



**Francis Marion University**  
6th Annual Research & Exhibition Day  
————— **2019** —————

*A celebration of student scholarship across disciplines*

**ABSTRACT BOOK**

Wednesday, April 10, 2019

Lee Nursing Building

9:30am – 3:30pm

**FMU RED, April 10, 2019, 9:30am-3:30pm**

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Congratulations to Caroline Shelley - the winner of the 2019 logo design contest!

**Similarity of Three-Dimensional Solid Models  
Using Congruency of Triangles**

Student Presenter: Christopher Sousa

Faculty Mentor: Dr. Rahul Renu

Presentation Type: Poster

Presentation number: 3

Presentation time: 9:30am – 10:00am

**Abstract**

Objectively quantifying the similarity of three-dimensional models is a well-developed field of research and is driven by the beneficial implications in a manufacturing environment. These benefits include decision support during product design, early identification of quality concerns, and reduced product development time. The research outlined in this project seeks to evaluate triangle congruency as a viable method to assess similarity of solid models. The proposed method compares two separate, three-dimensional solid models by comparing their constituent triangles. Larger the number of congruent triangles shared, the larger is the similarity of the two solid models. The method has been employed to assess the similarity of solid models in an engineering shape benchmark. The results are currently being analyzed to compare the proposed method to methods from literature. Additionally, results are also being analyzed to determine the sensitivity of the proposed method to number of decimal places used to compute side lengths, and sensitivity to resolution of the triangles used to construct the solid models. Conclusions of this research seek to illuminate gaps in literature regarding the specific function of this method as well as possible

avenues to improve this method and increase its relevance as an engineering tool. Future work for this project includes the investigation into methods to discover a single model to optimally and geometrically represent a subset of models within a database. This will eliminate the subjectivity in the categorization process of models in database storage as well as increase performance of the method presented in this research.

**Investigating the Nature of Chemical Bonds Using the Topology  
of the Molecular Electron Density**

Student Presenter: Katherine Austin Floyd

Faculty Mentor: Dr. Minerva Brauss

Presentation Type: Poster

Presentation number: 6

Presentation time: 9:30am – 10:00am

**Abstract**

Chemical bonds are often classified as either ionic or covalent bonds based on the properties of the atoms involved, and this research continues our investigations of the nature of chemical bonding using the Quantum Theory of Atoms-In-Molecules (QTAIM) software considering chlorine-containing molecules. This software considers the topology of the electron density ( $\rho$ ), especially the Laplacian of the electron density ( $\nabla^2\rho$ ) at bond critical points using five different computational approximation methods. Preliminary results demonstrate the expected covalent character of the carbon-chlorine bond in various organic molecules with electron density being small and positive and with del

squared rho being negative values. Qualitatively, these different methods seem indistinguishable but statistical analyses determine that there are specific differences between some of the methods used to calculate the electron density and Laplacian of the electron density ( $\Delta^2 \rho$ ).

### **Penthaus**

Student Presenter: Wesley Ellis

Faculty Mentor: Ms. Allison Steadman

Presentation Type: Exhibit

Presentation number: 10

Presentation time: 9:30am – 10:00am

#### **Abstract**

During the performance of The Bacchae I life casted a student's face and made a head as a prop from it. His head was ripped off by the bacchantes so I created the head prop.

### **Instructions on Implicit Bias and Juror Decision Making**

Student Presenters: Dayna Nyman and Ronkeela Jones

Faculty Mentor: Dr. Shannon Smith

Presentation Type: Poster

Presentation number: 20

Presentation time: 9:30am – 10:00am

#### **Abstract**

Concerns regarding disparities in conviction rates and sentencing have been documented throughout U.S. history, with research indicating that Black defendants receive longer sentences, particularly when judges have greater discretion in sentencing (Mitchell, 2005). Recently, a jurisdiction in Washington state began providing formal instructions to jury members in some cases in an effort to minimize the impact of implicit bias in jury decision making. Little is known, however, regarding the practical implications of providing such information to jurors. Participants in the present study were randomly assigned to watch a video depicting standard jury instructions or implicit bias instructions prior to reading a criminal case vignette. Preliminary results ( $N = 77$ ) suggest that participants in the implicit bias condition may be more likely to render a guilty verdict in conditions where the defendant is described as White rather than Black. Data collection is ongoing.

### **On the Zeros of the Dirichlet Eta Function**

Student Presenter: Jared Singleton

Faculty Mentor: N/A

Presentation Type: Poster

Presentation number: 26

Presentation time: 9:30am – 10:00am

#### **Abstract**

On the Zeros of the Dirichlet Eta Function: It has been proposed that the zeros of the Dirichlet eta Function,  $\eta(a+ib)$ , lie on the critical strip, where  $a=1/2$ . By separating the function into its real and complex parts, we may simplify the problem and focus solely on the real part. Through the Eta functions functional equation we determine that we may equate the real parts of  $\eta(a+ib)$  and  $\eta(1-a-ib)$ . We then square the real parts and add a trigonometric function, creating an alternating sum on the RHS and the difference of two p-series on the LHS. By using the alternating sum test we determine that the sum must converge. From this we see that the p-series must also converge, which is only possible if  $a=1/2$ . It is then shown how this result applies to the Riemann Zeta Function.

### **Environmental Biomonitoring Project**

Student Presenters: Loreal Anderson and Terrik Boatwright

Faculty Mentor: Ms. Padmaja Rao

Presentation Type: Poster

Presentation number: 41

Presentation time: 9:30am – 10:00am

#### **Abstract**

WBS (Wildsumaco Biological Station) Biomonitoring The purpose of this project was to address issues experienced with the current biomonitoring system at the Wildsumaco Biological Station in Ecuador by creating a software solution. The current system has needed constant physical maintenance and has also experienced some data issues. Some of the physical issues that are being faced with the current system are the frequent need to change device batteries, the need to physically collect data storage cards, and the different functional requirements of dissimilar monitoring devices. Some of the data issues that are being experienced by the current system are inefficient data collection and data transfer to FMU, and lack of environmental data collection. The goal of the new system is to have a wireless mesh network of nodes that is capable of working off grid in forested terrain and uploading data. The individual nodes (Raspberry Pi's) will collect and send data (videos, pictures, and environmental readings) to a supervisor node (web app). Another goal of the system is for the data transfer from the supervisor node to FMU to be an automatic process.



**Metanalysis of Body Image Interventions for Adolescent  
Females**

Student Presenter: Marilyn Cox  
Faculty Mentor: Dr. Crystal Hill-Chapman  
Presentation Type: Poster

Presentation number: 31

Presentation time: 10:00am – 10:30am

**Abstract**

The purpose of this project is to outline the effect sizes of two main evidence-based body image interventions: Eating Among Teens and The Body Project which have been implemented with females ages 9-16. The interventions examine the effect of the program on body image and body satisfaction in adolescent females. Articles to be included in the meta-analysis are from 2004 to present. Data was collected and results are to be presented.

**Effects of Mindfulness Curriculum on ADHD Characteristics: A  
Pilot Study**

Student Presenter: Ashley Wallace  
Faculty Mentor: Dr. Crystal Hill-Chapman  
Presentation Type: Poster

Presentation number: 34

Presentation time: 10:00am – 10:30am

**Abstract**

Hyperactivity is a common referral reason for students in schools. The practice of yoga and meditation, both mindful practices, have also begun making way into treatment of hyperactivity symptoms. This study used MindUP, featuring 15 lessons that help students focus their attention, improve self-regulation skills, build resilience to stress, and develop a positive mind-set in both school and life. This study included two African American, 8-year-old, females who completed the MindUP curriculum. Teachers rated the participants on the hyperactivity subscale of the Strength and Difficulties Questionnaire (SDQ) prior to beginning the program and then again after program completion. Results indicated an improvement in the participant's hyperactivity scores on the SDQ. Implementation of mindfulness curriculum may be effective with other students exhibiting hyperactivity.

**The Effects of the Handwriting Without Tears Program on a  
General Education Classroom After Six Weeks of  
Implementation**

Student Presenter: Elizabeth Harrelson  
Faculty Mentor: Dr. Crystal Hill-Chapman  
Presentation Type: Poster

Presentation number: 35

Presentation time: 10:00am – 10:30am

**Abstract**

The purpose of this research project is to investigate the influence a research-based, classroom-wide handwriting curriculum has on a general education, first-grade classroom's handwriting skills after six weeks of implementation. Handwriting Without Tears (HWT), the educational program used in this study, is an established handwriting curriculum historically used by occupational therapy practitioners in traditional one-on-one service delivery but also designed for full-classroom implementation and instruction (Olsen & Knapton, 2008). An experimental group, consisting of eighteen first-grade students in one general education class, and a control group, made up of fifteen first-grade students in a separate general education class, are used to derive the conclusion of whether or not a classroom-wide handwriting curriculum produces overall benefits and to what extent. Results are to be presented.

**Examining Potential Risk Factors for Grade Retention**

Student Presenter: Austin Jones  
Faculty Mentor: Dr. Crystal Hill-Chapman  
Presentation Type: Poster

Presentation number: 40

Presentation time: 10:00am – 10:30am

**Abstract**

The purpose of this research project is to examine and measure potential risk factors correlated with grade retention in elementary schools. This study was conducted using archival data from one elementary school in the Southeastern United States. Data was obtained for the 2014-2015 school year through the 2017-2018 school year. With this information, teachers may be able to better identify students likely to be recommended for grade retention based on risk factors present. Results are to be presented.

### **Health Companion**

Student Presenters: Matt Harrington, Joshua Lipps,  
and Patrick Marlowe

Faculty Mentor: Ms. Padmaja Rao

Presentation Type: Poster

Presentation number: 42

Presentation time: 10:00am – 10:30am

#### **Abstract**

The goal of this project was to use readily available, user friendly technology to achieve improved health care outcomes for medically underserved groups in the Pee Dee region of South Carolina. This group includes rural, elderly, and low-income citizens who have the highest concentration of chronic health conditions in South Carolina. The primary members of the team are computer science students from Pee Dee region who partnered with students from health sciences, marketing, and fine arts.

An app for android-based mobile phones is being developed that will have two main functions: to enable users to search for low or no-cost health resources and to allow users to track key indicators of their overall health, such as blood pressure, blood sugar, cholesterol, weight and vaccinations. This would enable the region's citizens to become engaged in their self-care by communicating effectively with health care providers, thereby improving overall population health literacy and outcomes. This project is being built using Agile methodology with a variation of Scrum project management framework, a novel application in an academic setting. This research project was funded by South Carolina Research Authority from July 1st 2018 to July 1st 2019.

### **The pathogenic concerns of pets in the home in regard to species and animal lifestyle.**

Student Presenter: Cassidy Mahoney

Faculty Mentor: Dr. Lorianne Turner

Presentation Type: Poster

Presentation number: 2

Presentation time: 10:30am – 11:00am

#### **Abstract**

This study will examine two main questions: whether feline pets or canine pets create a more pathogenic environment in one's home, and whether outdoor pets cause a significant difference in pathogenic bacteria brought inside the home. It will examine the various bacteria that exist in the typical home, with a focus on the pathogens that pets accumulate in a living space. Consideration of the natural human flora must be compared alongside this, to verify whether the bacteria found are brought forth by pets and if they would actually be harmful to one's health. This analysis will only include canine and feline pets to provide greater focus within the time constraints. Results will be examined to provide knowledge of which bacterial strains are shared between organisms and which may pose a threat to human health.

**Singing and lung function: A study on how singing affects lung function in students in a university level choir.**

Student Presenter: Zaira Reyes

Faculty Mentors: Dr. Shayna Wrighten and Dr. Francis Coleman

Presentation Type: Poster

Presentation number: 7

Presentation time: 10:30am – 11:00am

**Abstract**

Singing has been used in some healthcare settings as a form of treatment; however, there is not a lot of research on the effects singing have on health. In particular, the effects of singing on lung function have been widely understudied. This study investigated the effects of singing on lung function in a population of students from a Chorus 101 class at Francis Marion University. There were 8 subjects who consented to participate in the study. The subjects participated by answering a background questionnaire on their health and previous singing experience. Following the questionnaire spirometric tests that measured their tidal volume, inspiratory reserve volume, expiratory reserve volume and forced vital capacity were performed. The objective was to see if singing improved lung function over time. We hypothesized that singing will improve lung function. The effects of singing on lung function needs further studying to explore the different possible outcomes on pulmonary health. More specifically, there needs to be more information on the possibility of singing being a form of treatment for pulmonary diseases.

**Preparation and characterization of adrenal carcinoma cells that over-express AC**

Student Presenter: Jessica Lynn Ratliff

Faculty Mentor: Dr. Lorianne Turner

Presentation Type: Poster

Presentation number: 13

Presentation time: 10:30am – 11:00am

**Abstract**

Our goal for this research project is to prepare and characterize the response of mammalian cells that over-express acid ceramidase (AC). Acid ceramidase converts ceramide to sphingosine. Ceramide can be upregulated as a response to stress, leading to apoptosis. When AC is upregulated, excess ceramide produced in response to stress can be converted by AC to S-1-P, which can result in cell proliferation. The mammalian cells being used are adrenal-corticotropic cells or adrenal carcinomas, called H259R. Previous research conducted found that CMV-AC in a previous cell line was silenced over time due to methylation. A new line of cells were created from the control line (H259R-AC-GFP) using the promoter EF1-alpha.

**Buried Child Production Dramaturgy**

Student Presenter: Emily Bochette

Faculty Mentor: Ms. Allison Steadman

Presentation Type: Poster

Presentation number: 24

Presentation time: 10:30am – 11:00am

**Abstract**

I will be presenting a compilation of research for Buried Child by Sam Shepard. This was originally presented to my script analysis class and I will be expanding upon this binder with a poster presentation.

**Herpetological Survey of Marsh Wildlife Management Area**

Student Presenter: Tyler Blake Wright

Faculty Mentor: Dr. Jeffrey Camper

Presentation Type: Poster

Presentation number: 28

Presentation time: 10:30am – 11:00am

**Abstract**

A short-term herpetological survey of Marsh Wildlife Management Area was performed between January 31, 2018 and September 12, 2018. Marsh is a 8,660 acre plot located in Marion County, SC. The tract includes a variety habitat types including river floodplains, hardwoods forest, extensive pine, mixed pine-hardwood forest and diverse longleaf pine. This diversity of habitat is a key feature in the coastal plain of the southeastern United States giving it the most reptile and amphibian species in all of North America with more than 100 species. Interest arose in this area due to its proximity to the Woodbury which has had studies conducted on its premises in past years. This survey was crucial for surveying another public land system to document species and help aid in information to stop the species extinction crisis particularly in herps.

### **Synthesis and Characterization of Nanoprisms, Nanowires and Nanospheres**

Student Presenters: Rachael Kerr, Laura-Joy George, Philip Mickel, Corbin Witt, and Laquisha Mills  
Faculty Mentor: Dr. Jennifer Kelley  
Presentation Type: Poster

Presentation number: 33

Presentation time: 10:30am – 11:00am

#### **Abstract**

Because of the prevalence of nanoparticle technology in biomedical, industrial and environmental applications, it is important to understand how nanoparticles are formed as well as their unique properties. We have synthesized a variety of shapes of nanoparticles: prisms, wires and spheres. Each of these types of nanoparticle was characterized using several techniques such as ultraviolet-visible spectroscopy (UV-vis), Fourier transform infrared spectroscopy (FTIR), powder X-ray diffraction (PXR), transmission electron microscopy (TEM) and scanning electron microscopy (SEM). The size of our nanoparticles ranged from 15 nm – 200 nm and displayed an array of colors that were dependent on their shape and size. While exhibiting some deviations from expected outcomes, these data confirmed the shapes and structural properties of the nanoparticles.

### **Lack of Access to Veterinary Care in Rural Areas: Causes, Effects, and Solutions**

Student Presenter: Kendall Berry  
Faculty Mentor: Dr. Tamatha Barbeau  
Presentation Type: Poster

RED 2019 Abstract Book

Presentation number: 18

Presentation time: 11:00am – 11:30am

#### **Abstract**

This project is an inquiry into the economic and other reasons for the lack of veterinarians and veterinary care in rural areas, the problems that shortage creates for people and animals, and propose possible solutions. Due to such things as a large income-to-debt ratio, many veterinarians want to go into small animal medicine instead of large or farm animal medicine, and they also want to live in cities. Along with living in cities, many veterinarians want to work in large practices so that they do not have to work as many hours during the day and have less time on call. This leads to a shortage of veterinarians in rural areas, including the Pee Dee. This shortage leads to problems such as the spread of zoonotic diseases and parasites from animals to humans, an abundance of easily treated health problems in animals, overpopulation of animals, and lack of access for people whose animals are in need of veterinary care. Along with the shortage of veterinarians, many people cannot afford to have a veterinarian see their animals. Some of the possible solutions to this problem is to have existing rural practices increase their salary and benefits of new veterinarians that are getting hired, have lower tuition for veterinary students while they are in veterinary school, encourage veterinary schools to recruit students from rural areas that have an interest in large animal medicine and mixed animal medicine, and to have government programs that encourage veterinarians to work in rural areas.

## **Investigating Transduction Efficiencies of Gene Therapy Vectors**

Student Presenter: Luke Fennell

Faculty Mentor: Dr. Jennifer Lyles

Presentation Type: Poster

Presentation number: 27

Presentation time: 11:00am – 11:30am

### **Abstract**

Gene therapy is a cutting-edge technique used to treat genetic disorders by introducing a functional copy of a mutated or absent gene. This type of treatment requires a vector for delivery of the functional gene, and among the most successful gene therapy vectors is Adeno-associated virus (AAV). Gene therapy using AAV vectors has demonstrated tremendous success over the last decade, including the approval of the first commercially available gene therapy treatment for clinical use. AAV vectors are known for their long-term persistence following a single administration of the vector, a property that is critical to the success of the therapy. A potential barrier to long-term persistence is the initial entry of the vector into the host cell. It is known that different “serotypes” of AAV have different affinities for various cell types. Traditionally, AAV-2 has been the most widely used and widely studied serotype. However, it has been demonstrated that alternative serotypes may have greater affinities for certain cell types than AAV-2, resulting in greater transduction efficiency and ultimately a greater therapeutic effect. As a result, the field has shifted towards the use of alternative AAV serotypes depending on the target tissue – for example, AAV-9 is now used to target hepatocytes (liver cells). Additionally, AAV vectors may contain either single-stranded (ss) or self-complementary (sc) genomes. The configuration of the vector genome upon nuclear entry has also been shown to have an effect on transduction efficiency. While

preliminary data demonstrates that both the vector serotype and genome configuration affect transduction efficiency, there is still much characterization that needs to be done. Characterizing the transduction efficiencies of each AAV serotype in common laboratory cell lines and cataloging this information will aid in establishing a vector “toolkit”. Researchers and clinicians will be able to use this information to ensure that the most suitable vector is being used for the appropriate target tissue or cell line in order to maximize transduction efficiency and therapeutic effect. Specifically, the transduction efficiency of AAV-DJ—a newly engineered serotype of AAV with a hybrid capsid derived from eight serotypes—is being investigated in several mammalian cell lines, including HEK293 cells (human), HeLa cells (human), and C2C12 cells (mouse). AAV-DJ is currently a leading candidate for liver gene therapy.

**Factors Influencing Retention Rates Across 142 Postsecondary Institutions**

Student Presenter: Zachary Middleton  
Faculty Mentor: Dr. Minerva Brauss  
Presentation Type: Poster

Presentation number: 37

Presentation time: 11:00am – 11:30am

**Abstract**

On average, retention rate is 70.49% with a standard deviation of 10.9 across 142 postsecondary institutions in the Southeastern United States. The purpose of this study was to discover if there exists significant factors that influence retention rate. The data for this study was collected from the National Center for Education Statistics or NCES. The NCES uses the Integrated Postsecondary Education Data System or IPEDS. We used SPSS statistical package to examine the data and determine the results of this study. Using step-wise linear regression, the study showed that factors such as graduation rate BA/BS degree within 6years, ACT English 75th percentile score, and percent of students who did not receive Pell Grants or Subsidized Stafford Loans influenced retention rates.

**Empathy, the Autism Spectrum and Risky Behavior in a Community Sample**

Student Presenter: Caroline Coke Lawson  
Faculty Mentor: Dr. Teresa Herzog  
Presentation Type: Poster

Presentation number: 1

Presentation time: 11:30am – 12:00pm

**Abstract**

Autism spectrum disorder (ASD) involves a central deficit of diminished social processing. However, all people may display a range of abilities along an empathizing-systematizing spectrum, with empathizing (i.e., sensitivity to social cues) is at one end, and systematizing (i.e., facility with technical information) on the other (Baron-Cohen, 2009). The current study (n = 350) applied the empathizing-systemizing theory to two areas of behavior that have relations to social behavior: Risk-taking and emotion regulation. We replicated previous research that high systematizers reported engaging in fewer risky behaviors than empathizers (Ramos, Boada, Moreno, Llorente, & Parellada, 2013). We extended this to show that they also scored lower on sensation seeking. Moreover, on two subscales of a measure of emotion regulation, participants higher on empathizing showed greater situational awareness of social situations while systematizers were higher on emotional control.



### **Identifying the fungal symbiont of *Neottia bifolia***

Student Presenter: Andrew Westfall

Faculty Mentor: Dr. Jeremy D. Rentsch

Presentation Type: Poster

Presentation number: 15

Presentation time: 11:30am – 12:00pm

#### **Abstract**

Mutualism is an integral part for the survival of a multitude of species and is observed in at least ninety-five percent of angiosperms. The most common type of plant mutualism is an association with fungi known as arbuscular mycorrhizae. This association, of fungi in the plant roots, increases the plant root's surface area. This increased surface area allows the plant to obtain additional water and nutrients; in turn, the plant feeds the fungus. The family Orchidaceae heavily depends on this mutualism for germination and more, depending on the species. The Southern Twayblade, *Neottia bifolia*, is a rare orchid found in the United States and Canada. Because of its rarity and peculiar habitat, few scientific studies have been completed on it. Most orchids species documented so far have only had a mutualistic relationship with one species of fungus at a time. However, preliminary research on *N. bifolia* has failed to reveal the identity of this fungal symbiont conclusively. Preliminary research has been largely confined to DNA extraction, PCR, and gel electrophoresis. Normally, these methods would suffice in amplifying the locus for one species, but conducting these procedures revealed a larger than average band, implying the presence of multiple fungi in the genomic DNA extraction. Therefore, we propose to use cloning techniques with *Escherichia coli* to isolate and sequence each amplicon individually and identify the fungal symbiont; separating it from potential contaminants. Sequencing revealed that the DNA of the fungal

symbiont belonged to clade B of the genus *Sebacina*, and the remaining DNA that was present belonged to *Neottia bifolia*.

### **Does Economic Integration Affect GDP**

Student Presenter: Matthew Bainbridge

Faculty Mentor: Dr. Caroline S. Padgett

Presentation Type: Poster

Presentation number: 23

Presentation time: 11:30am – 12:00pm

#### **Abstract**

Brexit, or the proposed exit of Britain from the European Union, is at the forefront of today's political and economic debate. Economic Integration has long been considered by Economists to provide enormous benefits to participants, beginning with the simple trade models of David Ricardo in the 1800s. However, the recent desire of the UK to exit casts doubt on whether the public supports these conclusions. This study will utilize a panel data set of EU countries from 1995-2017 to investigate the benefits of integration on GDP. This paper uses the EU as a natural experiment of full integration (or full political union) to test the effects of adding new countries into the EU, on the incoming members and the existing members to see whether this has benefited the EU overall.

### **Maternal Health and Obstetric Care Access**

Student Presenter: Tyler Davis

Faculty Mentor: Dr. Caroline S. Padgett

Presentation Type: Poster

Presentation number: 29

Presentation time: 11:30am – 12:00pm

#### **Abstract**

Numerous studies have been conducted on the infant mortality rate around the globe. While it is important, it also can show us how the mothers of these infants are also being affected. The purpose of this study is to determine if and how the current healthcare system affects maternal health in rural South Carolina. A meta-analysis study was conducted analyzing the links between the infant mortality rates for each county of South Carolina and data from the hospitals in South Carolina to determine how mothers are affected. The possible policies and solutions to resolve this issue are also discussed.

In non-metropolitan, or rural, areas of the state where there is no or reduced access to healthcare present, more health issues tend to be present than in regions where there is access to healthcare. This study examines, through the lens of infant mortality and its factors, the relationship between healthcare and how other factors may be impacted by healthcare. These factors come from not only a health standpoint but also a social and economic standpoint. Through this study, the research question, “How does the lack of access to healthcare affect maternal health in rural South Carolina?” is answered.

### **Sequencing and assembling the Chloroplast genome of *Neottia bifolia***

Student Presenter: Caroline Shelley

Faculty Mentor: Dr. Jeremy D. Rentsch

Presentation Type: Poster

Presentation number: 38

Presentation time: 11:30am – 12:00pm

#### **Abstract**

Chloroplasts have non-recombining genomes and possess a uniparental mode of inheritance. Sequencing the chloroplast genome provides significant insights into the genetics of photosynthetic organisms. Populations of *Neottia bifolia*, the rare Southern Twayblade, have been discovered on the property of Francis Marion University. Much about the ecology and phylogeography of this species remains a mystery. For example, a closely related species, *Neottia nidus-avis*, is a mycoheterotrophic plant that lacks leaves and parasitizes its historic fungal symbiont for carbon resources. Along with the evolution of mycoheterotrophy came the loss of several chloroplast genes critical for photo- synthesis. While *Neottia bifolia* appears to be autotrophic, comparative genomics tools could help us identify missing genes in the chloroplast genome if the species is in the early stages of mycoheterotrophy. Further, sequencing the chloroplast genome will provide valuable markers to use as a population genetics resource. Here, we present the results of full chloroplast sequencing using a series of 16 long polymerase chain reactions. Reactions were pooled for Illumina DNA library prep and sequenced using a MiSeq nano flowcell. A reference-based assembly using the chloroplast genome of *Epipactis veratrifolia* was performed in Geneious 11.1.3, using the Geneious assembler.

### **Data-Driven Conceptual Design using Historical Knowledge**

Student Presenter: Shikhar Chodha

Faculty Mentor: Dr. Rahul S. Renu

Presentation Type: Poster

Presentation number: 5

Presentation time: 12:00pm – 12:30pm

#### **Abstract**

The engineering design process is iterative and can be repeated at any phase. These iterations increase the cost of product development and can be reduced by early stage resolution of issues. In early stages of engineering design, concepts are developed by analysing functionalities required. Solutions for achieving all required functions are combined to form a concept. This process of identifying and combining solutions for different functions is conducted systematically using morphological matrices. These matrices list functions as rows and every corresponding column lists a solution for achieving the function. Multiple possible solutions can be generated by navigating through this matrix and selecting and combining one or more solutions from each row.

While morphological matrices present a systematic method of identifying and combining solution principles, they have some disadvantages. First, the number of possible combinations can be very large. And, second, the compatibility of solution principles is not guaranteed. To counter these issues, this research proposes the use of historical designs to populate a morphological matrix and use related data to eliminate infeasible combinations. By reusing historical designs, we hypothesize that issue resolution can be conducted in the early stages of design, leading to reduced product development costs and time. This hypothesis will be tested and verified in the coming months.

### **Modeling Strategic Make, Buy, or Repair Decisions in Spare Parts Supply Chains**

Student Presenter: Dante E. Ahquin

Faculty Mentor: Dr. Brett A. Shields

Presentation Type: Poster

Presentation number: 16

Presentation time: 12:00pm – 12:30pm

#### **Abstract**

Strategic decisions in spare parts supply chains have significant implications within the supply chain configuration. As advanced manufacturing techniques become more readily available, the ability to repair failed critical components is prominent. To date, no research has considered repairing parts integrated with make-or-buy decisions. Here we formulate a mixed-integer linear programming model that decides the number of machines purchased, production levels for new components, procurement of parts from suppliers, and repairs of failed components. The objective of the math model is to minimize the cost of satisfying critical spare parts demand over a long-term planning horizon.

**Extraction, Isolation, and Comparative Analysis of *M. smegmatis*  
and *E. coli* bacteriophages**

Student Presenter: Jack Slade Evans II  
Faculty Mentor: Dr. Timothy E. Shannon  
Presentation Type: Poster

Presentation number: 21

Presentation time: 12:00pm – 12:30pm

**Abstract**

This project aims to extract and comparatively analyze antagonistic bacteriophages targeting *Escherichia coli* and *Mycobacterium smegmatis* bacteria. The experiment is a continuation and modification of previous work done to presumptively test the presence of *Helicobacter pylori* bacteriophages contained within probiotic kefir solutions. The change in hosts and desired phages was made due to the ease of cultivation and similar implications of phage isolation. Given that bacteriophages have been identified that prey upon both species, the project will be working on the hypothesis that *E. coli*-specific bacteriophages exist within a variety of soil-exposed environments and therefore be compared to a soil-derived, local *M. smegmatis* mycobacteriophage due to the assumption that mammalian phage introduction occurs orally – or in the specific case, via livestock animals' vegetation-based diets. Consequently, the ultimate goals of this experiment are to: extract *E. coli*-specific bacteriophages from locations rich in mammalian fecal matter, to extract *M. smegmatis*-targeting mycobacteriophages from a local soil sample, isolate said viral particles, and conduct a comparative analysis on their capacities to create plaques on their respective hosts.

**Brain Waves and Symetry Perception**

Student Presenters: Hallsy Kellar, Madison Cox, Zachary Gerrald,  
and Eric Henderson  
Faculty Mentor: Dr. Jesse Sargent  
Presentation Type: Poster

Presentation number: 32

Presentation time: 12:00pm – 12:30pm

**Abstract**

Previous behavioral research has shown that symmetrical patterns are easier to remember (the symmetry effect). Electroencephalography (EEG) studies have shown that perception of symmetrical compared to random patterns is associated with a specific difference in electrical activity in the brain (SPN). The current study asked if this symmetry related brain response (SPN) occurs when people are not just perceiving symmetrical patterns but also trying to remember the locations of the elements. If so, does the magnitude of the SPN track spatial memory accuracy. We recorded EEG from 20 participants while they saw patterns of squares on a screen for 3 s and then immediately had to click on where the squares had been. We showed that the SPN occurs during a memory task but that it does not track behavioral performance.

### **Modeling Feral Cat Populations at Francis Marion University**

Student Presenter: Elizabeth Brooke Haywood

Faculty Mentor: Dr. Nicole Panza

Presentation Type: Poster

Presentation number: 39

Presentation time: 12:00pm – 12:30pm

#### **Abstract**

Managing feral and semi-feral cat populations has posed a difficult problem to ecologists and animal-lovers alike. Many college campuses often become home to feral cat populations due to abandonment by students and the surrounding communities, coupled with the quick reproduction rate of cats. Trap-neuter-release (TNR) has been suggested as an ethical method to diminish feral cat populations by trapping feral cats and preventing them from being able to reproduce before re-releasing them back into the population. This project specifically models a TNR program on Francis Marion's population of semi-feral cats.

### **Developing an Optical Activity Laboratory Experiment for Instrumental Analysis**

Student Presenter: Deannah Neupert

Faculty Mentor: Dr. Kristofoland Varazo

Presentation Type: Poster

Presentation number: 11

Presentation time: 12:30pm – 1:00pm

#### **Abstract**

An optical activity lab has been developed for Instrumental Analysis Laboratory course, Chemistry 303, to explore specific rotation and Biot's Law. Optical activity is important in organic chemistry laboratories, but is also important in analytical labs. We investigated the dependence of the optical rotation of solutions with the concentration with the optically active compounds Beta-D-lactose and d-tartaric acid according to Biot's Law. We first analyzed the solutions on an older, student polarimeter but our results did not agree well with literature values. We then switched to using a Vernier Polarimeter and achieved good results,  $\pm 1$  degree. With our results and established procedure, we have a good start to an optical activity lab for Instrumental Analysis. This experiment stresses the importance of both organic chemistry and analytical chemistry as a part of an undergraduate's laboratory experience.

**Systematic Study of Basis Set and Level of Theory Dependable of the Quantum Theory of Atoms in Molecules Analysis of Nature of Chemical Bonding in First and Second Row Chlorides**

Student Presenter: Jewel Cyrus Green

Faculty Mentor: Dr. Allen Clabo

Presentation Type: Poster

Presentation number: 30

Presentation time: 12:30pm – 1:00pm

**Abstract**

Having previously surveyed over 200 molecules of various kinds (ionic, covalent, organic, transition metal complexes, etc.) using the quantum theory of atoms-in-molecules (QTAIM) method to describe the topology of the electron density and the nature of the chemical bonding in these molecules we have become concerned about the effect on these computations to basis set and level of theory. Thus, we have surveyed a number of basis sets and levels of theory to determine any effects on the properties calculated by QTAIM method [including  $\rho$ ,  $\nabla^2\rho$ , DI, and  $K(\rho)$ ] for the complete set of first- and second-row chlorides (XCl, X=H, Li-F, Na-Cl). Using the M06-2X density functional with large basis sets [6-311+G(d,p), 6-311++G(2d,2p), cc-pVDZ, cc-pVTZ], the numerical values changed insignificantly for most molecules.

**An Analysis of Student Debt and Loan Repayment in South Carolina Dentistry**

Student Presenter: Kacey Medlin

Faculty Mentor: Dr. Ben Kyer

Presentation Type: Poster

Presentation number: 36

Presentation time: 12:30pm – 1:00pm

**Abstract**

In the United States, the field of dentistry is expected to grow at a rate of 19% from 2016 to 2026 as more connections are made between oral health and overall health. As dentistry continues to become a popular career field, the cost of dental education is also steadily increasing. The average dental student graduates with almost \$300,000 in education debt. The aim of my research is to analyze the options for loan repayment in South Carolina dentistry. I will proceed by conducting a cost comparison of four hypothetical dental students graduating from the Medical University of South Carolina with differing amounts of student debt. The economic concept of discounting will be applied, and multiple discount rates will be used for each hypothetical student which will give an estimate of when each dentist will have their debt payed off. The data for each hypothetical student will be compared to each other, and conclusions will be made about the pros and cons of each student debt scenario. Special attention will be paid to the South Carolina Rural Dentist Incentive Program Grant, which allows dentists to have their education debt paid in exchange for serving in a health professional shortage area.

### **Dog Sees God Set Design**

Student Presenter: Lorna Young

Faculty Mentor: Mr. Jared Cole

Presentation Type: Exhibit

Presentation number: 9

Presentation time: 1:00pm – 1:30pm

#### **Abstract**

This is an exhibit of the research and actuality of a design for Dog Sees God. I have done this for an independent study and have previously entered it into a competition at a theatre convention.

### **A Comparison of Lung Function Values Among a SCUBA Diver Population and in Comparison to a Non-Diver Population**

Student Presenter: Gabriel C. Hutson

Faculty Mentor: Dr. Erin Eaton

Presentation Type: Poster

Presentation number: 12

Presentation time: 1:00pm – 1:30pm

#### **Abstract**

The purpose of this study was to investigate possible correlations between lung function values (PEF, IRV, ERV, and FVC) among a diver population, as well as in comparison to a non-diver population. Independent variables for both populations were biological sex, age, and weekly physical activity. Independent

variables for the diver population were dive tenure, number of logged dives, certification level, and gas mixture used. A spirometry test was conducted to collect lung function values of both populations. Data from this study suggest a statistically significant relationship between diver and non-diver sex and FVC, dive age and ERV, diver sex and ERV, and non-diver FVC and weekly physical activity.

### **Analyzing Johnson Noise Using A TeachSpin Noise Fundamentals Apparatus**

Student Presenter: Chace Covington

Faculty Mentor: Dr. R. Sethfield Smith

Presentation Type: Poster

Presentation number: 19

Presentation time: 1:00pm – 1:30pm

#### **Abstract**

Johnson noise is electronic noise generated from a nonzero emf in resistors due to a thermodynamic connection between heat dissipation and fluctuations. While the average emf in resistors is zero, the value fluctuates around zero, creating noise that interferes with signals that one can measure from the circuit. A TeachSpin Noise Fundamentals apparatus was used to measure Johnson noise and explore some of its properties. Johnson noise was analyzed as a function of resistance by inserting resistors with different resistances into the circuit. By adjusting the bandwidth of an electrical signal, Johnson noise was also analyzed as a function of noise density and the results were used to measure a value for Boltzmann's constant.

### **Magnetic Torque**

Student Presenter: James G Morris  
Faculty Mentor: Dr. R. Sethfield Smith  
Presentation Type: Poster

Presentation number: 8

Presentation time: 1:30pm – 2:00pm

#### **Abstract**

The purpose of this project is to investigate the interaction of a magnetic moment with a magnetic field. Five experiments were conducted to measure the magnetic moment of a dipole, including: Balancing Magnetic Torque and Gravitational Torque, Harmonic Oscillation of a Spherical Pendulum, Precessional Motion of a Spinning Sphere, Net Force in a Magnetic Field Gradient Using the Magnetic Force Balance, and Determining the Magnetic Moment from the  $1/r^3$  Dependence of the Magnetic Field Along the axis of a Magnetic Dipole. The data will be compared to theory, and the results reported.

### **Forensic Application in Determining the Age Estimation of Documents Using Infrared Spectroscopy**

Student Presenter: Philip Mickel  
Faculty Mentor: Dr. Jessica McCutcheon  
Presentation Type: 1:30pm – 2:00pm

Presentation number: 25

Presentation time: 1:30pm – 2:00pm

#### **Abstract**

In the field of forensic science, determining the age of a paper-based document will aid in verifying the authenticity of the document. Diffuse Reflectance Infrared Fourier Transform Spectroscopy (DRIFTS) is a portable, non-destructive method that characterizes the surface qualities of a material; Attenuated Total Reflectance Fourier Transform Infrared Spectroscopy (ATR-FTIR) is non-destructive and measures chemical qualities of a sample. A non-destructive method is crucial for the evaluation of evidence at crime scenes. In this study, several types of paper in various conditions will be analyzed over a set period. Varying storage conditions such as humidity, heat, and light will be applied since all of these contribute to the aging of the paper. The chemical changes in the surface qualities of paper due to aging will be examined via DRIFTS and ATR-FTIR and then statistically analyzed with chemometrics. The characterization of paper through DRIFTS and ATR-FTIR will provide a reliable timescale for which a document was produced. A consistent method for the verification of paper will improve the analysis and trust of questioned documents in the court system.



**Sense of Place Dimensions in Relation to Personality in the Rural Experience**

Student Presenter: Ashley Krause  
Faculty Mentor: Dr. Teresa Herzog  
Presentation Type: Poster

Presentation number: 4

Presentation time: 2:30pm – 3:00pm

**Abstract**

Sense of place refers to cognitions surrounding people's impressions, memories, and emotions that are distinctive of meaningful locales. Aspects of sense of place include region, size, architectural, or natural features (Ujang & Zakariya, 2015). Less research has been conducted in relation to places that are strongly identified with a certain ethos, such as the rural South. Since World War II, the South has been associated with higher provincialism (Boles, 1992), or emphasis on traditional values to the exclusion of wider experiences. We hypothesized that people who had a positive sense of place regarding the South would be lower on risk-taking and sensation-seeking. Students in the Introductory Psychology Laboratory at Francis Marion University completed items on sense of place, personality, and behavior. Using a multiple hierarchical regression, we found that participants high on "rootedness" in the South were not lower on risky behavior, contrary to our hypothesis; however, they were significantly lower in sensation seeking.

**Calculating Magnetic Fields Using GPUs, CUDA, the Tree Method, and Fast Multipole Method**

Student Presenter: Anquan Leverne Gamble  
Faculty Mentor: Dr. K. Daniel Brauss  
Presentation Type: Poster

Presentation number: 14

Presentation time: 2:30pm – 3:00pm

**Abstract**

Direct calculations of interactions between  $N$  particles require  $O(N^2)$  operations. These calculations are used in astrophysics (galaxies), biology (DNA) and chemistry (molecules) models. When the number of particles is on the order of billions, a method to reduce the operation count becomes useful. Two methods that approximate particle-particle interactions and reduce operations to  $O(N)$  or  $O(N \log(N))$  are the Fast Multipole Method (FMM) and the Tree Method. On a GPU of the Francis Marion University supercomputer, we test a Tree Method based on work by Rio Yokota and written in C/CUDA for potential calculations between particles.

### **Environmental Surveillance Project**

Student Presenters: Loreal Sharreff Anderson and  
Terrik Boatwright  
Faculty Mentor: Ms. Padmaja Rao  
Presentation Type: Poster

Presentation number: 17

Presentation time: 3:00pm – 3:30pm

#### **Abstract**

The Environmental Surveillance application works to replace the manual retrieval of videos and images taken from Raspberry Pi nodes. These nodes, or miniature computers with hard drives are strategically placed throughout the Ecuadorian jungle, and capture videos and images saved to an SD-card. Each quarter, Dr. Zwiers carries out the task of manually gathering the SD cards with a number of his students for research. We have brought automation to this process by allowing the data to be received through an environmental surveillance web application. This web application allows the upload and traversal of the data that is captured by the nodes through a custom mesh network. A supervisor node bridges the gap between the mesh network that houses the data capturing nodes to the internet. Once the data is on the internet, images and videos can be accessed through the web application. Environmental data is captured when motion is detected and a fifteen second video is started.

### **Database Retrieval of Three-Dimensional Models Using KDE**

Student Presenter: Caleb Fulmer  
Faculty Mentor: Dr. Rahul S. Renu  
Presentation Type: Poster

Presentation number: 22

Presentation time: 3:00pm – 3:30pm

#### **Abstract**

Retrieval of models can be used as a technique to relate new designs to historical designs and their corresponding quality concerns. The focus of this research is three-dimensional solid model retrieval. Specifically, it is an investigation of database indexing methods to improve search and retrieval times and precision of engineering models. This research proposes the use of unsupervised learning to form groups of parts in large databases; for example, a large database would include approximately 100,000 models. Each group will have a representative model. A new design will be used as a query model and compared to the representative models. Further searching will be performed within groups whose representative models are most like similar to the query model. It is hypothesized that this approach will make the search and retrieval process more efficient than existing approaches. Testing and verification will be performed in the coming months.

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