

## Undergraduate Research and Internship Symposium Book of Abstracts

- Title:** Basic Needs Insecurity and Student Well-being: A Qualitative Update from the Field

### Authors

Kelsey Cook (Anthropology B.A)

Jason Ruiz (Software Engineering B.S)

### Faculty Mentor

Max Stein (Social Sciences)

### Abstract

This study seeks to identify the knowledge, student understanding, and behaviors surrounding student basic needs securities within a university setting. Basic needs insecurity among students in higher education is a national health crisis which impacts academic performance, social dynamics, and overall well-being under normal circumstances, let alone during the Covid-19 pandemic. We examine individual and group knowledge about basic needs, available assistance, and the stigma associated with its use to understand how these factors impact students. This study is being conducted among credit-earning undergraduates at Florida Gulf Coast University using a combination of open-ended student interviews (n=30), focus groups (n=5), open-ended specialist interviews, and participant-observation. We present preliminary insights from these interviews and outline the process of qualitative data analysis in order to develop a culturally relative structured instrument to measure the impact of student basic needs insecurity on the well-being of all FGCU undergraduates (N~14,000). The personal narratives presented are analyzed using qualitative data analysis to identify dominant themes, ideas, and behaviors associated with the experience of basic needs insecurity.

### Keywords

Basic Needs Insecurity, Covid-19, Student well-being, stigma

- Title:** Heterogeneous Palladium-NHC Catalysts for Greener C - C Coupling Syntheses Featuring Structurally Secured Metal Coordination Site

### Authors

Jennii Burrell (Biochemistry B.S)

### Faculty Mentor

Daniel Paull (Chemistry & Physics)

### Abstract

Advances in catalytic C - C coupling systems over the last 50 years has had a major impact on organic synthesis and drug discovery projects. Utilizing these cross-coupling systems, synthetic chemists gain access to a wider variety of structures that can be analyzed for structure-activity relationships in drug discovery and optimization research. While these systems offer a reliable method for creating an array of structures with new C - C bonds, they require transition metal

catalysts, posing a major problem in the development of viable pharmaceutical products due to strict limits on metal contamination and hazardous metal waste. In pursuit of a heterogeneous catalyst to implement in aqueous coupling reactions for development of early-stage pharmaceutical compounds, the unique reactivity of functionalized N-heterocyclic carbene rings (NHC) serves as the base for our solid-supported palladium catalysts. Several structural variables are being explored to investigate their effect on retaining the active metal species to the catalytic complex, limiting metal leaching and bolstering recyclability of the catalysts. The functionality of this catalyst provides a greener tool for utilization in many coupling reactions requiring a heterogeneous catalyst for sensitive syntheses of drug molecules.

Keywords

Catalysis, N-heterocyclic Carbene, Palladium, Green Chemistry

Grants

Blair/Brodie Summer Research Scholarship Seidler Scholarly Collaborative Fellowship

- 3. Title:** Differential Detection and Analysis of DNA from Various Substrates Commonly Found at Crime Scenes

Authors

Camila Garcia (Biochemistry B.S)

Faculty Mentor

Sulekha Coticone (Chemistry & Physics)

Abstract

One of the most challenging issues in forensic biochemistry is obtaining DNA from fingerprints. In this study, techniques such as PCR and capillary electrophoresis were utilized to analyze Low-Copy Number (LCN) DNA in fingerprints on different substrates/objects. Fingerprints were placed on different objects (that could potentially be used while committing a crime) and revealed by using black fingerprint powder. DNA was collected by swabbing each print with a cotton swab and stored in sterile water. Extraction of DNA was carried out by using the Chelex extraction method followed by quantification using UV-Vis Spectrophotometry. Finally, PCR and capillary electrophoresis were performed to determine human-specific profiles and establish a useful and accurate protocol to analyze LCN DNA. The different protocols used were (i) increasing PCR cycles (ii) injection time, and (iii) increasing the amount of sample in formamide. Preliminary results showed that increasing the injection time provided the best protocol to analyze LCN DNA giving an average percent allele of 45.3% compared to the pure profile. Additional experiments are being performed to determine the substrate which would yield the most complete human profile. These studies will provide useful information for DNA analysts as they evaluate LCN DNA frequently found at crime scenes.

Keywords

DNA Analysis, Forensic Science, Crime Scene Assault Weapons, Collection

#### Grants

Florida Georgia Louis Stokes Alliance for Minority

#### **4. Title:** Analysis of Expression of Flowering Genes from *Melaleuca quinquenervia*

##### Authors

Susan Taylor (Biochemistry B.S)

Shawn Brunelle (Biology B.A)

Rodrigo Tomas (Biotechnology B.S)

##### Faculty Mentor

Marilyn Cruz-Alvarez (Biological Sciences)

##### Abstract

*Melaleuca quinquenervia*, native to Australia, was introduced to South Florida over a century ago. It is a highly invasive species due to its short juvenile stage and ability to flower several times a year. Biotechnology can help elucidate flowering regulation in *Melaleuca*. Regulation of flowering genes in *Melaleuca* can be compared with homologous genes from the model species *Arabidopsis thaliana*. Genes homologous to FRUITFULL (FUL), and LEAFY (LFY) have been isolated from a *Melaleuca* genomic library, and possible promoter regions of these genes amplified from the respective genomic clones. Promoters of the floral meristem identity genes APETALA1 (AP1), CAULIFLOWER (CAL), FUL and LFY from *Arabidopsis thaliana* were obtained by PCR amplification of *Arabidopsis* DNA using sequence specific primers, acting as a control. PCR products were cloned into plasmids, upstream of the  $\beta$ -glucuronidase (GUS) reporter gene. The promoter-GUS reporter gene cassettes are being transferred into an *Agrobacterium tumefaciens* vector. After genetic transformation with *Agrobacterium tumefaciens*, *Arabidopsis* plants will be assayed for GUS enzymatic activity to analyze promoter activity. Once promoter activity is confirmed, transgenic plants will be subjected to varying conditions, and regulation of expression of *Melaleuca* genes will be compared to that of the *Arabidopsis* genes in the same conditions.

##### Keywords

Flowering, Regulation, *Melaleuca*

##### Grants

Seidler Scholarly Collaborative Fellowship

#### **5. Title:** 3-Dimensional Routine Cell Passaging of NIH/3T3 Cells

##### Authors

David Gailndo (Bioengineering B.S)

Megan Young (Bioengineering B.S)

##### Faculty Mentor

Jiehong Liao (Bioengineering)

#### Abstract

Hydrogels are three-dimensional (3D) matrices that are composed polymers and can retain large amounts of water in their crosslinked network. Hydrogels can be tailored to have different mechanical properties through material formulation and crosslinking density. There are three main types of hydrogels used in cellular and tissue engineering: natural, synthetic, and hybrid, with various subcategories for each. Hydrogels have been used in a variety of applications to study cell function in a 3D microenvironment more closely resembling native tissues. However, it is routine to expand cell populations for these experiments through passaging, typically conducted on two-dimensional (2D) surfaces such as a petri dish. It is possible that the cells may grow and function irregularly as they are not maintained in an environment similar to the tissues from which they were obtained, which could lead to erroneous results in subsequent cellular experiments. This work explores the use of hydrogels for routine cell passaging where cells can grow and function in a 3D environment as they would inside the body. Cells will be grown in three different environments: 2D tissue culture plastic, 2D hydrogel layer, and embedded in 3D hydrogel. Cell morphology, proliferation, and live/dead ratio will be monitored throughout the study.

#### Keywords

cell culture, hydrogel, three-dimensional environment, two-dimensional surface

### **6. Title: The Effect Of Substrate Stiffness On Cell Health After Electroporation**

#### Authors

Felicia May (Bioengineering B.S)

Patrick Scarff (Bioengineering B.S)

#### Faculty Mentors

Jiehong Liao (Bioengineering)

#### Abstract

Stiffness of a cell's microenvironment can affect its differentiation, adhesion, migration, and cell cycle. These processes are critical for cellular health, and therefore suggest that the mechanical environment plays an important role in cellular health. Electroporation is a method of delivering particles into a cell by disrupting the cell membrane with an electrical voltage. Studies have shown a correlation between environmental stiffness and effectiveness of gene delivery using electroporation, however the mechanisms for these observations are unknown. This study evaluates how substrate stiffness and electroporation affect cellular health to consider state of health as an intermediate factor in the varying effects of gene delivery. Mitochondrial metabolic activity, along with Heat Shock Protein 70 (HSP70) production, are valuable means for evaluating the stress a cell is undergoing. Both will be measured in environments of varying stiffness via MTT assay and Western Blot, respectively, to determine how substrate stiffness affects cellular health. Cells on substrates of varying stiffness will then be subjected to electroporation conditions consistent with previous experiments to examine additional effects. Cellular health is expected to be impacted by

environmental conditions and elucidating the contributions of stiffness and electroporation will enable more controlled studies in the effectiveness of gene delivery.

Keywords

Electroporation, Hydrogel, Heat Shock Protein (HSP), Substrate Stiffness

**7. Title:** FBP1 Expression in Dynamically Stiffened Hydrogel

Authors

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Faculty Mentors

Jiehong Liao (Bioengineering)

Christopher Geiger (Bioengineering)

Abstract

Hydrogels are commonly used to mimic the extracellular matrix in ex vivo microenvironments. Stiffness of the extracellular matrix has been known to influence cellular function. Recently, new methods have allowed for the design of dynamically stiffened hydrogels that better simulate tumor progression. Studies have shown that in various cancers, Fuse Binding Protein 1 (FBP1) is downregulated which is correlated with advanced tumor stages. However, there have been no studies examining FBP1 expression by cells exposed to a dynamically stiffened matrix environment. This work investigates the production of FBP1 using dynamically stiffened Methacrylated Hyaluronic Acid Hydrogels (MeHa) to determine how FBP1 production changes with increasing substrate stiffness and whether FBP1 levels differ for cells on substrates of fixed stiffness versus a dynamically stiffened substrate at the same stiffness. Cells will be placed on MeHa hydrogels of low stiffness (8 kPa -10 kPa) and dynamically stiffened to a high stiffness (50kPa and up) based on stiffness measurements from hydrogel formulations in previous studies. Protein production will be visualized through immunofluorescence and measured with western blot after 6 days. Understanding how progressive matrix stiffness affects the expression of various proteins, such as FBP1, has important implications in the development of new cancer treatments.

Keywords

cancer, far upstream element binding protein 1 (FBP1), hydrogel, substrate stiffness

**8. Title:** Insulin-Glucose Dynamic Model for Type 1 Diabetes

Authors

Alexandra Zamitalo (Bioengineering B.S)

Faculty Mentors

Daniel Kern (Mathematics)

### Abstract

This presentation introduces a mathematical model generated to illustrate the blood-glucose response of a type 1 diabetic to simulated meals, short-term insulin injections, and epinephrine fluctuations over a period of 24 hours. This model is more accurate than a minimal model without being as analytically cumbersome as a maximal model. The addition of epinephrine adds an additional term to this system to account for the body's natural response to hypoglycemia, a complexity not addressed in minimal models. Further, this model utilizes a series of simulated meals and injections rather than the traditional glucose tolerance test to provide a more accurate demonstration of changes to blood-glucose concentration. Finally, this model assesses this system over the time frame of one day rather than the course of one instantaneous input of glucose into the system, which is a more meaningful and accurate assessment of a diabetic's endocrine system. This assessment is represented by a system of differential equations which was then numerically solved with MATLAB. This is valuable because it introduces the effects of epinephrine simply and efficiently, and it allows for analysis of blood-glucose levels for a type 1 diabetic in a way that allows for more appropriate and meaningful interpretation.

### Keywords

Type 1 Diabetes, Differential Equations, Epinephrine, MATLAB

## **9. Title: Effects of Various Squat Depths on Vertical Jump Height and Ground Reaction Force**

### Authors

Alexandra Zamitalo (Bioengineering B.S)

Joel Oliver (Bioengineering B.S)

Darrell Davis (Bioengineering B.S)

### Faculty Mentors

Derek Lura (Bioengineering)

### Abstract

This presentation addresses whether individuals can naturally choose a squat depth in preparation for a vertical jump that would result in the most successful jump. The objective of this study was to assess the vertical displacement and the maximum ground reaction force (GRF) going into a standing vertical jump at three squat depths: a knee flexion angle chosen by the participant, one shallower than 45 degrees, and one deeper than 45 degrees. The hypothesis tested is that there will be a correlation between the peak knee flexion angle and the peak GRF. Data collection used a Qualisys Track Manager (QTM) capturing the motion of reflective markers on seven anatomical landmarks to collect knee flexion angles and vertical displacement. AMTI 6-axis Force Plates were used to collect GRF data. This study fills several gaps in current literature investigating vertical jumps and various knee characteristics and, as a result, introduces the potential benefits of a more generalizable conclusion, and perhaps that healthy individuals are familiar with their own limitations and can produce a physiologically optimal angle for knee flexion before a jump. This study suggests

further investigations into other cases where participants are naturally familiar with conditions of their own optimal performance.

Keywords

Vertical Jump, Biomechanics, Knee Flexion, Ground Reaction Force

**10. Title:** Can Different Breeds Of Honeybees Better Survive Against Varroa Mites?

Authors

Luis Perez (Biology B.A)

Faculty Mentors

Nora Demers (Biological Sciences)

Abstract

Honeybees face many threats when trying to survive. Some of these threats range from different types of diseases. One of the biggest threats that beekeepers are faced with dealing with are the Varroa mites. It is a tick like creature that attaches itself to the abdomen of developing bees and feeds off the developing body. While doing this the mite infects the honeybee with disease affecting the body that is still in development. Some breeds of honeybees can protect themselves from Varroa mites better than others. There are studies that have been made comparing the different breeds and how they are able to better defend against the mite.

Keywords

Honeybees, Mites, Survival, Survey

**11. Title:** Comparison Of Five Commonly Used Databases For Research On Anal Fin Ratio In *Gambusia Affinis* And *Holbrooki*

Authors

Isabel Sanchoyerto (Biology B.A)

Faculty Mentors

Nora Demers (Biological Sciences)

Abstract

The endocrine system controls the development of the sex organs of *Gambusia affinis* and *holbrooki*. Endocrine disruptors can disrupt this function and create sex organ issues. Researchers can view their anal fins to determine whether it has been affected by endocrine disruptors. Using Zotero, 10 articles that showed proof of elongation of the anal fin ray due to endocrine disruptors were accumulated and then used to compare databases. After finding the relevant articles, five databases were analyzed; Web of Science, PubMed, Google Scholar, ProQuest, and Science Direct.

The articles were searched on each of the five databases and the information provided by the database was compared. I came to the conclusion that the best database for this specific type of research was Web of Science. It provided the most clear and easy to use data when searching for proof of anal fin morphology. It was able to give the most information in regard to the number of times the given article was cited by other papers, whether or not the database provided related references, and the key words that were used by that specific database. Through my research, I found that each database has a purpose and a directed audience

#### Keywords

Endocrine disruptors, Anal fin, Gambusia, Database

### **12. Title:** Computational Screening of Green-Solvents in Suzuki Coupling

#### Authors

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#### Faculty Mentors

Daniel Lambrecht (Chemistry & Physics)

#### Abstracts

Solvents are used in the synthesis of medicinal drugs in great amounts. Most of the solvents used by pharmaceutical companies pose risks to humans, animals, and the environment. The objective of this project is to find alternative approaches in the synthesis of conventional medicinal drugs using "green" solvents, which are solvents that offer less harm to the environment in general. To accomplish that, 17 solvents were analyzed, and several approaches were taken into consideration, such as polarity, viscosity, and flame point. Computational approaches take on a special role in green solvent selection because it allows the safe analysis of solvents by avoiding usage or exposure to potentially harmful chemicals and promotes the ability to screen a large number of solvents in a given amount of time. The reaction used in the analysis of green-solvent was the Suzuki-Miyaura coupling, which is the main synthesis of carbon-carbon coupling reaction in medicinal chemistry. The relative reaction rates of all solvents were calculated relative to the predicted rate of 2-propanol. This project identified excellent green-solvents alternatives, the predictions reveal some trends that may inform expedited and more rational approaches for identifying green solvents offering low barriers and high yields for Suzuki reaction.

#### Keywords

Green Solvents, Suzuki-Miyaura coupling, Computational Screening

#### Grants

Blair/Brodie Summer Research Scholarship, Seidler Scholarly Collaborative Fellowship

### **13. Title:** Simulated Microgravity Effects In The Zebrafish Visual System

#### Authors

Estelle Ayomen (Biology B.S)

#### Faculty Mentors

Sherri Emer (Biological Sciences)

#### Abstract

Visual challenges are becoming increasingly apparent in astronauts upon return to Earth following exposure to spaceflight and microgravity. Neuroplasticity, the ability of the nervous system to adapt to changing conditions, is a well-established phenomenon. Changes in the eye and brain are possible throughout life, but capacity for remodeling in visual areas of the adult brain following altered visual input from the eye is still debated. The goal of this work was to use zebrafish to simulate eye changes that occur in microgravity and investigate morphological changes in the cellular architecture of visual brain areas. Zebrafish were exposed to prednisolone, which induces pressure-related ocular changes. To test the hypothesis that the altered eyes could be associated with corresponding brain remodeling, histology, immunohistochemistry, and anterograde tract tracing were used with microscopy to label and image the brains of zebrafish, respectively. Cell death was assessed by comparing fluorescence intensity of caspase-labeled visual brain areas in control and prednisolone-exposed fish. Understanding the cellular alterations of the brain is essential to developing models for understanding how the brain adapts to space travel and Earth upon return. This work may also reveal new neuroplasticity information regarding visual processing centers within the adult brain.

#### Keywords

Microgravity, Apoptosis, Neuroplasticity, Zebrafish

#### Grants

USA (Undergraduate Scholarly Award), Florida Space Grant

### **14. Title:** Computational Chemistry for the Prediction of Green Solvents in Medicinal Drug Synthesis

#### Authors

Alexa Barrera (Biology B.S)

Idea Andrade (Biology B.S)

#### Faculty

Daniel Lambrecht (Chemistry & Physics)

#### Abstract

The Suzuki-Miyaura reaction is one of the most significant carbon-carbon coupling reactions in medicinal chemistry. It is a metal catalyzed reaction, utilizing palladium (Pd), to covalently link

systems of alkenes, styrenes, or biaryl compounds. This work specifically studies N-heterocyclic carbene (NHC) palladium complexes with the aim of identifying green solvents that offer high reaction rates and yields. Given that many organic solvents utilized in medicinal chemistry have the potential to be harmful to humans, animals, and the environment upon exposure, our goal was to select benign, green solvents to be utilized for Suzuki catalysis based on a computational approach. This computational approach allows us to predict the activation barriers for NHC/palladium catalyzed aryl-aryl coupling reactions and investigate trends in catalytic efficiency. We expect to further enhance the applicability of this reaction while achieving sustainability and eco-friendliness.

Keywords

Green, Chemistry, Computational, Medicinal

**15. Title:** Movement patterns of *Gopherus Polyphemus* in a fragmented habitat in southwest Florida

Authors

Sophia Brown (Biology B.S)

Faculty Mentors

Phil Allman (Biological Sciences)

Abstract

*Gopherus polyphemus* is a federally threatened species, therefore making management of current populations important. Understanding their movement patterns are crucial for conservation efforts. Gopher tortoises live in a diverse range of habitats across the southeastern region of the United States. Populations in southwest Florida are of significant interest due to the lack of information in this region. The purpose of this study was to see if gopher tortoises are moving between fragmented habitat at Railhead Scrub Preserve with broader implications to better understand tortoise movements when environmental barriers fragment adjacent habitats. We tracked six gopher tortoises over seven months using standard radio telemetry methods. We determined home range size by measuring minimum bounding geometry in QGIS. Four tortoises moved between fragmented areas of the preserve. Male and females had an average home range of 1.049 ha and 0.93 ha respectively. Male and female gopher tortoises used an average of 8 and 5.5 burrows in a home range that contained an average of 30.25 and 11 total burrows respectively. Movement patterns in this study show that physical barriers do not always prevent the movement of gopher tortoises. This could have implications for future land management practices especially when development is occurring near gopher tortoise populations.

Keywords

Gopher tortoises

**16. Title:** Regulation of FePer1, Gene Encoding 1-Cys Peroxiredoxin in Buckwheat (*Fagopyrum esculentum* Moench): A Transgenic Study

### Authors

Shannon Bute (Biology B.S)

### Faculty Mentors

Takashi Ueda (Biological Sciences)

### Abstract

Peroxiredoxins (Prxs) are a super family of thiol-specific antioxidant proteins that are evolutionarily conserved throughout all kingdoms. They have been proposed to neutralize harmful free oxygen radicals and multiple peroxide substrates by the use of catalytic cysteine residues to protect against environmental and other external stresses. FePer1 is an antioxidant protein belonging to the 1-Cys Prx family in buckwheat (*Fagopyrum esculentum* Moench), and it is expressed during the seed maturation and germination. To examine whether the 5' regulatory region of the FePer1 gene is responsible for this regulated expression of FePer1, the 525-bp regulatory region of FePer1 gene was isolated, fused to the  $\beta$ -glucuronidase (GUS) reporter gene, and introduced into the genome of *Arabidopsis thaliana* plants. Transcriptional regulation of the FePer1 gene can be readily examined in various tissues in the transgenic *Arabidopsis* plants by monitoring the blue colored products formed in situ after histochemical GUS enzymatic assays. We have so far identified several tissues and organs in the transgenic plants in which the 5' regulatory region of the FePer1 gene is activated, which include maturing seeds, seedlings, leaf trichomes, and various tissues in the floral organs.

### Keywords

Gene Regulation, Peroxiredoxin, FePer1

- 17. Title:** A Seasonal Examination of the Morphological Anal Fin Elongation in Mosquitofish (*Gambusia holbrooki*) in south west Florida Surface Water

### Authors

Maria Claudia Caceres (Biology B.S)

### Faculty Mentors

Nora Demers (Biological Sciences)

### Abstract

Mosquitofish, *Gambusia holbrooki* were captured and examined for morphological variations in the sexual development of their secondary sexual structures, over the course of 9 months in south west Florida. The morphological differences were possibly attributed to seasonal differences in the presence of androgenic endocrine disrupting chemicals present in their habitat causing a masculinization in the female specimens' reproductive organs. Male and female *G. holbrooki* were collected at three sites exposed to septic treated wastewater and at one site with zero exposure to treated wastewater. In the lab, the ratio of the length of the fourth through sixth anal fin ray were measured and recorded for each specimen. The 4:6 ratios of the captured mosquitofish were

compared based on whether the collection date fell on Florida's wet vs dry season and whether the sampling site was a location with exposure to septic treated wastewater vs non-septic exposure. The calculated data did not support our hypothesis that female *G. holbrooki* captured in Florida's wet season presented higher levels of masculinization on the individual or overall sample size. The data demonstrated a 4:6 ratio greater than 1.25 in over 50% of the specimen collected in the non-septic dry, septic dry, and septic wet sampling sites indicating additional seasonal studies are necessary to understand this phenomena.

#### Keywords

Ecotoxicology, *Gambusia holbrooki*, Endocrine disruptors, Hormones

### **18. Title:** Computational Investigation of Substrate Dependence of the Suzuki Coupling Reaction in Medicinal Chemistry

#### Authors

Cristina Campero (Biology B.S)

Jessica Laing (Biology B.S)

Julia Kotkin (Clinical Laboratory Science B.S)

#### Faculty Mentors

Daniel Lambrecht (Chemistry & Physics)

#### Abstract

The Suzuki-Miyaura coupling is the most widely used carbon-carbon coupling reaction in medicinal chemistry. Palladium with nitrogen-heterocyclic carbene ligands of type IPr=N,N'-bis(2,6-diisopropylphenyl)imidazol-2-ylidene has been shown to be an efficient catalyst for aryl-aryl couplings, giving access to the biaryl functionality frequently found in contemporary drug molecules. However, previous studies focused on model substrates, leaving unanswered the question whether the catalyst would also perform well on other types of substrates. This work uses computation to study the substrate dependence of the activation energy to assess for which types of substrates the catalyst would be active. Our hypothesis was that electron-donating substituents would lower the activation barrier, however, we used both electron-donating and electron-withdrawing to see how much of a difference there is. To test this hypothesis, substrates were modified with NO<sub>2</sub>, CF<sub>3</sub>, Isopropyl, and Tert-Butyl substituents and activation barriers were predicted using computational approaches.

#### Keywords

Suzuki-Miyaura coupling, Electron-donating, Activation energy, Activation Barriers

#### Grants

Honors

**19. Title:** Testing the Effectiveness of Yeast Fermentation in Three Different Sugar Water Solutions for Trapping Mosquitoes

Authors

Grant Cardinal (Biology B.S)

Faculty Mentors

Joyce Fassbender (Biological Sciences)

Abstract

Mosquitoes transmit diseases to human populations all over the world. Carbon dioxide (CO<sub>2</sub>) has been identified as an attractant for mosquito species which helps with the study and sampling of these species. Baker's yeast has been found to be a cost-effective and sustainable source for the production of CO<sub>2</sub> when mixed with sugar in a water solution. In this experiment, 40g of three different types of sugars (white, brown, and molasses) were dissolved into water with yeast to determine the difference in trap effectiveness. Each trial solution also contained 500mL of H<sub>2</sub>O and 3g of yeast. The traps were all set out near a pond at the same location to control for environmental conditions. Traps were set out for twelve hours (starting at 7 pm) for three days per sugar type resulting in a total of three weeks of sampling. No mosquitos were found in any of the trials. The results obtained in this study may suggest that a different technique for CO<sub>2</sub> production may be indicated in future studies to improve mosquito density while sampling with CO<sub>2</sub> baited traps.

Keywords

Carbon Dioxide, Attractant, Sugar-yeast solution, Mosquitoes

**20. Title:** How Often Do Boas and Pythons Eat?

Authors

Allyssa Coots (Biology B.S)

Ashley Ramos (Biology B.S)

Faculty

Andrew Durso (Biological Sciences)

Abstract

There is very minimal information known about the diets of snakes around the world, partly because they eat infrequently. We reviewed a total of 20 different scientific articles for information on boas (16 species) and pythons (21 species), which are large constricting snakes that use sit-and-wait foraging. We collected the total number of individuals, the number of individuals with food in the stomach, and whether the snakes examined were wild or preserved museum specimens. We tested whether the two snake families differed from one another and whether the method of collection has an impact on the presence of stomach contents. We also calculated the overall

average percentage of empty stomachs. We hope that this analysis expands the knowledge of feeding frequency of these fascinating creatures.

Keywords

Boas and Pythons, Diet, Literature Analysis, Snakes

**21. Title:** Literature Analysis on Five Select Endocrine Disrupting Chemical Compounds Found in the Water of Southwest Florida

Authors

Sydney Craig (Biology B.S)

Faculty Mentors

Nora Demers (Biological Sciences)

Abstract

The endocrine system is a chemical messenger system comprising feedback loops of the hormones released by internal glands of an organism directly into the circulatory system, as well as regulating distant target organs. Endocrine disrupting chemicals are substances that interact with the normal activity of the endocrine system of your body that are found in the environment such as food sources, personal care items, and manufactured products. Some endocrine disrupting chemicals are more present in certain environmental areas than others. Research was conducted in Dr. Demers lab at FGCU and has identified several organic compounds with EDC properties. In the waters of Southwest Florida, we see five endocrine disrupting chemicals that are some of the most present, which are Phthalates, Bisphenol A, DEET, Sucralose, and Triclosan. In this review, a literature analysis was performed of these chemicals to see the effects they had on aquatic species. Five articles were narrowed down for each of the five chemicals. These five chemicals effected aquatic species through gene expression, morphology, histology, and behavior. After reviewing these articles based on the reviewed literature, we can suggest that *Gambusia* would be a good model organism for these endocrine disrupting chemicals.

Keywords

Endocrine Disrupting Chemical, Literature Analysis, Effects, Fish

**22. Title:** PCR Investigation to Isolate APETALA 1 Gene in *Melaleuca quinquenervia*

Authors

Grace Dorton (Biology B.S)

Faculty Mentors

Marilyn Cruz-Alvarez (Biological Sciences)

#### Abstract

Melaleuca quinquenervia is invasive to Florida, where it flowers very young and very frequently. Environmental effects on flowering genes may be responsible for this pattern. If the gene(s) and environmental factor(s) can be identified, the knowledge gained may be applied to speed fruit production in agricultural trees. APETALA 1 (AP1) is a gene known to promote flowering in other plant species. To isolate the AP1 gene from *M. quinquenervia*, DNA primers were designed based on the sequences of AP1 genes from other species. Reverse transcription-PCR (rtPCR) was performed using these primers and mRNA from *M. quinquenervia* flowers. A cDNA fragment was isolated, cloned into the pCRTPO plasmid, and sequenced. Although the cloned fragment did not contain the sequence of the reverse primer used for rtPCR, it showed high homology to the FRUITFUL (FUL) gene from *M. quinquenervia*, previously isolated, and closely related to AP1. Based on the obtained sequence, several new primers were designed to be used for specific PCR amplification of the new gene from *M. quinquenervia* DNA. Once a set of primers is identified that specifically amplifies the putative AP1 gene, it will be used to screen a *M. quinquenervia* genomic library to obtain the complete gene sequences.

#### Keywords

PCR, *Melaleuca quinquenervia*, APETALA 1 gene

### **23. Title:** *Trichechus manatus latirostris*, the Florida Manatee: Studying Their Environmental Dangers And Conservation Efforts

#### Authors

Hannah Duckett (Biology B.S)

Lauren Penland (Biology B.S)

#### Faculty Mentors

Hidetoshi Urakawa (Marine & Ecological Sciences)

#### Abstracts

*Trichechus manatus latirostris*, commonly known as the Florida manatee, is a subspecies of the West Indian Manatee, native to the south eastern region of North America. Currently, these manatees are considered threatened under the Endangered Species Act, with 13,000 left in the world. The purpose of this research was to understand how their breathing method and cycle could interact adversely with watercraft collisions-the primary cause of human-related casualties of the species. Three different locations in Florida known to have high manatee sightings were used to observe manatees and measure their breathing frequencies. The observed breathing intervals for each manatee ranged from one minute to five minutes. Manatees identified to be 'active' surfaced for a breath approximately every minute to a minute and ten seconds. In contrast, those manatees who were less active or inactive were observed taking a breath approximately every minute and 20 seconds to a minute and 40 seconds, also considering two manatees who surfaced for a breath

every three and a half minutes and five minutes, respectively. A brief review of the current conservation status and mortality of the Florida manatee was conducted using a documented manatee mortality data set by Florida Fish and Wildlife Conservation Commission (FWC). With the conservation efforts implemented by the FWC and other conservationist organizations, there has been an increase in the manatee population, however, watercraft collisions still remain a major concern for the future of the species.

Keywords

Conservation, Florida manatee

**24. Title:** Antibacterial Properties of Various Cytokine Mimetic Peptides

Authors

Ibtissam Essaghir (Biology B.S)

Danielle Fletcher-Williams (Biology B.S)

Faculty Mentors

Mustafa Mujtaba (Biological Sciences)

Abstract

Bacterial infections are one of the leading causes of mortality and have increased treatment costs due to these pathogens becoming resistant to commonly prescribed antibiotics. Cytokines are produced by the immune system as a response to infection to modulate both innate and adaptive immunity against microbes. The goal of this research was to test the antibacterial effects of various cytokine and cytokine receptor mimetic peptides on common bacterial pathogens such as *Staphylococcus aureus* and *Escherichia coli*. The peptides' effect on the bacterial growth was tested using the Kirby-Bauer diffusion assay and measuring the absorbance of the growth of the bacteria in presence of various peptide concentrations. The plates were also stained with 0.1% crystal violet to check for biofilm activity. Results show that mimetic peptides #2 (EB peptide) and #14 (IFN $\gamma$ 1 peptide) had significant antibacterial activity (0.625 mg/mL and higher) against *Staphylococcus aureus*, but only the EB peptide had antibacterial activity against *Escherichia coli*. Furthermore, the zones of inhibition of the IFN $\gamma$ 1 peptide was determined to be bactericidal and not bacteriostatic. These two peptides also inhibited bacterial biofilm activity in addition to bacterial growth. Thus, the results presented here increase our understanding of the development of antibacterial peptides for microbial infections.

Keywords

Antibacterial, Cytokine mimetic peptides, Gram-positive Bacteria, Gram-negative Bacteria

Grants

Blair/Brodie Summer Research Scholarship, Seidler Scholarly Collaborative Fellowship

**25. Title:** Evaluating the Role of Fyn Kinase Lipidation in Cell Attachment, Growth, and Migration

### Authors

Susan Faiz (Biology B.S)

Rhett Donathan (Biology B.S)

### Faculty Mentors

Mustafa Mujtaba (Biological Sciences)

### Abstract

SRC family kinases (SFKs) are activating enzymes in signal transduction pathways that help regulate cell growth and are found throughout the human body. A specific SFK, called SFK Fyn is overexpressed in prostate cancer and its pathway contributes to rapid cancer growth. SFK Fyn contains a conserved sites for attachment of 2 fatty acids, myristate and palmitate which when bound, bring the enzyme into the activation cascade and cell growth. Previous theoretical research has indicated that this step in the transduction pathway may be a potential target for anticancer therapies. The goal of the project was to determine if blocking the two fatty acids, Myristate and Palmitate, would prevent the SFK Fyn from activating the growth pathway and slow the growth of the prostate cancer cells. Our experiment showed that the blocking of myristic acid was most potent at inhibiting prostate cancer cell growth, adhesion, and migration. This study provides early evidence that future research could target this step in the pathway in future prostate cancer therapies.

### Keywords

Cancer, Biochemistry, Cell biology

## **26. Title:** Girls in Engineering, Math, and Science: Is it making a difference?

### Authors

Danielle Fletcher-Williams (Biology B.S)

### Faculty Mentors

Laura Frost (Chemistry & Physics)

### Abstract

This research project evaluates two aspects of the STEM outreach program Girls in Engineering, Math, and Science (GEMS). The first research question asks whether middle school girls learn STEM topics as a result of participating in GEMS events. By examining post-GEMS survey data, we found that GEMS participants do actually learn STEM concepts through participation in GEMS. The second research question asks how FGCU STEM majors who assist with GEMS are affected by participating in GEMS. Assisting with GEMS has a profoundly positive effect on our FGCU STEM majors post-graduation as reported in a survey developed and examined for this study. The survey found that 71% of participants stated that STEM Outreach activities (including GEMS) had a positive influence on preparation for employment. The results of our survey analysis will be discussed.

### Keywords

GEMS, Girls in Engineering, Math, and Science, STEM Outreach, STEM

## **27. Title:** A Literature Review Of 4 Chemicals For Evidence Of Endocrine Disruption In Aquatic Organisms

### Authors

Meaze Gbalazeh (Biology B.S)

### Faculty Mentors

Nora Demers (Biological Sciences)

### Abstracts

All fish, mammals and birds have endocrine systems composed of several glands including the pituitary, thyroid, adrenal, and pineal gland. Endocrine systems are responsible for producing hormones that are released into the bloodstream to signal cellular response in tissues and organs. Endocrine disrupting chemicals (EDC's) are substances found in items such as plastic containers, metal cans, detergents, food, toys, cosmetics, and pesticides. They have been shown to interfere with the endocrine system causing cancer, reproductive issues, sex organ abnormalities, and other metabolic issues. *Gambusia holbrooki*, a mosquitofish, was collected throughout various locations in southwest Florida, as a model organism for evidence of endocrine disruption based on observation of abnormal anal fin ratios. Water samples were obtained from all *Gambusia* collection sites and tested for the presence of organic compounds. To begin to narrow down the potential cause of the witnessed morphological changes to *Gambusia*, a literature review of four organic chemicals found in southwest Florida water samples, atenolol, sulfamethoxazole, benzophenone, and lamotrigine was completed. To look for evidence of these compounds as endocrine disruptors in other aquatic species. Six articles were evaluated per compound. In the literature, Benzophenone was found to cause changes to enzyme states, and morphology of aquatic species at concentrations between  $1 \times 10^{-6}$  -  $110.1 \text{ kg/y}$ . Sulfamethoxazole showed evidence of causing altered immune response, cellular morphology changes, and changes to gene expression in concentrations between  $0.05$  -  $100000 \text{ }\mu\text{g/L}$ . Lamotrigine exhibited evidence of changes to gene expression at concentrations between  $6.25 \text{ }\mu\text{M}$  -  $764 \text{ }\mu\text{M}$ . Atenolol was found to show no, dangerous, effects on aquatic species. Once all 100 observed organic compounds found in our Florida water samples are researched for their endocrine disrupting capabilities, isolated, and tested on *Gambusia* in the lab, we will be able to pinpoint what is causing the morphological changes to *Gambusia* anal fins.

### Keywords

Endocrine Disruptor, Aquatic Species, *Gambusia Holbrooki*, Endocrine disrupting chemicals

## **28. Title:** A Literature Review on Which Academic Database Describes the Best and Most Recent Information on Gene Expression in *Gambusia*

### Author

Kirsten Gonzalez (Biology B.S)

### Faculty Mentors

Nora Demers (Biological Sciences)

### Abstract

Endocrine disruptors are both natural and man-made compounds that interfere with the body's hormones. When EDC's get into the body, they can mimic the shape of a hormone and trigger abnormal processes in the body. This review focuses on Endocrine disrupting chemicals affecting gene expression in *Gambusia*. In order to find the most relevant research, 5 different databases were analyzed. 10 journal articles about gene expression in *Gambusia* were selected in the following databases, Web of Science, Pub Med, Google Scholar, Pro Quest and Science Direct. The databases were compared on which was most resourceful based off, the number of citations each article possessed, if related references were available on the database, what keywords were used and, if the database offered additional resources to expand on the subject. The findings from this review demonstrated that Web of Science is the most efficient database. Web of Science journal articles discovered through analysis that androgen and progesterone in water samples are closely related to male to female ratios in mosquitofish populations. Web of Science demonstrated that the discharge of EDC's in waterways could result in altered gene expression in both males and female *Gambusia*.

### Keywords

*Gambusia*, Endocrine Disruptors, Gene Expression, Database

- 29. Title:** Assessing Inter-measurer Variability of Geometric Morphometric Morphology in *Gambusia holbrooki* (mosquitofish) Anal Fins as an Indicator of Endocrine Disrupting Compounds in Southwest Florida

### Author

Kristabella Harris (Biology B.S)

### Faculty Mentors

Nora Demers (Biological Sciences)

### Abstract

Research being conducted by a group of students at FGCU, under the direction of Dr. Nora Demers has shown that the species *Gambusia holbrooki* (mosquitofish), living in reuse and septic waters around the Estero bay area are experiencing an abnormal elongation of their anal fin in female specimens likely due to endocrine disrupting compounds present in the waters. Normal female mosquitofish have anal fins 3-6 that are all relatively equal in length, giving a 4:6 ratio of about 1, however, researchers have been seeing an increase in this ratio, suggested that the fish may be experiencing masculinization. While researchers are working carefully and diligently, the question arose one day; "How do we know that these measurements we are making are valid?" The

goal of this study was to look at inter- and intra- measurer variability to determine if students are generating reproducible results. 410 already measured and documented fish were selected and remeasured three different times, by three different researchers. Averages and standard deviations of the calculated 4:6 ratios of the anal fins were then taken. Specimens that had the most variability were reassessed so that decisions could be made as to why there is such a variation across measurements. Results showed that overall, the researchers involved in this study are generating accurate and valid data points. The data points that were not consistent had similar errors in the methods, these included: errors in the input of data, incorrectly labeling the number of the fins, and imaging errors related to the background making it hard to see where the fins start and end. There is also a trend that overtime, these methods have improved, and data is being collected more concisely now than when this research project first began.

#### Keywords

Endocrine Disrupting Chemicals, Reproducibility, Inter-measurer Variability, *Gambusia holbrooki*

- 30. Title:** N-heterocyclic carbene-metal complexes as bio-organometallic antimicrobial and anticancer drugs (2015-2020)

#### Author

Amy Hoagland (Biology B.S)

#### Faculty Mentors

Alejandro Bugarin (Chemistry & Physics)

#### Abstract

N-heterocyclic carbenes (NHCs) are organic compounds that commonly mimic the chemical properties of phosphines. NHCs have made significant impacts on the fields of organometallic and medicinal chemistry because of their structural diversity and chemical properties, as well as their versatility and stability. NHC-metal complexes have been found to exhibit strong antimicrobial and anticancer activity and have been researched extensively as metal-based drug candidates and catalysts. This review focuses on the advances in design, development, characterization, and biomedical applications of NHC-metal complexes from 2015 to 2020, including silver, gold, palladium, rhodium, ruthenium, iridium, and platinum metal complexes. Silver and gold complexes specifically, have exhibited the most encouraging results towards medicinal chemistry, making them promising NHC-metal based drug candidates. This review aims to aid and encourage medicinal chemists to further improve the biomedical applications of NHC-metal complexes for use as antibacterial or anticancer treatments.

#### Keywords

N-heterocyclic carbene, Anticancer drug, Silver, Gold

- 31. Title:** Detecting Live Salmonella Cells in Lettuce Samples Using Silver Nanoparticle Antibody-Conjugated Optical Probes

### Author

Logan Horn (Biology B.S)  
Netanya Godoy (Biology B.S)  
Nicholas Zach (Biology B.S)  
Mirtha Fernandez (Biology B.S)  
Melissa Cordova (Biology B.S)  
Jaycee Holmes (Biology B.S)  
Ashley Stumpf (Biology B.S)  
Brittany Wolbach (Biology B.S)

### Faculty Mentors

Kerry Lee (Biological Sciences)

### Abstracts

Detecting *Salmonella* spp. directly from a food source can reduce bacterial transmission and agricultural product loss. Current testing methods are time-consuming and often provide results that are not specific to the culprit pathogenic bacteria. Previous research showed the detection of *Salmonella* spp. can be accomplished using silver (Ag) nanoparticles conjugated to anti-*Salmonella* antibodies (Anti-S). This research was designed to study the detection of *Salmonella* spp. in a food sample. Iceberg lettuce was diluted with PBS and homogenized prior to bacterial exposure. Conjugation was achieved by utilizing the charge difference between Ag NP's (+) and Anti-S (-) in addition to polyethylene glycol (PEG) to further stabilize the complex, which was added to *Salmonella* spp. contaminated lettuce sample. Due to localized surface plasmon resonance of the Ag NP Anti-S complexes, a halo around tagged *Salmonella* spp. cells were identified using dark-field optical microscopy. *Escherichia coli* was used as a negative control and revealed a complete absence of Ag NP Anti-S tagging. This research concluded lettuce cells did not impact the imaging of bacteria Ag NP bound complexes, resulting in the continual success of *Salmonella* spp. detection. This method offers a potential rapid approach for preventing *Salmonella* spp. outbreaks in agricultural practice and food industries.

### Keywords

Silver Nanoparticle, Conjugation, *Salmonella* detection, Anti-salmonella antibody

## **32. Title:** Computational Investigation of Substrate Dependence of the Suzuki Coupling Reaction in Medicinal Chemistry

### Authors

Karan Kalia (Biology B.S)  
Michelle DeAngelis (Psychology B.A)  
Hannah Bethman (Biology B.A)

### Faculty Mentors

Daniel Lambrecht (Chemistry & Physics)

### Abstract

The Suzuki-Miyaura coupling is the most widely used carbon-carbon coupling reaction in medicinal chemistry. Palladium with nitrogen-heterocyclic carbene ligands of type IPr=N,N'-bis(2,6-diisopropylphenyl)imidazol-2-ylidene has been shown to be an efficient catalyst for aryl-aryl couplings, giving access to the biaryl functionality frequently found in contemporary drug molecules. However, previous studies focused on model substrates, leaving unanswered the question of whether the catalyst would also perform well on other types of substrates. This work uses computation to study the substrate dependence of the activation energy to assess for which types of substrates the catalyst would be active. Our hypothesis was that electron-withdrawing substituents would lower the activation barrier. To test this hypothesis, substrates were modified with NO<sub>2</sub> and CF<sub>3</sub> substituents, and activation barriers were predicted using computational approaches.

### Keywords

Suzuki- Miyaura coupling, Medicinal chemistry, Electron withdrawing group, Biaryl functionality

### Grants

Honors

## **33. Title: Microgravitational Impacts On The Retina Of mus musculus**

### Authors

Benjamin Kallet (Biology B.S)

### Mentors

Sherri Emer (Biological Sciences)

### Abstract

For decades, astronauts have been returning from space with impaired vision, following both short and long duration missions. That being said, overall astronaut health and safety is impacted in these microgravity conditions. Scientists overwhelmingly agree that other physiological systems such as skeletal, muscular, and cardiovascular change in response to microgravity. The severity of the damage to the retina in microgravity is not well understood, but it is possible that fluid shifts and pressure changes in the head can lead to changes in the eye. To test the hypothesis that the retina changes in microgravity, we evaluated the morphology of retinal tissue from *Mus musculus* maintained on Earth and aboard the International Space Station (ISS). Retinas of ground control and spaceflight eyes were sectioned with a vibratome, mounted on prepared slides, and immunolabeled with primary rod and cone antibodies followed by secondary antibody conjugated to fluorophore. Cell nuclei were labeled with DAPI. Following measurement of the number of labeled cells, length of rod and cone outer segments, and width of inner (horizontal, amacrine, bipolar cells) and outer (rod and cone) nuclear layers, significant differences were observed between ground controls and spaceflight specimens. These data build on preliminary data presented previously and provide a

more complete analysis of retinal changes that occur in microgravity. Retinal morphology cannot be studied in detail in live astronauts, therefore assessing a rodent model provides valuable data that are inaccessible in live humans. This research is extremely important to our understanding of the physiological effects of spaceflight and can be used to manage the health of astronauts during space exploration missions and upon their return to Earth.

Keywords

Mice, Gravity, Space, Retina

**34. Title: Imaging of Ag Nanoparticles and Concentrations of Penetration Within Breast Cancer Tumor Spheres**

Authors

Kalli Kouba (Biology B.S)

Lorenzo Sintamour (Biology B.S)

Joshua Ehlers (Biology B.S)

Danielle Reddie (Biology B.S)

Jenna Freeman (Biology B.S)

Ryan Davalos (Biology B.S)

Logan Stone (Biology B.S)

Faculty Mentor

Karry Lee (Biological Sciences)

Lyndsay Rhodes (Biological Sciences)

Abstract

Throughout the years of cancer research, a question that remains unsolved is how exactly to target malignant tumors successfully without causing damage to the surrounding cells. Somewhat recently, silver nanoparticles (AgNPs) have become the ideal method to targeting cancerous masses, however it is still unknown specifically how deep the nanoparticles are able to penetrate. This research encompasses the issue at hand by utilizing long term AgNPs to penetrate into MDA-MB-231 breast cancer cells along with the concentration at which the differing sizes penetrate the tumors. By utilizing nanoparticles which can withstand long term storage, an experiment to be determine how deep into the tumors the nanoparticles are able to penetrate was performed. In total, four variations of nanoparticle sizes were noted throughout the tumors ranging from largest at the top of the tumors, and smallest nanoparticles being distributed throughout the bottom layers of each tumor. These findings can provide new information to utilize in determining the most effective method of treating cancerous tumors.

Keywords

Breast Cancer, Nanoparticles, Silver, Tumor

### Grants

Biology department funding and Grant funding from Office of Undergraduate Studies

- 35. Title:** Synthesis, Molecular Docking Studies, And In Vitro Evaluation Of 1,3,5-Triazine Derivatives As Promising Antimicrobial Agents

### Authors

Abby Lewis (Biology B.S)

### Faculty Mentors

Alejandro Bugarin (Chemistry & Physics)

### Abstract

1,3,5-triazine is a six-membered heterocyclic ring and its derivatives have piqued the interest of the scientific community due to them being proven as accomplished bioactive herbicides, cancer agents, and more. A single-step reaction was used to synthesize a series of 1,3,5-triazine derivatives, which were then characterized by NMR, and mass spectrometry analysis. Using antimicrobial screening, two fungal and five bacterial strains were examined. Growth inhibition against *E. coli*, *K. pneumoniae*, and *A. baumannii* bacteria and *C. neoformans* fungus was shown to be good with newly synthesized 6-(thiazol-4-yl)-1,3,5-triazine-2,4-diamine. X-ray crystal structure of the *E. coli* 24 kDa domain in complex with clorobiocin was used to perform molecular docking studies using the Surflex-Dock program of Sybyl-X software.

### Keywords

Molecular docking studies, in vitro, 1,3,5-triazine derivatives, Antimicrobial agents

### Grants

Seidler Scholarly Collaborative Fellowship

- 36. Title:** Assessing species boundaries in Florida plant lineages: examples from the Bluehearts (*Buchnera*) and needle-leaved St. John's-worts (*Hypericum*)

### Authors

Luna Luis (Biology B.S)

Martinez Jeralyn (Biology B.S)

### Faculty Mentors

Jay Horn (Biological Sciences)

### Abstract

To conserve biodiversity, an understanding of species concepts is crucial, given that species are the "currency" of biodiversity. Herein we investigate species boundaries within two plant lineages

native to Florida: the Bluehearts (*Buchnera*, family Orobanchaceae) and the needle-leaved St. John's-worts (*Hypericum* section *Myriandra*). Both these lineages are ideal for evolutionary analysis due to long-standing taxonomic discrepancies based on highly variable morphological features and ecological niches. With regard to the Florida Bluehearts, we wished to investigate the evolutionary distinctiveness of a white-flowered morphotype of *Buchnera floridana* that differs from the typical morphotype both structurally and ecologically. To assess patterns of phylogenetic diversity among accessions of both typical and white-flowered populations of *B. floridana*, we used sequences of the molecular markers ITS (nuclear genome) and *trnH-psbA* (chloroplast genome). With regard to the needle-leaved St. John's-worts, we wished to assess the evolutionary distinctiveness of a south Florida morphotype of the Coastalplain St. John's-wort (*Hypericum brachyphyllum*) that is sometimes treated as a distinct species, *H. limosum*. To assess the phylogenetic placement of *H. limosum* among related species, we generated sequences of the molecular markers ITS (nuclear genome) and *trnH-psbA* and *trnL-trnF* (chloroplast genome) for two *H. limosum* accessions and analyzed them in the context of a pre-existing data matrix of *Hypericum* sequences. Phylogenetic analyses of our aligned matrices used both maximum likelihood and Bayesian methods.

#### Keywords

Native plants, Phylogenetics, Speciation

### **37. Title: Microgravity Effects on TRPV1 Pain Receptors in Mouse Mandible Specimens.**

#### Author

Logan Marks (Biology B.S)

#### Faculty

Sherri Emer (Biological Sciences)

#### Abstract

Pain and temperature are detected by receptors throughout the body that are grouped in the transient receptor potential (TRP) protein family. One specific receptor, TRPV1, is highly expressed in the oral cavity and plays a role in dental pain detection because of its localization to the sensory nerve endings in the tooth pulp. Though TRPV1 has been well studied in modern medicine, there has been no detailed investigation on the effects of gravitational forces on TRPV1 expression and how it may influence pain response as it also functions as a force detector. We proposed that exposure to microgravity would be associated with atrophy-like effects on the TRPV1 nociceptor in areas of low chewing pressure. Through collaboration with NASA, we acquired mandibles from mice maintained at Kennedy Space Center or on the International Space Station. Using immunohistochemistry techniques and fluorescence microscopy, we compared fluorescence intensity of labeled TRPV1 in the tooth pulp of animals exposed to microgravity and Earth's gravity. This study is useful in expanding our understanding of how we can utilize microgravity to develop new orofacial pain management techniques in humans on Earth and in microgravity.

#### Keywords

TRPV1, Pain, Microgravity, Tooth pulp

Grants

Whitaker Center Mini-Grant

**38. Title:** Analyzing 4:6 Ratios Of Female Mosquito Fish (*Gambusia Holbrooki*) During Dry Season Sampling Among Septic Tank And Reuse Water Locations

Author

Ashley Marston (Biology B.S)

Yanique Smith (Biotechnology B.S)

Faculty

Nora Demers (Biological Sciences)

Abstract

In recent history, researchers have observed sexual dimorphism in aquatic wildlife, these dimorphisms have been linked to endocrine-disrupting chemicals (EDC). EDC's are chemicals that mimic hormones in the body: hormones that are usually responsible for development, reproduction, and immunity EDC's are often introduced into the aquatic environment via human activities through the use of pesticides, fertilizers, and the improper containment and management of human waste. The increased abundance of endocrine-disrupting chemicals are a serious environmental issue, especially for fish. When an EDC has contaminated a waterway the fishes and the aquatic animals in that waterway are constantly bathed in the chemicals, this constant exposure causes drastic changes in hormonal development. In this experiment we studied the EDC's effect on *Gambusia holbrooki*, commonly called the mosquitofish. Sexual dimorphic female mosquitofish are identified by the elongation of anal fins, a secondary sex trait normally found only in male mosquitofish. During this experiment mosquitofish found in waterways influenced by a septic system and waterways influenced by reuse water were examined to see which population, Septic or Reused, would show more sexual dimorphism in the female mosquitofish collected.

Keywords

Endocrine Disruption, Mosquitofish, Androgenic, Septic

**39. Title:** Regeneration of *Melaleuca quinquenervia* from Leaf Tissue Explants

Authors

Kevin Ortiz Diaz (Biology B.S)

Faculty Mentors

Marilyn Cruz-Alvarez (Biological Sciences)

Abstract

Melaleuca quinquenervia is an invasive plant species that currently threatens the diverse biomes of Southwest Florida. Melaleuca trees flower early and frequently in Florida. In order to study flowering in Melaleuca, we have identified and isolated genes from Melaleuca with homology to flowering genes in other plant species. To study the function of these genes we need to analyze the effect of their overexpression or suppression of their expression in Melaleuca plants. However, no method is currently available to transform Melaleuca or regenerate transgenic plants from transformed explants. This research seeks to establish a Melaleuca regeneration method from explants in culture that would make possible Melaleuca transformation in the future. Leaf tissue explants from young Melaleuca plants were placed into different types of media. Either Murashige and Skoog Basal Salts, or Lloyd and McGown Woody salts were used. Varying concentrations of naphthalene acetic acid and benzylaminopurine, and either bacto-agar or gellan gum powder were added to the media. After two months, explants showing root development were transplanted to new media favoring stem growth, resulting in six explants being successfully regenerated into full plants. Having accomplished the task of regenerating Melaleuca, the next phase involves establishing a transformation method for Melaleuca.

Keywords

Melaleuca, Genetics, Regeneration

Grants

Blair/Brodie Summer Research Scholarship

**40. Title:** Nutrient Analysis of Surface Groundwater in San Carlos Park Florida, Community Using Septic Drainage Systems

Authors

John Perna (Biology B.S)

Faculty Mentors

Nora Demers (Biological Sciences)

Abstract

The area of San Carlos Park (SCP), Florida is a residential area in Lee County that ranges 2.5 square miles with over 8000 homes of 25,000 residents with 80% utilizing septic tanks that feed into the creeks and canals that empty into the Estero Bay river system. Septic tanks are used to filter human waste products that include pharmaceuticals, pesticides, personal care items and plasticides. Human generated waste contains nutrients and organics that get concentrated into the surface groundwater of these creeks and canals. The nutrients that were analyzed in SCP are Total Phosphorus, Total Nitrogen, Orthophosphate, NO<sub>x</sub> (Nitrate + Nitrite), Ammonia (NH<sub>3</sub>) and Chlorophyll a. They were selected for their different reaches of the drainage district in San Carlos Park, also their biological effect on the water quality. The nutrients were sampled in three separate strands (Caloosa, Cypress and Outfall) and data was collected onto to spreadsheets, figures, and graphs. The data showed that not all the nutrients had strong concentrations as predicated, but

Orthophosphate was the only nutrient that was over standard of 0.02 mg/L. The high concentration of Orthophosphate can be coming from partially treated and untreated sewage, runoff from agricultural sites, and application of some lawn fertilizers. The community of SCP could remedy the situation by using bioswales and upgrading the package plant run by Lee County Utilities. This would create a more sustainable system for the community and provide a healthier nutrient concentration for the area.

Keywords

Water Quality, Nutrients, Septic Tanks, San Carlos Park

**41. Title:** Feeding Frequency in Snakes as it Relates to Their Diet and Taxonomic Classification

Author

Ashley Ramos (Biology B.S)

Allyssa Coots (Biology B.S)

Faculty Mentors

Andrew Durso (Biological Sciences)

Abstract

Snakes do not eat very often because they tend to eat large prey which they digest for a long period of time. As a result, many snakes that are captured in ecological studies have empty stomachs. This means researchers must dissect or catch very large numbers of snakes in order to obtain a reasonable sample size for studies of what snakes eat. For any one species, there may be only a handful of studies about what they eat and some snake species have had no research done at all. In our analysis, we wanted to measure how often snake stomachs are empty or full across many species of snakes. We collected 78 papers which contained data about the dietary habits of snakes and compiled the percentage of empty stomachs from each. We also recorded the taxonomic family, percentage of each prey type, and whether the study used wild snakes or preserved museum specimens. We found that across all studies on average 42% of snake stomachs were empty. We also found important variation among snake families and between wild and museum specimens. We recommend that future studies more explicitly report stomach contents broken down by sex, body size/age, and reproductive condition.

Keywords

Snake, Diet, Meta-analysis, Ecology

**42. Title:** Effects of Microgravity on Mouse Mandible Bone Cells

Authors

Michael Realbuto (Biology B.S)

Faculty Mentors

Sherri Emer (Biological Sciences)

#### Abstract

Microgravity conditions experienced during space exploration have a myriad of effects on living organisms, such as fluid shift, wasting of skeletal muscle, and loss of bone density. In particular, changes in bone density can be detrimental to astronauts returning to earth, as their weakened skeletons struggle to support their weight when they return to normal gravity. While bone density loss in long bones is demonstrable, effects on other bone types is poorly understood. The purpose of this study is to evaluate the cellular changes in bone that occur in microgravity. Mandible samples were obtained from mice maintained on the ISS or at Kennedy Space Center. Mandibles were decalcified, sectioned, and stained for the presence of osteocytes, osteoblasts, and osteoclasts. Light microscopy was used to compare the numbers of each cell type in the spaceflight and control samples. Cell types were used to determine the prevalent process-- bone formation, absorption, or maintenance-- that was likely occurring. These data supplement previous data related to ligament and mechanoreceptor differences in Earth and spaceflight mouse mandibles. The findings are an important component to the overall understanding of bone homeostasis mechanisms during and following microgravity exposure and even during disease experienced by humans on Earth.

#### Keywords

Microgravity, Bone, Mouse, Spaceflight

- 43. Title:** Differential expression of the CCE1 transposable element in Varieties of Brassica oleracea is Caused by Differences in Methylation

#### Authors

Brandon Sanchez (Biology B.S)

Carolina Cora (Biotechnology B.S)

#### Faculty Mentors

Marilyn Cruz-Alvarez (Biological Sciences)

#### Abstract

Brassica oleracea includes varieties with different developmental patterns such as broccoli and cauliflower. A transposable element, named CCE1 (CAULIFLOWER CURD EXPRESSION1), has identical sequences among varieties, but is expressed preferentially in cauliflower. This may be relevant since transposable elements can be silenced through methylation, and alter gene expression, which may lead to developmental differences among varieties. The current research goal is to determine if the regulatory region of CCE1 is located within the coding sequences, where differences in DNA methylation have been found among varieties. The complete coding sequences were introduced into broccoli protoplasts. Reverse transcription- PCR (rt-PCR) showed that CCE1 mRNA is detected only in transformed protoplasts, indicating that the region regulating transcription of CCE1 is within the coding region. The CCE1 coding sequences were also introduced into Arabidopsis thaliana plants through Agrobacterium tumefaciens transformation. Transgenic plants were selected by their resistance to kanamycin. DNA was extracted from these plants and PCR confirmed that CCE1

sequences were present. Through several rounds of self-pollination and growth on kanamycin media we selected transgenic plants homozygous for a single insertion of the CCE1 sequences. rt-PCR showed that most of these expressed CCE1, confirming that the coding sequences are sufficient for transcription.

Keywords

Transposable element, Brassica

**44. Title:** A Novel Synthesis Method Provides Higher Stability of Silver-Anti-HER2 Conjugated Nanoparticles

Authors

Connor Schepke (Biology B.S)  
Matthew Shannon (Biology B.S)  
Victoria Johnson  
Karishma Kalia (Biology B.S)  
Kalli Kouba (Biology B.S)  
Jamie Grabowski (Biology B.S)  
Rebecca Valera (Biology B.S)

Faculty Mentors

Kerry Lee (Biological Sciences)  
Lyndsay Rhodes (Biological Sciences)

Abstract

Specific cancer cell targeting remains a monumental challenge for many medicinal research institutes. Nanoparticles provide distinct physical and chemical properties, making them an ideal diagnostic medicine tool to locate and target cancer cells. One of the main problems in the field of nanoparticle medicine is the lack of stable nanoparticles with a long shelf life. In this experiment, anti-HER2 antibody-conjugated silver (Ag) nanoparticles (NP) were designed using a novel synthesis method which proved to show more durable NPs. We performed stability and size distribution assays which were able to show that our nanoparticles were stable over the course of the standard in vitro tests as well as had a shelf life of over 18 months in proper storage, which is far longer than most currently developed nanoparticles. This experiment offers new evidence of the durability of antibody-conjugated nanoparticle optical probes to successfully target cancer cells, as well as proposes a new way of nanoparticle synthesis that provides higher stability and longer shelf life.

Keywords

Nanoparticles, Cancer Targeted therapy, Nanoparticle stabilization

**45. Title:** Quantification of Endocrine Disrupting Chemicals in Southwest Florida Waters

Authors

Angela Scine (Biology B.S)

David Montoya (Biotechnology B.S)

Faculty Mentor

Daniel Paull (Chemistry & Physics)

Nora Demers (biological Sciences)

Abstract

The purpose of this research project is to identify what endocrine disrupting chemicals (EDCs) are in our local waterways. EDCs have shown signs to effect reproduction, different types of cancers, obesity, and metabolism. Most recently they have shown they cause masculinization of fish within the contaminated waterways. The identification of the sources of EDCs in our water is a crucial step towards potential improvements in new regulations of water quality. To detect and quantify EDCs we have developed methods to extract them within environmental samples and measure them using liquid chromatography-mass spectrometry (LCMS). The LCMS separates the components of the liquid samples with liquid chromatography, and then the individual components are identified and quantified by mass spectrometry. This instrument allows for precision of compound identification within low detection limits. The EDCs we have first chosen to measure come from a variety of sources such as pharmaceuticals, pesticides, chemicals from food and beverage, and chemicals in plastic. Examples of these include Lamotrigine, DEET, Sucralose, and Bisphenol A and S (BPA, BPS). Some ways these chemicals can possibly find their way into our local waterways is by the use of pesticides and inadequate treatment of septic tanks and wastewater treatment plants. To confirm this and to discover more ways of possible contamination we aim to measure and identify these EDCs so preventative measures can be taken.

Keywords

Endocrine Disrupting Chemicals, Contamination, Local Waterways

Grants

Blair/Brodie Summer Research Scholarship

**46. Title:** Effectiveness of Various Electric Toothbrushes in Mechanical Removal of Plaque

Author

Michelle Simontchik (Biology B.S)

Kristina Bilokopytova (Biology B.S)

Faculty Mentor

Mustafa Mujtaba (Biological Sciences)

Abstract

Good oral hygiene can prevent conditions leading to cavities, which start by development of plaques formed by bacteria growing in a biofilm on teeth enamel. In this study, we determine how effective electric toothbrushes are in the mechanical removal of bacterial plaque formed on plastic

plates by two oral bacteria, Streptococcus mutans and Streptococcus mitis. The bacteria were grown on plastic surfaces, after which various toothbrushes (Sonicare, Braun, and Burst) were used to remove the biofilm using similar techniques and time. Plates were then washed with sterile water and incubated with media for determination of bacterial growth 24 hours later or stained with crystal violet for determination of biofilm plaque removal. Furthermore, each toothbrush was evaluated for retention of bacteria on the bristles as well following water washings. Results showed that all three toothbrushes effectively removed the biofilm plaques on the plastic plate without any significant differences. Not all bacteria were eliminated as growth was observed 24 hours later post brushing for all three toothbrushes tested. Furthermore, retention of bacteria on toothbrush bristles showed Oral-B had the least number of bacteria after sterile water washings. Thus, the data here increase our understanding bacterial plaque removal and retention by various toothbrushes.

Keywords

Dental Hygiene, Mechanical removal, Bacterial plaque, Electrical toothbrush

**47. Title:** L-Serine Effects On Amyloid Plaques And Neurofibrillary Tangles In Zebrafish

Author

Abigail St.Croix (Biology B.S)

Faculty Mentor

Sherri Emer

Abstract

As of today, there is no cure for Alzheimer's disease (AD), but certain treatments may decrease the speed at which neurological degradation occurs. For example, the amino acid, L-serine, present in some human diets, may be neuroprotective. In recent studies of a rat AD model, animals administered higher doses of L-serine orally exhibited protected memory, while animals receiving low or no doses continued to exhibit memory loss. L-serine is a precursor to D-serine, which is used by astrocytes, nervous system glial cells that provide neuronal support and communication, repair damages to neurons, and maintain the blood-brain barrier. The objective of this study was to use zebrafish to test the hypothesis that treatment with L-serine would reverse and/or prevent the continuous buildup of amyloid plaques and/or increase of neurofibrillary tau tangles characteristic of AD brain pathology. Brains of fish exposed to okadaic acid (OA; induces AD pathology), serine, or both were analyzed for differences in amyloid plaques and tau tangles using immunohistochemistry and fluorescence microscopy. This study provides important information regarding dietary amino acids and their effects on long term brain health as well as their potential as a natural treatment for AD patients.

Keywords

L-Serine, Alzheimer's Disease, Amyloid Plaques and Neurofibrillary Tangles, Zebrafish

**48. Title:** Functional Analysis of Melaleuca quinquenervia FRUITFUL-LIKE and LEAFY-LIKE genes

Authors

Gabriel Taggart (Biology B.S)

Shawn Brunelle (Biology B.A)

Rodrigo Tomas (Biotechnology B.S)

Faculty Mentors

Marylin Cruz-Alvarez (Biological Sciences)

Abstract

Melaleuca quinquenervia is an invasive tree species in Southwest Florida known for frequently flowering during the wet season. To better understand this flowering, research is being conducted on two Melaleuca genes with homology to flowering genes in other species, FRUITFUL (FUL) and LEAFY (LFY). RNAs from Melaleuca flowers and stamens were reverse transcribed and amplified through Polymerase Chain Reaction (PCR) using primers specific for MqFUL-LIKE and MqLFY-LIKE, respectively, to obtain complete coding regions. Amplified fragments were inserted into plasmid pCR2.1-TOPO. After identifying clones with the correct coding sequences, these sequences were placed into plasmid pFF19 between the CaMV3S 5' and 3' regulatory regions, so that MqFUL-LIKE and MqLFY-LIKE can be expressed in plant cells. The coding sequences along with the regulatory regions were cut from pFF19 and placed into plasmid pGA482. pGA482 constructs containing the MqFUL-LIKE and MqLFY-LIKE coding sequences were placed into Agrobacterium tumefaciens. Arabidopsis thaliana were transformed using Agrobacterium. We are currently working on selecting transgenic plants. Progeny plants homozygous for the inserted Melaleuca genes MqFUL-LIKE and MqLFY-LIKE will be crossbred with ful and lfy mutants, respectively, to analyze if the Melaleuca genes are able to rescue the Arabidopsis mutations.

Keywords

Melaleuca, Biotechnology, Arabidopsis, Flowering

Grant

FGCU Scholarship-Research Venture Capital Funds

**49. Title:** Oil Efficacy of Essential Oils Thyme and Coriander Against The Opportunistic Fungal Pathogen Aspergillus fumigatus

Author

Bryan Alvarez (Biotechnology B.S)

Melisa Havens (Biology B.S)

Faculty Mentors

Yainitza Hernandez-Rodriguez (Biological Sciences)

Abstract

Aspergillosis is caused by the filamentous fungi *Aspergillus fumigatus* and is considered one of the leading opportunistic fungal diseases amongst cancer patients, organ transplant recipients and people living with chronic pulmonary disease. Fungal infections represent a serious threat to immunocompromised individuals with nearly 600,000 yearly deaths attributed directly to aspergillosis. Concerns in treating these patients are further exacerbated due to an increase in azole resistance amongst some clinical isolates of *A.fumigatus*. This situation has become problematic as physicians are quickly being left with little to no ways of treating these infections. This research focuses on the ability of the plant essential oils, Thyme and Coriander, to inhibit the growth of *A.fumigatus* in comparison to voriconazole, a common anti-fungal used to treat aspergillosis. To assess the response of the fungi under the oil treatment, we compare the inhibitory effects of the oils after colonial establishment at normal body temperature (37°C) to the inhibitory effects exhibited by the voriconazole. Furthermore, we aim to test the efficacy of the oils when working synergistically, individually and in unison with the anti-fungal. This comparison allows us to model and distinguish the effectiveness of the oils individual and synergistic properties against the fungi in patients that present with symptoms of aspergillosis.

#### Keywords

Aspergillosis, *Aspergillus fumigatus*, Essential Oils, Voriconazole

### **50. Title:** Ectopic Expression of Buckwheat Fagopyritol Synthase Enhances the Stress-Tolerance in transgenic *Arabidopsis* plants

#### Authors

Stephanie Galindo (Biotechnology B.S)

Nhu Tran (Biotechnology B.S)

Pedro Ramirez (Biotechnology B.S)

Karolina Czarnecki (Biology B.S)

#### Faculty Mentors

Takashi Ueda (Biological Sciences)

#### Abstract

Fagopyritol synthases (FeGoS) are galactinol synthase (GoS) homologues from common buckwheat (*Fagopyrum esculentum* Moench). GoS generally catalyzes the condensation of UDP-galactose and myo-inositol to synthesize galactinols, which have been shown to accumulate during seed desiccation and imbibition periods in plants. Additionally, GoS transcripts have been found to be elevated in plants exposed to various environmental stress conditions including desiccation, and salt tolerance. This suggests that GoS plays a role in mediating the oxidative damage resulting from environmental stress. The goal of this research is to examine the role of fagopyritol synthases in stress-tolerance of plants. For this, the coding region of FeGoS gene (FeGoS-1) was inserted into an expression vector to attain constitutive expression of the gene in plants. Subsequently, the synthetic gene was introduced into *Arabidopsis* plants, and ectopic expression of the gene in leaf tissues was confirmed. Previously we demonstrated that these transgenic plants exhibited enhanced tolerance

capabilities for desiccation and salinity compared to wild type plants. We have been testing the chilling resistance in these plants and expect to see enhanced tolerance as well.

Keywords

Fagopyritol synthase, Arabidopsis thaliana, Transgenic plants, Stress tolerance

**51. Title:** Chemicals of Emerging Concern (CECs): A quantitative study of dangerous chemicals in our waterways

Authors

David Montoya (Biotechnology B.S)

Angela Scine (Biology B.S)

Faculty Mentors

Daniel Paull (Chemistry & Physics)

Nora Demers (Biological Sciences)

Abstract

Water quality in Florida is a concerning subject that cannot be overlooked. As agriculture continues to grow, the use of fertilizers, pesticides, and herbicides that are in the landscape has shown to have effects on our biosphere. Homeowners are to blame as well, often neglecting proper use and disposal of industrial chemicals, medications and personal care products which make their way into the environment. Chemicals about which little is known that nonetheless seep into our waterways are now classified as chemicals of emerging concern (CECs). These chemicals have demonstrated immediate problems, perhaps especially in Southwest Florida, including harmful algal blooms and the strangling of the Everglades. These CECs are by definition unregulated and nearly unmonitored, and we are focusing our efforts on bringing to light the environmental fate of CECs that are known to, or are likely to, affect the endocrine system in animals, causing behavioral and developmental abnormalities. Florida is a leader in reuse water, and these endocrine-disrupting chemicals (EDC) have been linked with cancer, birth defects in children, kidney damage, etc. During the past year our research team has been able to create a monitoring program that has enabled us to detect up to seventeen CECs. The objective of our research program is to improve our monitorization method and continue testing water samples in Southwest Florida.

**52. Title:** Phytoremediation of Landfill Leachate

Authors

Jessica Douglas (Environmental Engineering B.S.Env.E)

Faculty Mentor

Ashley Thomson (Environmental and Civil Engineering)

Abstract

Currently, landfill operators pay wastewater treatment facilities for the treatment of their leachate based on leachate characteristics, including chemical oxygen demand (COD) and ammonium concentrations. There is a need to have low-cost, passive remediation technologies to reduce nutrient loadings in leachate to lower discharge costs. Phytoremediation, or the use of plants for the remediation of pollutants, may be a viable option as it is inexpensive and sustainable in terms of carbon footprint, energy use, and lifetime. Previously, field work was completed on the viability of this technology by Dr. Ashley Thomson. Multiple studies were analyzed to produce an in depth literature review of four different phytoremediation technologies for landfill leachate pretreatment. The technologies researched were horizontal and vertical sub-surface flow wetlands, natural wetlands, and floating wetlands. Removal efficiencies separated by technology were compiled and presented in a table that will be the centerpiece of a peer-reviewed literature review. In addition to comparing removal efficiencies, graphs were constructed that visualize correlations between cost, removal efficiencies, and types of treatment.

Keywords

Phytoremediation, Low-Cost, Landfill Leachate, Constructed Wetlands

Grants

Blair/Brodie Summer Research Scholarship

**53. Title:** Monitoring Rainfall Nutrients and Dissolved Iron with Potential Impacts on Inland Algal Blooms

Author

Zoie Kassis (Environmental Engineering B.S.Env.E)

Faculty Mentor

Barry Rosen (Biological Sciences)

Thomas Missimer (Environmental and Civil Engineering)

Abstract

Saharan dust nutrients, specifically iron, along with other minerals when deposited in interior freshwaters in SWFL may stimulate algal bloom growth. This can affect marine cycles, structures of inland waterways, and additionally, could contribute to eutrophication which is a natural marine process where excess nutrients in waterways cause algae blooms and red tides, thus causing oxygen deprivation. Hypoxia can result in dead marine life which hurts fishing, recreation, and tourism industries. Recently, nox, nitrite, nitrate, ammonia, and phosphate samples of water and iron samples of dust have been analyzed at the ETI to investigate this issue. To determine whether excess nutrients from the annual Saharan Dust Cloud cause inland microbial blooms, we collected rainwater and covered dust samples from the field at the ETI. We diluted and digested the dust with acid, then ran the dust samples through an ICP-MS to look for concentrations of iron. Nutrient concentrations were measured using the nutrient autoanalyzer and metals were measured using the ICP-MS. The rainwater collected showed higher concentrations of nutrients during the months of the dry seasons. The rainwater collected also showed a correlation from decreasing slope of the

graphs, that as rainfall frequency increases, the nutrient concentrations go down. For dust collection, the dry season seems to be a time of interest as we saw higher concentrations of iron during the months of January through May. Since Fe concentrations were higher as well as nutrient concentrations that attribute to harmful blooms, during the dry season and at the beginning of the annual dust cloud, it can be concluded that iron has a potential effect on inland marine life and ecosystems.

Keywords

Algal Blooms, Saharan Dust Cloud, Nutrient Concentration, Rainwater and Dust Analysis

**54. Title:** Economic Analysis of Constructed Wetland Treatment Technologies

Author

Ronald Knish (Environmental Engineering B.S.Env.E)

Faculty Mentor

Osman Karatum (Environmental and Civil Engineering)

Abstract

Landfill leachate is currently treated based upon its ammonium concentration and chemical oxygen demand (COD). Depending on these concentrations, this can cost landfill operators significant amounts of money. There is currently a need for low-cost, passive remediation technologies to lower treatment cost and to reduce nutrient loading. The aim of this research was to create a cost benefit analysis in order to determine the economic feasibility of using wetland technologies as a phytoremediation technique for the reduction of the pollutants contained in landfill leachate. Twenty-seven studies were analyzed and assigned an economic cost score (A-E) based upon a set of common assumptions. The studies were then further analyzed for total cost at their given scale per the peer-reviewed publication, either full scale, pilot scale, or lab scale. All 27 studies were scaled to a common full scale for consistency of analysis to determine if the wetland configurations presented in the studies are economically feasible options for the treatment of landfill leachate.

Keywords

Cost benefit analysis, Economic feasibility, Landfill leachate

Grants

Blair/Brodie Summer Research Scholarship

**55. Title:** Chemical UV filter usage and estimated loading rates in Southwest Florida

Author

Alexis Scheele (Environmental Engineering B.S.Env.E)

Kimberly Sutter (Environmental Engineering B.S.Env.E)

Faculty

Lauren Redfern (Environmental and Civil Engineering)

Abstract

Chemical ultra-violet (UV) filters are increasingly associated with negative environmental impacts, such as coral bleaching. The primary offender, oxybenzone (OBZ), is a chemical UV filter found in numerous sunscreens and personal care products. To better understand the volume of OBZ and chemical UV filters in general entering our bodies of water in Southwest Florida, a survey was developed and distributed. Both an online survey (with QR code and email link) and in-person survey were developed. We conducted multiple in-person survey trips at beaches in Lee County through Summer and Fall 2020. The survey asks beachgoers eleven questions about their sunscreen consumption and usage. Based on the survey, we identified the most commonly used chemical UV filters in Southwest Florida are oxybenzone, octinoxate, and avobenzone. The most important factor consumers consider when purchasing sunscreens are SPF ratings, ingredients, and the price. In addition, we found approximately 4-6 fl. oz. of sunscreen used per person per visit as a conservative estimate. Considering we have approximately 5 million visitors to Lee County beaches each year, and an estimated 70% of these tourists both wear sunscreen and enter the water, our initial estimates suggest that approximately 17.5 million ounces (550 US tons) of sunscreen enter our water bodies each year. We are continuing to conduct surveys and update these estimates. This study was conducted to aid advancement in research and pave the way for possible remediation techniques.

Keywords

Oxybenzone, UV filters, Sunscreen, Southwest Florida

Grants

Blair/Brodie Summer Research Scholarship

**56. Title: Temporal and Spatial Variability of Fecal Indicator Bacteria in Southwest Florida Tidal Streams**

Author

Emily Daniels (Environmental Studies B.A)  
Hannah Boyette (Environmental Studies B.A)  
Luke Roides (Environmental Studies B.A)  
Sam Ebert (Environmental Studies B.A)

Faculty Mentor

Don Duke (Marine & Ecological Sciences)

Abstract

The objective of this study was to characterize the spatial and temporal variations of Enterococci and e. coli in target waterbodies, and with the aim of identifying possible source locations. This research conducted a small number of sampling events (3-8 times over one year) on a fine spatial resolution (more than one sample per linear kilometer on three 8-km stream reaches). Results were not able to compensate for variations - especially varying tides, flows, storm events, and human activities - but showed strong ability to document differing pollutant tendencies in different portions of each reach. Upstream reaches of Estero River beyond residential development, routinely showed very small FIB concentration, while upstream reaches of Spring Creek and Imperial River, more densely developed, routinely had very high FIB concentration documenting that human land use affects FIBs more powerfully than other potential sources (sediments, non-human animals, etc). Two reaches of Estero River near privately-operated wastewater treatment plants showed higher concentrations in nearly every sample, documenting those as sources of particular concern. In all three streams FIBs were in high concentration near the mouth, suggesting that resuspension of estuarine sediments and/or inland movement of estuarine waters influence bacteria concentrations, a mechanism for future research to target.

#### Keywords

FIB, tidal streams, SW Florida, bacteria

#### Grants

USA (Undergraduate Scholarly Award), The City of Bonita Springs Dept of Public Works and the Village of Estero Dept of Public Works

### **57. Title:** Old vs. New Pond Soil Permeability for Flood Control

#### Author

Travis Jones (Environmental Studies B.A)

#### Faculty Mentor

Thomas Serge (Biological Sciences)

Daniel Canfield (Environmental Science M.S)

#### Abstract

This project deals with soil permeability comparing two ponds around Florida Gulf Coast University campus. These two ponds are different ages, one being a couple years old and the other being roughly twenty years old. The permeability of the pond is greatly affected by the type of soil, we predict the soil will consist of clay, sand, and other detritus layers; we hypothesize the permeability will decrease over time as organic matter and clay will build up in older ponds. This research will test to see which pond's soil is more permeable because it can help determine which pond aids more in flood control. Multiple core samples will be taken from each pond and tested by using permeometers in a lab and determining the type of soil the pond has at different depths of the ponds.

Keywords

Age, Permeability, Permeometer

- 58. Title:** Spatial Ecology and Multiscale Habitat Selection of the Black Spiny Tailed Iguana (*Ctenosaura Similis*)

Author

Marina Morningstar (Environmental Studies B.A)

Faculty Mentor

Matt Metcalf (Biological Sciences)

Abstract

Invasive reptiles are no stranger to Florida's hot and humid terrain. Spiny tailed iguanas (*Ctenosaura similis*) are native to Mexico and Central America, but have found their place in the southwestern part of Florida, showing dense populations with successful breeding groups. Data collected showing spatial telemetry of this invasive species has never been done in the United States. The site chosen was an abandoned property in Buckingham, Florida owned by Florida Gulf Coast University. The process began with mapping burrows GPS coordinates. Traps were then set and monitored to see what age and size ranges would be collected. A study group of 4 iguanas were then measured and fitted with 2 mm fishing line connected to a cotton bag holding the avian transmitter that rests down their tail. These iguanas were then monitored three times a week for one year to determine if these populations are localized or branch out to further areas. It was also important to show if these animals prefer to be housed in groups or if they live separate independent lives from each other. After these were collected the results concluded that the animals are not very social and are very territorial around their home range. Each iguana returned to their personal burrow every night for the entirety of this study along with each of the 4 animals traveling less than 152 meters per day away from their nesting spot during feeding and basking times.

Keywords

Iguana, Reptile, Telemetry, Spacial

- 59. Title:** Importance of Wetlands vs Wet Detention Ponds in Southwest Florida Flood Mitigation

Authors

Anna Mullen (Environmental Studies B.A)

Madison Mullen (Environmental Studies B.A)

Samuel Ebert (Environmental Studies B.A)

Faculty Mentor

Donald Duke (Marine & Ecological Sciences)

### Abstract

This research continues a 4-year investigation of surface water elevation on the FGCU campus, extending existing 24-hour-interval data and adding automated sensors collecting data on 10-minute intervals. Quantitative results demonstrate the campus surface water responds differently during each of three stages. During Stage 1, runoff enters the campus's 17 acres of stormwater detention ponds. During Stage 2, pond levels rise to hydrate about 30 acres of adjacent wetlands, vastly increasing capacity to detain runoff; and declining rapidly, presumably due to infiltration through newly-hydrated soils. Stage 3, infrequently activated, directs runoff through constructed drains into some of the nearly 300 acres of more-distant campus wetlands, intended for habitat preservation, which add immense further detention capacity. Data show surface water elevation rises considerably more per unit precipitation when only FGCU's ponds are capturing runoff, and less when the wetland storage system is activated, leading to conclusions that the stormwater ponds have very little effect at detaining runoff and mitigating flooding compared to the wetlands: pond depth below the surface is essentially irrelevant, and the much larger surface area of the wetlands is responsible for the fact that very little runoff leaves campus in most years except after intense precipitation occurring atop already-saturated wetlands.

### Keywords

Detention Pond, Flood Mitigation, Water Elevation, Wetlands

### Grants

USA (Undergraduate Scholarly Award)

## **60. Title: Microcystis Colony Disintegration Techniques**

### Authors

Boniface Mutai (Environmental Studies B.A)

### Faculty Mentor

Barry Rosen (Marine & Ecological Sciences)

Pan Donald (Marine & Ecological Sciences)

### Abstract

*Microcystis* sp. is common harmful cyanobacteria that can release toxic substances in freshwaters. Knowing the number of cells per liter cells is often used as a criterion for public health warnings of harmful algal blooms. However, *Microcystis* sp. is commonly observed as a massive colony, making counting individual cells is challenging. It is urgent to develop an accurate, simple, and rapid method for disintegrating colonies before counting algal cells for regulatory purposes, estimating blooms' status, and practicing proper water resources management. Three methods for disintegrating the cells of natural and cultured, colonial *Microcystis* populations are described, and the results are compared microscopically. Physical and chemical disruption of colonies has been conveniently applied to dense populations, and comparable results were obtained. This study was

designed to determine the best method for disintegrating different sized colonies and establish the basis for counting and quantification.

Keywords

Cyanobacteria; Colony disintegration; Harmful Algal Blooms, cell counting methods

**61. Title:** Farmers' Perceptions On Farming Conditions & The Vertical Hydroponic System: A Southwest Florida Pilot Study

Authors

Chaquer Talamas (Environmental Studies B.A)

Faculty Mentors

Molly Nation (Marine & Ecological Sciences)

Fritz Roka (Economics & Finance)

Abstract

With exponential global population growth, food production will have to substantially increase to meet demands. However, with current conventional farming (CF) methods being contributing factors in global environmental and economic concerns and competing with urbanization for land, food production and security face imposing threats. Vertical hydroponic farming (VHF) is a proposed solution. Little information is available regarding farmers' perceptions of this alternative food production system. To address this gap, a sequential explanatory pilot study utilizing a survey and follow-up interviews on South West Florida farmers will be developed and conducted. Obtaining findings from farmers, who are an integral part of the agriculture sector, will provide important information regarding current and future agriculture conditions and solutions for the future.

Keywords

Agriculture Farmers, Food production systems, Southwest Florida

**62. Title:** Analysis of Copper Concentration in Naples Bay Oysters and its Effect on Spat Recruitment

Authors

Jordan Davidson (Marine Science B.S)

Faculty Mentors

James Douglass (Marine & Ecological Sciences)

Abstract

Over the past year, Dr. James Douglass, myself, and other students in the Benthic Ecology lab have assisted in a study of the ongoing Naples Bay oyster restoration project. Oysters collected from the restoration and reference sites were shucked, dried, and ground into a powder for analysis of

copper concentration using an X-Ray Fluorescence Spectrometer. In addition, stringers with oyster shells were placed at the sites and were checked monthly for spat (baby oyster) recruitment. Oyster reefs perform important ecosystem functions, as a biogenic structure that provides nursery habitat to young fish and crustaceans, and as a filter feeder that can keep particulates and suspended sediments out of the water column. Copper enters Naples Bay through freshwater runoff via the Golden Gate Canal system, a watershed where copper sulfate is applied as an algaecide to canals, ponds, and golf course hazards. This study aimed to better understand how copper affects oysters and spat recruitment in Naples Bay.

#### Keywords

Oysters, Copper, Benthic, Naples Bay

### **63. Title: Transport and Settlement of Oyster Larvae in the San Carlos Bay, Southwest Florida**

#### Authors

Brooks Harp (Marine Science B.S)

Miranda Pace (Marine Science B.S)

#### Faculty Mentors

Felix Jose (Marine & Ecological Sciences)

#### Abstract

Oysters are an important indicator of the ecological health of a highly managed estuary that is connected to Lake Okeechobee. In general, it is thought that oyster larval supply is abundant during the spawning season throughout the Gulf of Mexico. The distribution of bivalve larvae is affected by different hydrodynamic and geological influences. Tide, wind and freshwater flows play a significant role in the transport and settlement of larvae within the bay and its connected water bodies, viz., Matlacha Pass and Pine Island Sound. Additional water releases from Lake Okeechobee combined with watershed runoff during the oyster spawning season could significantly affect the mortality rate of the larvae and its eventual settlement as a juvenile oyster. A field intensive study was conducted during June - October 2020 to determine the larval distribution of bivalves from samples collected from 10 locations (see Figure 1 below) bimonthly. Larval samples were collected using a pump and filtered for the size fraction 500- 20 microns and preserved with 5% formalin solution. Samples were split by homogenizing the sample on a stir plate and pipetting a volume to a petri dish for examination with a dissecting microscope. Samples were stained using Rose Bengal to distinguish bivalve larvae from sand and other particles. Oyster settlement was determined using triplicate stainless-steel wires each with 10 oyster shells deployed on a PVC frame. Oyster spat were counted and summed for each set of shells. Preliminary data analysis revealed that stations OL01-OL03 had highest bivalve larvae abundances and are the primary spawning grounds in the San Carlos Bay. Favorable tidal currents consistently bring larvae to the Matlacha Pass (Stations OL4 and OL5) and also to the Pine Island Sound, albeit in a reduced level. Peak larval count was observed during late July- early September, in consistent with the spawning period of the oysters. Settlement data showed a similar pattern with sites OL01-OL06 having increased settlement during the early study

period; however, as flows increased, settlement shifted to sites further up into Matlacha Pass and Pine Island Sound.

**64. Title:** Exploring Approachable 3D Animation with Motion Capture

Authors

Angela Humphrey (Digital Media Design)

Faculty Mentors

Rama Hoetzlein (Visual & Performing Arts)

Abstract

This research project, conducted in Digital Media Design with Dr. Rama Hoetzlein, was focused on making 3D animation and motion capture accessible to students with minimal or no experience with the subject. The end goal of the project was to help set up the first 3D animation class at FGCU, which is currently underway as of now during the Fall 2020 semester. A core focus of the project was to streamline "rigging," which is creating a skeleton for a 3D model. Rigging involves creating a relationship between the 3D model and the skeleton, known as skinning, and adding a set of inverse kinematic controls that the animator can use to manipulate the model to make expressive movements. Rigging is usually a lengthy and tedious process, but we have developed a way to rig new models in minutes. We explored the capabilities of the Microsoft Kinect and Noitom motion capture hardware throughout the project. We also learned how to animate models with a variety of motion capture sources through an animation rescaling tool. Our research has implications in both 3D animation and video games.

Keywords

3D animation, Autodesk Maya, Motion Capture, Digital Media Design

Grants

Seidler Scholarly Collaborative Fellowship

**65. Title:** Accessible Animation: Exploring Approachable 3D Animation

Authors

Angela Humphrey (Digital Media Design)

Faculty Mentors

Rama Hoetzlein (Visual & Performing Arts)

Abstract

This research project, conducted in partnership with FGCU Digital Media Design Professor Dr. Rama Hoetzlein, was focused on making 3D animation and motion capture accessible to students with minimal or no experience with the subject. The end goal of the project was to help set up the

first 3D animation class at FGCU, which is currently underway as of the Fall 2020 semester. A core focus of the project was to streamline "rigging," which is creating a posable skeleton for a 3D model. Rigging is usually a lengthy and tedious process, but I have developed a way to rig new models in minutes. This will be invaluable to students with little time and experience. We also explored the capabilities of the Microsoft Kinect, which proved to be a powerful and affordable tool for motion capture and gaming. Widely available and cheap, the Kinect can record motions that can then be imported into Maya and used to animate any bipedal model. Lastly, we learned how to animate models with a variety of motion capture sources through an animation rescaling tool made by professor Hoetzlein. Our research has implications in both 3D animation and video games.

#### Keywords

3D animation, Autodesk Maya, Digital Media Design, Game Design

#### Grants

Seidler Scholarly Collaborative Fellowship

### **67. Title:** Internship with the Broward County Sheriff's Office Crime Lab DNA Unit: Evaluation of Recovery Differences of Various Collection Methods

#### Authors

Alexis Whalen (Forensic Science B.S)

#### Faculty Mentors

Chris Comar (Broward County Sheriff's Office Crime Lab: DNA Unit)

Ariana Harrison (Broward County Sheriff's Office Crime Lab: DNA Unit)

Karin Crenshaw (Broward County Sheriff's Office Crime Lab: DNA Unit)

Sulekha Coticone (Chemistry & Physics)

#### Abstract

During the Summer of 2020, I worked with Broward County Sheriff's Office (BSO) Crime Lab as their DNA unit intern. The BSO Crime Lab's DNA unit was founded to identify and analyze body-fluid evidence to develop DNA profiles for matching to local, state, and national databases. As an intern in the DNA unit, I was able to assist a senior DNA analyst in an internal validation study. The purpose of the study was to compare BioSafe swabs and traditional cotton swabs, along with associated moistening agents [sterile water and Microbial-Vac solution (M-Vac)], for the crime scene collection of biological stains. My responsibility was to compare the recovery of DNA evidence of these different collection methods on different surfaces. For the study, I was responsible for obtaining samples, cell counting, performing dilutions for samples, swabbing samples with the different collection methods, and preparing them for extraction by adding lysis reagents. This internship gave me the opportunity to improve my analytical skills and develop skills important for forensic science such as preventative measures for contamination, pipetting, and operating other lab equipment essential to the DNA process.

Keywords

DNA collection, Forensic biology, Swabbing technique