novel transition.

CE-2

PEPTOID MACROCYCLES AS POTENTIAL ANTICANCER AGENTS: THE ROLE OF IONS IN CONFORMATIONAL EQUILIBRIUM

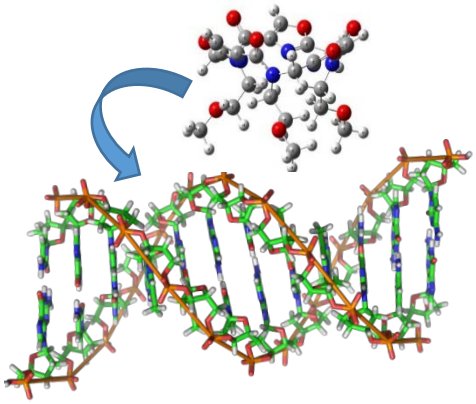
Amanda Prascsak, Omar Shah, Santino Timpani, Thomas Melfi and Roxy Nicoletti

Department of Chemistry and Physics

Faculty Mentors: Dr. Yana Kholod Kosenkov and Dr. Dmitri Kosenkov

ABSTRACT

In the field of cancer research, the toxicity of anti-cancer drugs is an urgent problem. Ligands, which are small organic molecules, have been proposed as potential anti-cancer drugs, since they bind to DNA macromolecules in telomeres to inhibit tumor growth. The cytotoxicity of these potential drugs is estimated based on the selectivity of their binding to specific DNA conformations. The current research focuses theoretically modeling ligands that have shown promise as anti-cancer drugs with low toxicity. Specifically, various oxazole and thiazole peptoid macrocycles are being considered. Different molecules belonging to this class, depending on their structure and substituents, bind in an extremely selective fashion to certain DNA forms, like the double-helix, parallel, anti–parallel, G-quadruplex, and mixed–type hybrid structures. Such oxazole/thiazole-based macrocycles can be chosen for optimal binding to these specific DNA conformations, and therefore, the subsequent targeted inhibition of telomerase in cancer cells.



To study conformational equilibrium in those designated sets of oxazole and thiazole peptoid macrocycles and to explore effects from the surroundings, focusing on the role of cations, a computational chemistry study has been conducted. Initially, a comprehensive sampling of various conformations for the predetermined oxazole/thiazole-based macrocycles was performed. Low energy conformations have been located for neutral peptoid macrocycle molecules as well as for their complexes with one and two sodium ions. The simulations have been conducted in solution to replicate the effects of the environment. It has been determined that sodium ions stabilize certain conformations significantly. Furthermore, we anticipate that the inclusion of cations in our ongoing study of ligand-DNA binding will promote strong affinity of the ligands under study to DNA molecules.

CE-3

MODELING IMPACT OF INTERMOLECULAR INTERACTIONS OF LPG-ALCOHOL MIXTURES ON STABILITY OF PHYLLOSILICATES: TOWARDS IMPROVEMENT OF DRILLING FLUIDS

Santino Timpani, Amanda Prascsak, Thomas Melfi

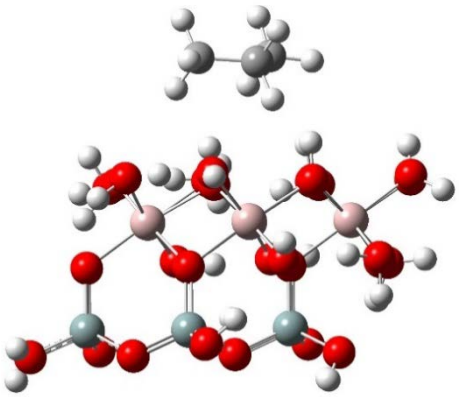
Department of Chemistry and Physics

Faculty Mentors: Dr. Yana Kholod Kosenkov and Dr. Dmitri Kosenkov

ABSTRACT

In recent years of fracking, the issue of borehole failures from shale instability has been increasing. Shale instability is caused by intermolecular interactions of polar water-based drilling fluids with shale minerals. Identifying this issue, it was proposed to use liquefied petroleum gas (LPG) based drilling fluids in fracking. LPG is a mixture of propane, butane, and other nonpolar components that can be safely recovered from the borehole. This project aims to solve issues of shale instability by improving a waterless fracking method that uses LPG-alcohol mixtures instead of water-based drilling fluids. Using computational chemistry methods, such as density function theory (DFT) and fragment molecular orbital theory (FMO) intermolecular interactions between components of LPG mixtures and phyllosilicates that create shale instability are identified and analyzed. These non-covalent interactions include Coulomb electrostatic, polarization, exchange-repulsion, and dispersion. Bulk steric factors that impact LPG-philosilicate interactions are also taken into consideration.

By using quantum DFT calculations, optimum configurations of the molecules separately and bound in the gas-phase are predicted. Performing an FMO investigation of the optimized LPG-based mixtures and philosilicate crystals will allow us to understand which intermolecular interactions are most prevalent in these systems. If successful, it may be possible to integrate the results into the field of fracking to solve the issue of borehole failures from shale instability and to provide a safe waterless drilling fluid.



CE-4

THE EFFECT OF SMALL MOLECULES ON THE STABILITY OF G-QUADRUPLEXES

Christopher Bentsen

Department of Chemistry and Physics

Faculty Mentors: Massimiliano Lamberto and Davis Jose

ABSTRACT

Telomeres are repetitive Guanine rich sequences at the ends of chromosomes that play a crucial role in protecting critical gene coding proteins from being attacked and lost through cell division. The human telomere consists of a repeating sequence of nucleotides, TTAGGG, that can form non-canonical DNA structures such as G-Quadruplexes, which is where our research is focused. The malfunctioning of telomeres results from many factors and the stability of the G-quadruplexes is one of them. In the current research, we are introducing porphyrin based small molecules to study the effect of ligand-induced stabilization/destabilization of these non-canonical DNA structures. Incorporation of different groups of ligands showed a structure/functional group based interaction of the small molecules with the G-quadruplexes and the difference in interaction is monitored using different spectroscopic techniques such as thermal melting experiments, fluorescence and Circular Dichroism (CD) spectroscopy. A detailed result of the effect of ligands studied, the techniques used to arrive at the conclusion and plans for future works will be discussed. This study will be useful in developing new therapeutic methods for treatment of diseases including cancer and genetic diseases such as Bloom syndrome, Werner syndrome, and Fanconi anemia.

CE-5

TWO-PHASE FLOW IN A HYDROTHERMAL VENT SYSTEM

Miranda Halpern

Department of Chemistry and Physics

Faculty Mentor: Dr. Kayla Lewis

ABSTRACT

Using six major assumptions from Lewis et al. (2018), the two-phase flow along a vertical wall in salt water is studied. With the use of Darcy's Law, the volumetric flux and temperature in relation to a dike are able to be calculated. The thickness of the layer as a function of height is sought. To solve this problem, the partial differential equations describing salt, mass, and heat transport are averaged across the thickness of the layer, converting them into ordinary differential equations that can then be solved to find the thickness. A formula for the rate at which heat is lost from the magma is derived, along with the length of time that the two-phase flow is able to persist as the magma cools. The conclusions found are that the width of the two-phase layer increases as height to 1/2 power. Liquid volume saturation and bulk salinity both increase with increasing depth. The bulk salinity reaches 10 wt% NaCl at the lowest height in the model. Phase separation at the top of the system persists for 21 days. The heat required to sustain the layer is derived primarily from the latent heat of magma crystallization. This research was inspired by E.M. Parmentier's *Two Phase Natural Convection Adjacent to A Vertical Heated Surface in a Permeable Medium* as well as Cheng and Minkowycz's work in *Free Convection About a Vertical Flat Plate Embedded in Porous Medium With Application to Heat Transfer From a Dike*. The implications of this research shows that fluid flow can significantly affect the chemical composition of the ocean. This allows a greater geophysical understanding of the world.

CE-6

ACIDOLYSIS PRODUCTS OF RHENIUM(I) ALKYLCARBONATO COMPLEXES TO TREAT AND INHIBIT INFLAMMATION IN CANCERS OF THE BREAST AND ORAL CAVITY

Arbaz M. Khan

Department of Chemistry and Physics
Department of Biology

Faculty Mentors: Gregory A. Moehring, Datta V. Naik and Jeffrey H. Weisburg

ABSTRACT

Organometallic compounds have been known to contribute to a myriad of pertinent advances in the medical field. Cis-platin, an organometallic compound with a platinum center, is one of the class of most effective chemotherapeutic agents used to treat cancer. A second class of organometallic compounds that has been studied extensively includes complexes with rhenium(I) centers. Our research focuses on rhenium(I) organometallic compounds supported by one α-diimine ligand, three carbonyl ligands, and a sixth carboxylate ligand. These complexes arise from the acidolysis of rhenium(I) complexes that include a single alkylcarbonate ligand. The alkylcarbonate ligand can be replaced by a carboxylate group using a variety of appropriate organic carboxylic acids. Prior research has reported that the pentylcarbonate-supported rhenium(I) complexes are cytotoxic. We hypothesize that analogous rhenium(I) complexes containing a carboxylate ligand in place of the pentylcarbonate ligand will also have cytotoxic properties.

The association between inflammation and cancer has been widely studied. The transcription factor NF-kB has been a key element in inflammation, and its activation has been shown to upregulate gene expression of other pro-inflammatory cytokines. Research has displayed that NF-kB activation may occur in most cell types. Employing carboxylate-supported rhenium(I) centers on the human squamous carcinoma (HSC-2) cells, human normal gingival fibroblast (HF-1) cells and breast cancer cell lines (MCF-7, Hs578T, and ZR-75-1), we are exploring if these complexes inhibit the activation of NF-kB and prevent the inflammatory process. Consequently, the determination of the sub-lethal concentration of the rhenium(I) carboxylate complexes is the first goal of this work. Determination of the sub-lethal concentration will lead to studies on the mechanism of action.

CE-7

QUANTIFYING SMALL DNA FRAGMENTS WITH ACRYLAMIDE GEL STAINING

Julia Baginski

Department of Chemistry and Physics

Faculty Mentor: Jonathan Ouellet

ABSTRACT

To better understand the relationship between structure and function for nucleic acids, it is common practice to measure the kinetics of the nucleic acid molecule over time and then use radioactive tagging to determine the size of the molecule. Though radioactive tagging is a precise and sensitive method for determining the size of small molecules (< 80 nucleotides long), radioactivity is expensive and heavily regulated by the government since it can be potentially hazardous to work with.

The goal of this project is to develop a cost-effective, accurate alternative to radioactive tagging through the use of gel stains. Various types of gel dyes are used to stain known DNA concentrations that were separated using 10% polyacrylamide gel electrophoresis. The gels are then imaged and processed using ImageJ to determine the intensity of the stained DNA band, which then allows for the concentration to be calculated.

A correlation is then quantified between the actual concentration of the DNA sample, determined by UV spectroscopy versus the calculated concentration found through ImageJ. As of yet, we have not been able to find a linear correlation between the actual concentration and the experimentally determined concentration; however, as we evaluate our hypothesis and accumulate more data, a correlation may present itself.

Currently, the hypothesis for my project is that the DNA is in such a large quantity that it titrates the dye, leading to a lower than expected fluorescence. To test this hypothesis, two discrete experiments are performed: one in which the quantity of staining dye varies and another in which the length of the DNA varies instead.

Defining the correlation between the experimentally determined stained DNA concentration and the actual concentration of the DNA would have a significantly positive impact on the study of DNA kinetics, reducing cost and improving safety in the lab.

CE-8

SELECTION OF AN APTAMER TO BIND 2-HYDROXYGLUTARATE THROUGH SELEX

Danielle Guillen, Artiom Efimenko, Krima Patel and Jennifer Lee

Department of Chemistry and Physics

Faculty Mentor: Dr. Jonathan Ouellet

ABSTRACT

Glioma and Acute Myeloid Leukemia are both cancers that have been linked to the formation of 2-HydroxyGlutarate (2-HG) during the Krebs Cycle. A point mutation on Arginine 132 of IDH1 enzyme causes a gain of function that converts α-Ketoglutarate (α-KG), the correct metabolite, into 2-HG, an inhibitor. Up to 86% percent of patients with excess levels of 2-HG have been found to have tumors relating to the above cancers. The goal of this research is to isolate an aptamer, or a single strand of RNA, that can bind to the 2-HG molecule with high specificity and accuracy. Through cycles of SELEX, Systematic Evolution of Ligands by Exponential Enrichment, a large pool of randomized RNA sequences can be narrowed down until eventually, only the addition of 2-HG to the RNA pool shows a high percentage of cleavage, while also showing little to no cleavage with the addition of random molecules, like magnesium. Once an aptamer is found, it will then be cloned, by use of a plasmid, and incorporated into a riboswitch, that will act as the mechanism to turn on and off translation of a desired gene to create a biosensor or cancer therapy.

CE-9

THE THEOPHYLLINE RIBOSWITCH: ITS DESIGN AND IMPLEMENTATION

Mika Schievelbein

Department of Chemistry and Physics

Faculty Mentor: Dr. Jonathan Ouellet

ABSTRACT

Fluorescence Activated Cell Sorting, or FACS, is a method that was used to convert the Theophylline aptamer into a riboswitch. This method could theoretically be used to convert other discovered aptamers into riboswitches, however it is a costly method and is only available to those with the high-tech, expensive FACS machines. The Theophylline riboswitch was previously discovered by implementing the Theophylline aptamer with random sequences into a specifically-designed plasmid and using a FACS machine to sort the cells.

We can structure a new system that would select only the sequence containing the Theophylline riboswitch without the use of a FACS machine. To do so, we place the aptamer with random sequences into a plasmid and transform the plasmid into bacteria cells. Then, the use of replica plating along with screening selects the cells that only contain the correct riboswitch sequence. By doing so, we confirm that this system is efficient in converting aptamers into riboswitches without the need for a FACS machine.

After an aptamer has been successfully converted into its riboswitch, the system of ratiometric fluorescence will allow for testing of the riboswitch's function. This is done by designing a plasmid that contains genes for two fluorescence proteins on either side of the inserted riboswitch. Currently, three different cloning methods are performed simultaneously in order to develop this plasmid. Firstly, a mutagenesis kit will be used to create the sequence of the new plasmid by PCR with pHL1720 as a template. Secondly, PCR of the sequence for the lactose operator used along with double digestion of the PCR produce and pHL1720, and ligation will be used to develop this plasmid. Lastly, subcloning will be used as the final method, in which the sequence for the lactose operon, mCherry gene, theophylline riboswitch, and GFP are cloned into pBR322 and then cloned into pHL1720. The two florescent proteins, mCherry and GFP will provide the ability to measure the riboswitch's function through fluorescence readings.

Both of these systems are the key to innovating the next step in creating synthetic riboswitches.

CE-10

SYNTHESIS OF SILVER NANOPARTICLES FOR ENVIRONMENTAL REMEDIATIONS

Angelique Ithier and Alexandra M. Tamburri

Department of Chemistry and Physics

Faculty Mentor: Dr. Tsanangurayi Tongesayi

ABSTRACT

Nanoparticles (NP) are small particles with a size range of one to 100nm that can be synthesized by either top-down methods (physical methods) or bottom-up methods (chemical and biological 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. NP-based research has largely focused of technological applications of NP 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 (Ag-NP); for instance, have shown tremendous potential in the biomedical field particularly in anticancer treatments. The Ag-NP have immense antimicrobial properties. Consequently, they have potential applications as disinfectants on medical tools and other medical surfaces. However, the electrochemical behaviors, ecotoxicity and cytotoxity of the Ag-Np remain largely unknown. The major goal of this project is therefore to study Ag-NP with respect to their fundamental properties, environmental impacts and potential applications in environmental remediation and water treatment. To date, we have explored various reducing and stabilizing agents in the synthesis of Ag-NP, and we are in the process of characterizing the NP.

CE-11

IMPACT OF MICROPLASTICS ON THE MOBILITY, SPECIATION, AND TOXICITY OF HEAVY METAL(LOIDS) IN THE AQUATIC ENVIRONMENT

Olenka Mallqui

Department of Chemistry and Physics

Faculty Mentor: Dr. T. Tongesayi

ABSTRACT

Every year, an estimated eight trillion tons of microplastics enter the United States oceans either from the degradation of discarded commercial macroplastics or use of commercial beauty products. Microplastics have become the latest source of pollution affecting a large portion of the aquatic environment. While scientific literature on the effects of microplastics on marine life continues to increase, the influence of the microplastics on the biogeochemistry of toxic elements already present in the environment remains largely unknown. Research has shown that microplastics are capable of adsorbing metal(loid)s, organics and microbes. Consequently, microplastics have the potential to change the speciation of metal(loid)s through biogeochemical reactions. Such a development will also affect the mobility and toxicity of the elements. In this study, we investigated the adsorption of lead and zinc by microplastics extracted from various hand, facial and body cleansers to determine their adsorption capacities under simulated natural conditions. Our data shows significant binding of both heavy metals under conditions investigated. Work on the biogeochemistry of the heavy metal(loid)s in ongoing.

DEPARTMENT OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING

CSSE-1

OUTLOOK MOBILE APP

Jimmy Duong and Anthony Vives

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Raman Lakshmanan

ABSTRACT

The Outlook is the university run student newspaper of Monmouth University, and The Outlook app is the mobile equivalent of The Outlook website. This native Android platform app seeks to fill in the niche of providing quick and easy access to university news and current events.

By utilizing utilizes RESTful web services to Joomla CMS based Outlook content server, the app retrieves newspaper articles in JSON encoded format. This data is requested by using Android Volley, an HTTP library, to send HTTP calls to the Outlook website; The JSON data is then parsed by the app to be utilized for its core functionalities. The app is developed using Model-View-Controller methodology.

The application will primarily target students and faculty by providing the ability to view newspaper articles as soon as they are released, save articles for offline or later use, and access older articles or issues. The target audience will also be able to view the latest released article or search from a list of already saved articles.

CSSE-2

CONSEAERGE: A BEACH VALET MOBILE APP FOR THE JERSEY SHORE

Bradley Gougler, Sandley Guo and Jessica Zemartis

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Raman Lakshmanan

ABSTRACT

Finding parking for public beaches can be time-consuming and stressful. ConSEAerge is a mobile app that brings valet services to New Jersey's public beaches. The app eases the experience of beach-goers by allowing the user to schedule a concierge service with a designated drop-off and pick-up location at their preferred beach, and associated services in addition to parking. The app allows users to register a new account, create a valet reservation and services, and pay for services rendered all within the same app.

The app was built natively for both Android and iOS mobile platforms, with common backend functionality being rendered in cloud computing in Amazon Web Services (AWS). The Android app was developed mainly with Kotlin (a new programming language) and the iOS app in Swift. The cloud computing backend uses AWS's Cognito for authentication and Lambda Function services for serverless computing. The Cognito portion provides a safe user pool that allows sensitive information to be stored. Lambda functions are snippets of code that are stored on AWS and then called through a REST API gateway service. The Lambda functions connect to a mySQL relational database in AWS's cloud. Additional Lambda functions interface with credit card payment processing services by Stripe payments.

CSSE-3

RACIAL POPULATION DISTRIBUTION OF THE UNITED STATES 1790 – 2010

Michael Karolewicz and Kalyna Reda

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Raman Lakshmanan

ABSTRACT

Every decade, United States Census data is made available to users to see the population of the United States. This data consists of thousands of different values for multiple races in every state between the years 1790 and 2010. Looking for a way to visually represent this data, Monmouth University's History Department looked to the Computer Science and Software Engineering Department for help. Working with Project Sponsors Geoffrey Fouad (from History & Anthropology) and Prof. Walter Greason (Education), the authors held multiple stakeholder meetings to fully understand the requirements of the project. The US Census data is held in csv files, making it difficult for the user to see the changes in population over periods of time for different races. Viewing the data on a choropleth map would be an easy way for viewers to see these changes, with higher populated areas showing in a darker color than lower populated areas. This racial map of the United States is now displayed on a web page and changes based on the user's choice of year, total population, percent population, and White, Black or Hispanic race. Viewers are now able to analyze this information looking at a visual display versus thousands of lines of data in different files.

This project used ArcGIS mapping technology with layers in conjunction with full stack web application consisting of data store in ArcGIS cloud using mySQL database for organization, and web front end using HTML, CSS, and JavaScript. The application is deployed in cloud computing service for scalability and performance.

CSSE-4

CORRELATING TWEETS WITH THE METOO HASHTAG TO GEOGRAPHICAL LOCATIONS

John Neppel and Thomas McHugh

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Raman Lakshmanan

ABSTRACT

The #MeToo movement was a major social movement on Twitter that endeavored to accentuate stories of sexual abuse, facilitate an outlet for victims to express their encounters, and promote a path for healing. On behalf of Dr. Sasha Canan, Director of Monmouth's Sexuality Education & Attitudes Lab and in coordination with Prof. Geoff Fouad (History and Anthropology), we were given the task to implement an web application that can be used to study the #MeToo movement by correlating shared Tweets containing the hashtag to the geographic locations they were shared from. The motivations for the application were to better understand the trends of the movement over time and to correlate the locations of shared Tweets to documented statistics on sexual assault.

To implement the application, we interfaced with the Twitter Search API to query for Tweet metadata pertaining to the hashtag. We also utilized the Google/OpenMap Geocoding API to generate approximate coordinates for Tweets that did not contain embedded location metadata. Upon receiving the data, we archived it into a relational database for further utilization. Based on requested data for presentation, we queried the database and generated interactive heat and point maps on a webpage via Google Maps for map layer service. The webpage allows users to view the locations of where the Tweets were shared from and to adjust the timeframe that is represented by the maps.

In our findings, Tweets containing #MeToo were well spread out across the United States and Canada but were more heavily concentrated in urbanized areas. We have also observed that Tweets containing the hashtag are much more prevalent following associated current events such as the legal proceedings of sexual misconduct by well know celebrities.

CSSE-5

RETICLE SOLUTIONS APP: LAW ENFORCEMENT CASE REPORT ANALYSIS AND VIDEO PLAYBACK SERVICE IN OFFICER TRAINING

Claudia Ondecker and Peter Montella

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Raman Lakshmanan

ABSTRACT

Reticle Solutions app is an iOS-based tablet application for use by high-ranking officers in local police departments. The app facilities each department and allows admins to manage their officer ranks with permissions to allow submission of cases, case videos and review/playback restriction.

Searching through different cases on the server, and being able to analyze a broken down detailed version of one is one of the main features of the app. Users are prompted with different questions about a scenario where a police was involved, and then the app gathers the response and stores the database for the officer to view. The officer can then upload a video of the police body cam footage during the incident that transpired; making it a completely digital version of everything that occurred.

Hypothetically, if the officer preformed incorrectly at the scene, the app will then take the case, and generate an email for the officer with instructions or a video that informs the police how to improve, and what they should have done. This will be used to prevent any mishaps or unprofessional incidents from occurring again. Overall Reticle Solutions is an easy to use app for officers, while accommodating their needs to be able to manage case studies in training officers.

The app was developed using Model-View-Controller methodology. It uses cloud-based services for data storage and sharing, video streaming, and notification when feedback requires further action.

CSSE-6

DMAVA: DEPARTMENT OF MILITARY AND VETERANS AFFAIRS VETERANS OUTREACH APP

Joshua Schlanger and William Jones

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Raman Lakshmanan

ABSTRACT

There are an estimated 400,000 veterans in the state of New Jersey. This is about 5 percent of the population; however, this number is not accurate. In reality, many veterans do not legally identify themselves as veterans. Most NJ veterans are unaware of extensive benefits and resources they are entitled to, nor do they know where to seek out these benefits and resources. Today's veterans are of a younger crowd; because of this, they are very in tune with technology. Technology, being the main source of information, is the gateway into getting any and all available information into the hands these NJ veterans.

Our project is design and development in both Android and iOS apps that is a hub for information related to the Department of Military and Veteran Affairs (DMAVA). We accomplished this project in coordination our client, NJ DMAVA. The content for the app is provided by DMAVA. The apps are written in their respective languages: Kotlin for Android and Swift for iOS. Because the applications have the same information, they will both use the same Firebase Cloud Firestore Cloud Database services. This ensures that the information is consistent across iOS and Android. The app allows veterans to submit requisition forms, which are required for veteran benefits eligibility. Along with the creation of these apps, we created a web portal which allows administrators to add, delete, and update information on location events and schedules for various VA services. The creation of this web portal was to provide a more user-friendly environment for administrators of DMAVA to update data for the apps. Our goal with this project is to reach as many veterans as possible. Given the younger demographic and the ease of technology, we believe that these apps will be a step in the direction of reaching this goal.

CSSE-7

SCAN-SEARCH DICTIONARY

Darius Howe, Kyle Mueller, Matt Shober, Greg Stickle and Nianqi Tian

Department of Computer Science and Software Engineering

Faculty Mentor: Dr. Cui Yu

ABSTRACT

Scan-search Dictionary is an iOS mobile application designed to provide users with a quick link between words they do not understand with definitions. It doesn't require to type or copy-paste words. Only presenting the word to the phone's camera is necessary. As *Shazam* is for music identification, *Scan-search Dictionary* is for word identification. The application incorporates two main features: Tesseract and Web Data Scraping. Tesseract is an open-source Optical Character Recognition (OCR) software, able to identify characters in images. When the user hovers the phone's camera over a book page, poster, display on screen, or etc., Tesseract identifies words from a selected frame of the live video feed. The user is then prompted with the word searched and a list of similar words. With the user's selection of a singular word, the Web Data Scraping process immediately begins. Via JavaScript and specifically using *Dictionary.com* as a source for definitions, the user is presented a screen with each definition associated with the selected word. For ease of use, a text-to-speech option is also available.

While not specifically having a ground-breaking design or feature, *Scan-search Dictionary* provides a foundation for an educational tool that can easily be used inside and outside of the classroom. The application provides a speed and efficiency aspect to information retrieval. The main goal of *Scan-search Dictionary* in order to make it viable is to beat a time set by how long a user takes to open a browser, search their word of interest, and read the definition.

DEPARTMENT OF MATHEMATICS

MA-1

STATISTICAL ANALYSIS OF WHITE BLOOD CELL COUNT AND CCL TEARS IN CANINES

Samantha Cavalli and Kristen Marzano

Department of Mathematics

Faculty Mentor: Dr. Richard Bastian

Client: Dr. Lindsay Nussbaum, DVM, Red Bank Veterinary Hospital, Tinton Falls, NJ

ABSTRACT

The cranial cruciate ligament (CCL) in canines is meant to prevent the improper motion of the knee, and if damaged or torn, complications with movement, mobility, and pain can arise. Current options for CCL tear diagnosis include physical examinations or X-rays, which are often misdiagnosed. Other more effective options are knee arthroscopy or surgery which is costly for owners. However, it is speculated that there will be an increase in the white blood cell (WBC) counts and gross anatomical appearance extracted from synovial fluid in dogs with CCL tears. Using a sample size of 99 dogs previously diagnosed with CCL tears undergoing surgery, we are testing for associations between positively diagnosed CCL tears and various factors such as the appearance of the CCL, gross osteoarthritis (OA), and gross cartilage as well as the counts for WBC estimate, monocytes, lymphocytes, and neutrophils to determine associations that could simplify current techniques.

MA-2

ANALYSIS OF SUTURE MATERIALS FOR VETERINARY MEDICINE

Catherine Crawford and Melissa Culmone

Department of Mathematics

Faculty Mentor: Dr. Richard Bastian

Client: Dr. Allison Newgent, Garden State Veterinary Specialists

ABSTRACT

The purpose of this study is to further understand complication rates of dissolvable sutures used in scrotal urethrostomy surgery for dogs. Dr. Allison Newgent at Garden State Veterinary Specialists collected data about 46 dogs including their age, weight, surgery, and suture material. The research questions we are addressing are: “What are the complication rates associated with dissolvable suture material?” and “What contributes to those rates?” Dissolvable sutures are considered more desirable than non-dissolvable sutures in veterinary medicine because the dog does not have to revisit the hospital for the sutures to be removed. We will be focusing on the relationship age, weight, suture type, suture size, and type of surgery have with complication rates post-surgery. Our response variables are qualitative while our predictor variables are both qualitative and quantitative. To analyze our data and address the research questions, we will perform the following tests: stepwise logistic regression and ordinal logistic regression.

MA-3

PREVALENCE OF OBESITY IN DACHSHUNDS WITH INTERVERTEBRAL DISC DISEASE (IVDD)

Taylor O'Rourke and Conor Tuturice

Department of Mathematics

Faculty Mentor: Dr. Richard Bastian

Client: Dr. Martha Cline, Red Bank Veterinary Hospital

ABSTRACT

Dr. Martha Cline is a veterinarian who specializes in nutrition and works primarily with dogs. Currently, she has conducted a study on Dachshunds and how obesity can increase their chances of Intervertebral Disc Disease (IVDD). The primary research question for this study is: Is there a prevalence of overweight and obesity in dachshunds diagnosed with IVDD by MRI presenting to a veterinary neurology service compared to dachshunds presenting to a general practice for a routine exam without history of IVDD? There is also a secondary research question which is: What is the relationship between Body Condition Score (BCS) and Modified Frankel Spinal Cord injury score (MFS) in dachshunds presenting to a veterinary neurology service diagnosed with IVDD? Dr. Cline collected the data by getting consent of owner if the patient had been diagnosed via MRI. She had two groups in this study, Group 1: Without IVDD, and Group 2: With IVDD. Group 1 data was collected retrospectively and group 2 data was collected prospectively from patients Dr. Cline treated. Dogs in both groups were given a BCS, which is a number from 1-9 describing their physical appearance, with 4-5 being an ideal weight. MFS is a number that describes the patient's severity of ruptured disc, with 0 representing the patient being paralyzed. The sample size was 140 dogs, 96 in Group 1 and 54 in Group 2. Statistics that have been run so far are descriptives in both groups 1 and 2 for BCS, body weight, BCS by gender, BCS by body weight (kg), BCS by breed.

MA-4

STATISTICAL ANALYSIS OF THE RELATIONSHIP BETWEEN WATER QUALITY PARAMETERS OF THE NAVESINK AND SHREWSBURY ESTUARIES

Kimberly Bianchi and Hunter Hostage

Department of Mathematics
Department of Biology

Faculty Mentors: Dr. Richard Bastian and Dr. Jason Adolf

ABSTRACT

Estuaries occur where rivers meet the sea and are characterized by gradients of salinity and associated water quality parameters. The Navesink and Shrewsbury estuaries both converge and flow out into Sandy Hook Bay and offer an ideal system for comparative estuarine studies due to their similar geomorphology, yet different watershed characteristics. Over the course of twelve weeks, five boat trips were taken to obtain water samples at twenty-one designated stations, each 1.6 kilometers apart, reaching from the tips of the rivers all the way to the outer edge of Sandy Hook Bay. These locations were tested for different parameters, including salinity, temperature, and dissolved oxygen. Each sample was also processed at the lab for chlorophyll *a*. Dr. Jason Adolf is trying to find statistical relationships between water quality parameters within these urban estuaries.

To analyze this data, scatterplots were created to compare the salinity vs the chlorophyll *a* measurements based on the location to try to find a trend in the data. Scatterplots were also made for chlorophyll *a* vs time based on every station to see if there was a seasonal trend in the data.

MA-5

STATISTICAL ANALYSIS OF MANGROVE CREEK DISPERSAL THROUGHOUT STREAM LOCATION AND TIDE CHANGES IN THE BAHAMAS

Yanhaorui Fang and Anthony Sarbello

Department of Mathematics
Department of Biology

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

ABSTRACT

Mangroves are a special type of tree that grow along bodies of water and have roots above and below the surface. Dr. Daneshgar has tracked the movement of data pods through a mangrove creek in the Bahamas to determine the possibility of potential mangrove seed pod dispersal. The stream was divided into three zone (upstream, midstream, and downstream) and pods were dropped in these different zones at both high and low tide. The pods were retrieved after ten days and their distance traveled was recorded. In order to find the relationship between tides and distance, we run an independent t-test. In order to find the relationship between distance and the stream zones, we use analysis of variance. Last but not the least, we would like to find out how stream and tide together affect the distance traveled. Since there are two dependent qualitative variables, so we use univariate analysis of variance to test for interactions.

MA-6

HOW DIFFERENT PLAYGROUPS EFFECT SALIVARY CORTISOL LEVELS OF SHELTER DOGS

Anna Lazur and Mike McGuigan

Department of Mathematics
Department of Psychology

Faculty Mentors: Dr. Richard Bastian and Dr. Lindsay Mehrkam

ABSTRACT

This study is examining the salivary cortisol levels of dogs from four different shelters utilizing four different types of playgroup and or activity. Salivary cortisol levels are representative of the short-term wellbeing of these shelter dogs, where lower levels indicate better mental welfare of the dog. The goal of the study is to establish the best practice for shelters to use with their dogs. Shelter A utilizes a large correctional based playgroup of about 5 dogs, where the primary focus was to correct the dog's poor behavior. Shelter B utilizes a small correctional based playgroup of about 3 dogs. Shelter C represents the control group, where playgroups were not implemented and instead volunteers walked the dogs one at a time. Shelter D utilizes a positive reinforcement playgroup, where dogs were not punished for poor behavior but rather rewarded for good behavior.

Salivary cortisol levels for each dog were tested both 1 hour before and 15 minutes after the playgroup/walk for a 7 day period. In our analysis we will be looking at the mean salivary cortisol levels prior to and after any activity, as well as the differences between the two. We will also be comparing the median cortisol levels between shelters to examine the effectiveness of each playgroup/walk in lowering the salivary cortisol levels. We will be using a comparison of medians rather than means because cortisol levels can vary greatly, which resulted in a lack of normality among the groups. In addition we will be comparing the medians between the numbers of days in playgroup.