FROSTBURG STATE UNIVERSITY

One University. A World of Experiences.

2022 FSU Undergraduate Research Symposium

Lane Center

May 6th, 2022
11:00 a.m.-2:00 p.m.

TABLE OF CONTENTS

THE ABSTRACTS

This Symposium includes 82 presentations featuring the work of 149 students, mentored by 41 Faculty and Staff from the Appalachian Laboratory of the University of Maryland Center for Environmental Science, and the Colleges of Business and Liberal Arts and Sciences from Frostburg State University. The projects presented at this Symposium took place in 2021 and 2022 and include coursework and independent study activities. Abstracts are organized alphabetically by laboratory or college, department or program and by project title. The Presentation number in parentheses following the title refers to the table locations of the Posters in the ARMAH. Oral presentations are scheduled in Lane Center 108, 109, 110, 111 and 113. A map of the ARMAH and the schedule for the oral presentations are at the end of this abstract booklet. Each presentation includes the following information:

Project Title (Poster with Table #, Oral Presentation)

Name(s) of presenting student(s)
Name(s) of contributing student(s) (if applicable)
Name(s) of faculty/staff mentor(s)

UNIVERSITY OF MARYLAND CENTER FOR ENVIRONMENTAL SCIENCE

APPALACHIAN LABORATORY

Genetic-Based Identification of the Sex of Tree-Roosting Bats Killed at Wind-Energy Facilities (Poster Table 1)

Presenting Students: Jasmine Smiley, Abigail Hunker
Faculty/Staff Mentors: Dr. David Nelson, Ms. Juliet Nagel

Wind-energy is growing throughout the world. Unfortunately, an unexpected side-effect of wind-energy is hundreds of thousands of birds and bats killed each year, especially during fall migration. The majority of wind-energy facilities in North America are comprised of five bat species: hoary (*Lasiurus* [*Aeorestes*] *cinereus*), eastern red (*L. borealis*), silver-haired (*Lasionycteris noctivagans*), Mexican free-tailed (*Tadarida brasiliensis*), and evening (*Nycticeius humeralis*) bats. As wind-energy facilities expand into new regions, additional species such as southern and northern yellow bats (*Dasypterus ega* and *D. intermedius*) may also be impacted. Due to low annual reproductive rates and long life-spans, bat populations are unable to recover quickly from high mortality events. Many questions remain about the timing and movement patterns of bats during migration. Understanding the ratio between male and female bats killed at wind-energy facilities can help answer those questions. This will allow wildlife managers and the wind-energy industry to make strategic plans on how to maximize operating time and energy production while reducing the risk for bat species and costs associated with mitigation. Using samples collected from nine bat species killed at wind-energy facilities across 16 states in the United States, we will use genetic methods to identify the sex of each bat. We hypothesize that the sex ratios of bats will vary by species, region, and time period.

FROSTBURG STATE UNIVERSITY

COLLEGE OF BUSINESS

ECONOMICS DEPARTMENT

American Foreign-Language Speakers and U.S. Imports: Not the Usual Trade Flow (Poster Table 1)

Presenting Student: Victoria Rosser
Faculty Mentors: Dr. Oleg Kucher, Dr. Suzanne McCoskey

When doing business internationally, a shared language eases transactions and reduces costs, increasing trade between countries. To apply this idea to the United States, an OLS panel data analysis is conducted over a number of U.S. trade partners to measure the connection between imports to the United States and the number Americans that speak an exporting country's language. This analysis produces a surprising result: the amount of American foreign-language speakers does not increase U.S. imports.

COLLEGE OF LIBERAL ARTS AND SCIENCES

BIOLOGY DEPARTMENT

A Simple Method for Isolation of DNA from River Otter Scat (Poster Table 11)

Presenting Student: Jennifer Evans
Faculty Mentor: Dr. William Seddon

Recovery of intact DNA is essential for PCR based studies. In this study, a comparison of DNA recovered from river otter scat and anal jelly using different sampling techniques will be evaluated. A swabbing technique to collect DNA from the surface of scat will be compared to direct extraction of DNA from otter scat and otter anal jelly. DNA samples will initially be evaluated spectrophotometrically to determine DNA concentration and purity. DNA will then be subjected to a previously developed PCR protocol targeting segments of introns common to the *Zfx* and *Zfy* zinc finger genes on the X and Y chromosomes, respectively. The PCR products will be analyzed using agarose gel electrophoresis. Preliminary data show that the length of the DNA fragments amplified from the X and Y chromosomes differ in size, and the different sized fragments can be resolved using gel electrophoresis. The non-invasive sampling method combined with PCR based analysis may be useful in determining the biological sex of unknown animals in future studies.

Analysis of COVID Strands Phylogeny and Mutations (Poster Table 7)

Presenting Student: Ismerai Reyes
Faculty Mentor: Dr. David Puthoff

The COVID-19 pandemic has been impacting human health for roughly over two years. New strands are being discovered at an alarming rate, signaling how quickly the virus is mutating as time goes on. The aim of this research is to compare the genetic phylogeny of various COVID-19 strands such as but not exclusive to alpha, beta, delta, and omicron. The DNA sequences for all the primary mutants has been analyzed in an effort to compile and compare regions of similarity in the sequences. The COVID-19 spike proteins sequences have also been compared and analyzed to highlight major changes between them and their significance. The results were then used to elaborate why certain spike protein mutations cause greater disease severity and or infection.

Assessment of Cannabinoid Synthases across Strains of *Cannabis sativa* (Poster Table 6)

Presenting Student: Diamond Herbert
Contributing Student: Quinton Browne
Faculty Mentor: Dr. David Puthoff

For millennia, *Cannabis sativa,* better known as hemp or marijuana has been utilized by many cultures for a multitude of functions. Cannabis is widely used as medicine, a food source, a fiber material, and a euphoriant. Cannabinoids are naturally occurring secondary metabolites exclusively found in *Cannabis sativa*. This includes cannabigerolic-acid (CBGA) (a common precursor for many other cannabinoids) and Cannabidiolic-acid (CBDA). CBGA synthase is important in the production of CBGA, and CBDA synthase is an enzyme that catalyzes oxidative cyclization of CBGA into CBDA. This project is being completed by multiple different groups working on multiple different cannabinoids and strains, allowing for greater coverage. The project began with obtaining the DNA primers for each synthase. The cannabis samples from each strain underwent Genomic DNA Purification followed by real time PCR which was assessed using Gel electrophoresis. RNA was also extracted and cDNA was produced from it. This cDNA was used in TA cloning. Competent cells with the cloned segments were screened for antibiotic resistance, and DNA from several colonies was extracted and those that were successfully screened using PCR will be sequenced. Cloning these sequences will be valuable for learning more about the synthesis of important medical compounds. Additionally, better understanding the genes behind their production could be valuable both for growers who are concerned with legal restrictions and for those enforcing said legal restrictions.

Biochemical and Molecular Characterization of Soil Bacteria Collected from Five States (Poster Table 12)

Presenting Student: Bisrat Demissie
Faculty Mentor: Dr. Kumudini Munasinghe

Soil Microbial communities are important for regulating soil ecosystems such as the nutrient cycles, and organic matter decomposition of living materials. There is a very little information available for the complexity of soil microbial communities. Conducting a comparative study will provide adequate knowledge about the variation of soil microbial communities in the soil. The main objective of the research is to identify bacteria from soil collected from five states and characterize them using biochemical and molecular techniques to understand bacterial diversity in soil samples. The soil homogenates were prepared by collecting 20 soil samples from every site of five states such as Maryland, Philadelphia, New Mexico, Arizona, and Kansas. The soil samples were stored at 4°C and analyzed in the microbiology lab at Frostburg State University Maryland. Element composition of the soils were measured using the XRF and biochemical reactions such as MacConkey, EMB, Starch, Fermentation, and Nitrate tests were conducted to identify bacteria using their enzyme secretions. Molecular characterization was conducted extracting bacterial DNA using Qiagen DNA extracting kits. The extracted DNA was amplified using the PCR, and purified DNA was tested using the DNA

finger printing and the nanodrop. NICB-Blast tool and Metagenomics will be performed to compare bacterial communities in the soils collected from each state.

Cloning ospA of Borrelia Burgdorferi for Plant Expression (Poster Table 7)

Presenting Student: Quinton Browne
Faculty Mentors: Dr. David Puthoff, Dr. Rebekah Taylor

Borrelia burgdorferi (Lyme disease) is a vector-borne disease that is both very common in the Mid-Atlantic region and which causes long term negative health effects. It is primarily spread to humans by deer ticks. Because one of the main ways that it is passed between ticks is by previously infected mouse blood, our goal is to reduce transmissibility to mice. This is being done by designing an oral vaccine which decreases infection rates in mice by inserting outer surface protein A (ospA) of *B. burgdorferi* into a plant vector: pCambia 1201. *Agrobacterium tumefaciens* was used as a means of introducing the vector (bearing *B. burgdorferi* ospA) into *Arabidopsis thaliana*. The pCambia vector was introduced into *A. tumefaciens* competent cells after being purified from *E. coli* colonies which had undergone a similar transformation process, as *E. coli* is more suitable for cloning. The successfully electroporated *A. tumefaciens* was then plated and colonies were picked and grown as liquid cultures. Liquid cultures transformed with either the ospA bearing pCambia or a control pCambia were used for floral dip of *A. thaliana*. These dipped plants' seeds have been tested for successful transformation, and one plant has been found to contain the sequence for ospA. Continued floral dips are being undertaken, and more plants are being tested to increase the number of transgene positive plants, and to develop a proper control for testing efficacy as a vaccine. Any additional seeds of positive plants will be planted and crossed to ensure use of only plants which express pCambia in later testing, and to that the process has been successful.

Cloning, Sequencing, and Assessing the Gene Expression of Different Strains of Cannabis sativa L (Oral Presentation)

Presenting Student: Nicole Felton
Faculty Mentor: Dr. David Puthoff

Cannabis sativa L is an herbaceous species that originated from Central Asia and has been used for medicinal and textile purposes for centuries. Hemp has a total THC concentration less than 0.3%. Hemp is often used for industrial purposes, for example, being made into rope, paper, and cloth. It is often made into oil for shampoo and body lotion. Hemp is often mixed into animal foods, and anxiety treatments. Two genes involved in synthesizing CBD and THC, cannabidiolic acid (CBDa) synthase and tetrahydrocannabinolic acid (THCa) synthase were chosen for study. Background research from 10 peer-reviewed papers was used as a base for our experimental design. We identified the gene sequence for each, which was around 1,000 nucleotides long. We used that gene sequence and NCBI to design primers (forward and reverse), which were ordered. CBDa synthase had 2 sets of primers, while THCa synthase only had 1 set of primers. We acquired 4 strains of hemp which were: Grower's Choice, Trump1, Lindorea, and Cherry #5. We completed DNA purification of

100 mg of dried flower tissue and used the nanodrop to measure the overall concentration of DNA in nanograms/microliter. Next, we completed PCR using the AccuPower Hotstart PCR Premix using the 3 sets of primers, and DNA from the 4 strains. Gel electrophoresis was used to assess the results of PCR. The PCR products were purified, and the overall concentration of 2 different strains (Grower's Choice and Trump1) with the 2 different primers (CBDa and THCa) were quantified. Clones were then produced for 2 genes using TA-cloning. In addition, RNA was purified, quantified for each strain, and cDNA synthesis was performed. Gel electrophoresis was completed for the cDNA and visualized. Lastly, we set up the reactions for real-time PCR in advance to prepare for gene expression analysis. The next steps of this experiment are to sequence the PCR products, analyze the sequence, and then generate/analyze the expression data.

Development of Growth Models for *Burkholderia cepacia* and *Burkholderia cenocepatia* Using Broth Cultures (Poster Table 12)

Presenting Students: Jacob Wilson, Jesudunsin Dawodu
Faculty Mentor: Dr. Kumudini Munasinghe

Burkholderia cepacia complex (BCC) was tied to various FDA drug recalls over the past few years. These bacteria can depend on a broad range of molecules and were isolated from sterilized and non-sterilized products such as baby lotions, nasal spray, curl defining styler, purified water, washcloths, baby wipes, oral electrolyte, anesthetic hydro jell, and Chlorohexidine oral mouth wash. *Burkholderia cenocepacia* is one of the most clinically important members of the BCC. These bacteria are opportunistic pathogens in patients who are immunocompromised and have respiratory tract infections such as Cystic fibrosis. The main research question is how to make a growth model for *Bukholderia* to calculate their faster generation time. *Burkholderia* broth cultures will be used for the time study to get data to calculate their generation time and develop primary and secondary models in the microbiology lab at Frostburg State University, Maryland. The results obtained from this study will be useful in finding bacterial log phase, lag phase, stationary phase, and the death phase to make decisions in the health field.

Evaluating Carnivore Behavioral Response to Lure Type Using Camera Traps (Poster Table 11)

Presenting Students: John Falker, Tanner Donaldson
Faculty Mentor: Dr. Thomas Lambert

Rare and elusive species, such as many carnivores, can present a challenge to wildlife managers who need accurate population estimates. Camera traps are a frequently used method for surveying these species. Baits or attractant are often used to increase the number of captures however little attention has been focused on how effective various bait types are or how these lures impact the behavior of species. Mammals rely heavily on olfactory and auditory senses, while vision is generally secondary.. In this study, we monitored mammalian predator activity at baited sites to compare behavioral responses and detection frequencies between a visual and olfactory bait reward (chicken

breast) and a largely olfactory scent lure (concentrated skunk essence). Detection rates between species varied, as did behavioral responses, but overall, it was observed that the chicken-baited sites were visited more frequently and for longer durations than were the skunk-lure sites.

Exploring Advanced Microscopy at FSU (Poster Table 7)

Presenting Student: Joshua Clem
Faculty Mentor: Dr. Rebekah Taylor

Advanced Microscopy (BIOL 456) is a unique course for Frostburg State University (FSU) undergraduate science students. BIOL 456 is a four-credit course divided into a lecture and laboratory section. The lecture component offers an in-depth analysis of the instrumentation, sample preparation, physical science, and theory of advanced microscopy. The laboratory component provides a comprehensive experience using digital microscopy software, conventional and modified light microscopy, fluorescence microscopy, immunostaining, and scanning electron microscopy in a state-of-the-art suite. Students are expected to gather extensive experience in these techniques while exploring their own curiosities for microscopy. The course offers opportunities to submit original work to competitions and present images at academic gatherings. This work exhibits a collection of images taken using numerous microscopy techniques during the Spring of 2022 semester in BIOL 456.

Exploring Advanced Microscopy Techniques (Poster Table 6)

Presenting Student: Rylee Johnson
Faculty Mentor: Dr. Rebekah Taylor

Microscopy allows scientists to view specimens that were once not visible to the naked eye. With the help of microscopes and other optical technology, we can see beyond our visible limitations and into cells, organelles, bacterium, amoebas, parasites, and much more. The field of microscopy includes a variety of different instruments and specific techniques. The differences between the microscopes, allow the instruments to be more suitable for specific samples. Therefore, scientists can achieve the ideal magnification and resolution of their specimen. This presentation contains a few examples of the advanced microscopy techniques that are used for diagnostics, observations, and field work.

Impacts of Clostridium Botulinum on Intestinal Parasite Communities of Seabirds (Poster Table 11)

Presenting Students: Zach Barnard, Gavin Studds
Faculty Mentor: Dr. Kate Sheehan

Trophically-transmitted parasites often induce sublethal effects in their definitive hosts, with some taxa establishing populations that are long-lived yet cause minimal damage. Consequently,

definitive hosts like seabirds can accumulate high diversities of parasites, which reflect the intermediate hosts species that they consume. This can be help us understand the degree to which marine systems are changing – as human-induced structural changes of food webs appear to be one of many factors that is driving declines in seabird populations. Furthermore, now more than ever, there are numerous reports of disease outbreaks in seabird colonies. The causative agents of disease that facilitates seabird die-offs vary from system to system (and regionally); however, moribund birds that are undergoing an immune challenge could be likely to have more pathogenic parasite infections. What is more, diseased seabirds could change their foraging behaviors and the types of parasites that they acquire in the process. Here, we compare the parasite communities of two seabird's species: Black-legged Kittiwakes and Glaucus-winged Gull – some expected to have typical parasites diversity, i.e., 'healthy' birds, and others that we expected to have altered parasite diversity as their foraging changed due to Avian Botulism. The 'diseased' birds from this second group succumbed during die-off event in summer 2021 on Middleton Island, Alaska. We found parasite abundance and diversity (species richness and Shannon-Weiner) increased in pelagic-foraging Black-legged Kittiwakes but parasite abundance and richness were no different between healthy and diseased Glaucus-winged Gulls that feed in many marine habitats. We also discuss parasitic infections that could have contributed to the die-off as damaged tissues from the bacterial infection and its toxins were more susceptible to secondary infection. Our findings suggest that moribund birds could be limiting their energy expended on pelagic foraging by also feeding in coastal and freshwater habitats closer to their breeding colonies.

Method Comparison of DNA & RNA Extraction from Hemp Flower Varieties (Poster Table 6)

Presenting Student: Abigail Hunker
Faculty Mentor: Dr. David Puthoff

The extraction of high-quality DNA and RNA from medicinal plants similar to *Cannabis sativa* is difficult not only due to differences in varieties, but the presence of large quantities of secondary metabolites, polysaccharides, and proteins such as tannins and polyphenols (Shahzadi et al. 2010). As researchers fill the gap of knowledge on *C. sativa*, it is essential to understand the most effective methods, in terms of quantity and quality, of extracting nucleic acids for genetic analysis. The aim of this research was to compare three extractions methods each for DNA and RNA, and to determine which provides the highest quantity of nucleic acids from *C. sativa*. The Qiagen DNeasy Plant Mini Kit, PureLink® Plant Total DNA Purification Kit, and a modified CTAB protocol derived from previous plant research (Abdel-Latif et al. 2017) were implemented for DNA extractions. RNA extraction methods were based around three commercial kits: BioWorld Phenol-Free Plant RNA Isolation Kit, Thermo Scientific GeneJET Plant RNA Purification Mini Kit, and Qiagen RNeasy Plant Mini Kit (using either the RLT or RLC buffer). The most effective extraction for DNA and RNA were the modified CTAB protocol and the Qiagen RNeasy Plant Mini Kit with the RLT buffer, respectively.

Molecular Characterization of Endomycorrhiza spp. to Formulate Biofertilizer with Nitrogen-fixing Bacteria (Poster Table 12)

Presenting Student: Matthew Ward
Contributing Student: Jesudunsin Dawodu
Faculty Mentor: Dr. Kumudini Munasinghe

The microorganisms within the soil hold an important role in the global cycling of elements and the nutrient content that is available to support the ecosystems. Biological fertility of soil is a highly complex and dynamic component of soil fertility and is least well-understood component of soil fertility, as well. To improve the crop production, mainly nitrogen containing chemical fertilizers have been used to increase the yield. The problem with using these chemical fertilizers is that they contaminate the groundwater, and most dangerously they are related to health issues we have. The research question is what combination of mycorrhizae fungi, which can increase the plant absorption of elements from the soil, and bacteria such as C*yanobacteria, Azospirillum*, and *Rhizobium* in a biofertilizer is more effective in terms of the quality and quantity of the crop yields. Mycorrhizae fungi was extracted and identified from three different mycorrhizae products that were used to grow three replicates with over 50 corn seeds per pot for 28 days and 3 months in the green house at Frostburg State University, Maryland. Then, the fungal DNA was extracted and analyzed in the microbiology lab. Once the time was reached, soil and the roots of the plants were used to extract mycorrhizae fungi. The extraction of DNA of the fungi was performed using earth microbiome ITS Illumina sequencing protocol. Fungal DNA was extracted using the Qiagen soil extraction kit with a 15,000g centrifuge at 4°C. Amplification of the DNA was performed using PCR with the nucleotide oligoes such as ITS1-F forward primer and kabir_ITS2rcbc barcode primers for the fungi. The extracted DNA samples from the fungi will be sent to Genwiz next generation gene sequencing lab to identify fungi with the performance of DNA purification, analyzing results of the Nanodrop, and Gel Electrophoresis. In addition, the spore count will also be collected for each product to find how much mycorrhizae that was cultured in the soil could inoculate plant roots. After the molecular characterization of the fungi, they will be incorporated into cultured and freeze-dried C*yanobacteria, Azospirillum*, and *Rhizobium* in the lab in different quantities and use these mixtures to grow corn seeds to determine which combination of the newly made biofertilizer will give the highest yield of corn. In addition, nitrogen content of the product will be measured using a nitrate electrode for further studies to increase the nitrogen fixation levels by changing the compositions of the bacteria and fungi in the soil.

Molecular Characterization of Fungi in the Soils to Understand Relationship between Plants and Fungal Communities (Poster Table 12)

Presenting Student: Andry Cantarero
Faculty Mentor: Dr. Kumudini Munasinghe

Fungi play a critical role in soil health, and they regulate the balance of carbon and nutrients as they have ability to break down organic molecules. There are vast counts of soil fungi in a single gram of

soil, and it is important to understand fungal diversity which is essential for human health as well as agricultural production. The research question is that how diverse the fungi communities in the soil collected from 5 states including Western Maryland. Twenty soil homogenates per each site were transported to the microbiology lab at Frostburg State University and stored soil samples at 4°C. Fungal DNA was extracted using the Qiagen soil extraction kit with a 15,000g centrifuge at 4°C. Amplification of the DNA was performed using PCR with the nucleotide oligoes such as ITS1-F forward primer and kabir_ITS2rcbc barcode primers. The extracted DNA samples from the fungi will be sent to Genwiz next generation gene sequencing lab to identify fungi with the performance of the Nanodrop, and Gel Electrophoresis results. The results obtain from this research will be used to find the relationship between plants and fungal communities and beneficial for the soil conservation projects.

Prevalence of Lyme Disease in Black-legged Deer Ticks in the Western Maryland Region (Poster Table 7)

Presenting Students: Megan Coe, Katy Garcia
Faculty Mentor: Dr. Rebekah Taylor

Lyme disease in the Western Maryland region is a serious issue with citizens and their pets. Using biotechnology techniques, *Ixodes scapularis* (black legged deer ticks) were identified and tested for *Borrelia burgdorferi,* the bacterium responsible for Lyme disease. DNA was extracted from each of the ticks and polymerase chain reaction (PCR) was used to amplify the ospA gene of the pathogen. Through gel electrophoresis, the ospA gene's presence was visualized, which determined whether each tick was positive or negative. A positive result indicated that a black-legged deer tick is a carrier of Lyme disease. All the ticks that were tested were collected by local citizens and sent to FSU upon their discovery. Citizen scientists provided the date that the tick was found and its approximate location. The data collected in this study provides a generalized idea of where Lyme disease is more prevalent in the Western Maryland region and surrounding areas.

Scientific Illustrations and the Benefit of Using a Variety of Mediums to Depict Different Species (Poster Table 11)

Presenting Student: Rena Klapp
Faculty Mentor: Clara Thiel, M.S.

Acorns are a trusted method of identifying oak trees, with size, texture, color, and cap shape defining the unique species an acorn belongs to. While photographs of acorns can be useful for learning to distinguish between species, scientific illustrations have the advantage of enhancing key features for identification. Because of this, choosing the ideal medium to depict the subject is vital for the success of an illustration. Here I tested the difference in mediums when used for creating scientific illustrations of acorns. Ten species of acorns were illustrated using five different mediums, pencil, ink, charcoal, pastel, and oil paint, then compared with a focus on how each medium enhanced different characteristics. Both pastels and oil paints add color to an illustration, but other aspects

such as texture must be considered when choosing which one to use for a specific subject, and the same is true of pencils and ink. However, the effect of charcoal will vary depending on the technique used. Therefore, when beginning a scientific illustration, the illustrator must also consider the techniques they will use in addition to the natural traits inherent in each medium to draw attention to the unique features of the subject.

Techniques of Advanced Microscopy (Poster Table 6)

Presenting Student: Kiana Matos
Faculty Mentor: Dr. Rebekah Taylor

Microscopy is an adventure into the unseen world around us. The duration of the spring 2022 semester at Frostburg State University was spent expanding on basic microscopy techniques that allowed for a closer look into what is all around. This expansion of knowledge went further than the basic brightfield microscopy techniques and delved into darkfield microscopy, fluorescence microscopy, polarized light microscopy, and a few other advanced microscopy techniques. While exploring these advanced microscopy techniques images were taken and a portfolio was made to demonstrate the technical skill set develop over the course of the semester.

CHEMISTRY DEPARTMENT

Analysis of Carbohydrate Content in Different Food Samples (Poster Table 2)

Presenting Students: Ismerai Reyes, Megan Coe
Faculty Mentor: Dr. Holly Currie

Accurate carbohydrate labeling for food and drinks is important for the health of people with certain health conditions such as diabetes. Under current guidelines, nutritional labels are allowed to have a margin of error as high as 20%. The aim of this research is to assess the accuracy of the carbohydrate amounts provided on the nutritional labels of various foods and drinks as well as the variation in carbohydrate content. The phenol-sulfuric acid method and absorbance spectroscopy were used to quantify the amount of carbohydrate in each beverage and comparisons between the experimental result and the food label were made.

Characterization and Quantification of the Polyphenols Found in Differing Teas (Poster Table 2)

Presenting Student: Maxwell Sykes
Faculty Mentor: Dr. Matthew Crawford

Aside from water, tea is the most widely consumed beverage in the world and has long been associated with health and vitality in many cultures. The secondary metabolites found within various plants(generally responsible for the defense against pathogens and UV radiation), known as polyphenols, have been postulated to possess various nutraceutical benefits and are believed to be the driving force behind the potential health benefits from teas; this is primarily in correlation to the antioxidant capabilities of polyphenols. The research herein focuses on the characterization and quantification of these polyphenols, extracted from differing tea varieties, by employing mass spectrometry and gas chromatography. The approach of this project is to use a gallic acid standard curve, coupled with a Folin-Ciocalteu assay, to gather absorbance data and a qualitative indicator for the presence of polyphenols within the tea-extract samples. Further characterization of these secondary metabolites will also aid in future research – allowing for antioxidant activity (as it relates to the different tea samples) to be quantified using a 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging capacity (DRSC) assay. The overall results of this study will hopefully illuminate beneficial aspects to the storage and utilization of the polyphenols found within plants, potentially leading to further, in-depth studies regarding their nutraceutical benefits.

Triticain-α: An Enzymatic Approach to Managing Celiac Disease (Poster Table 2)

Presenting Student: Joshua Clem
Faculty Mentors: Dr. Holly Currie, Dr. David Puthoff

Celiac Disease (CD) is an autoimmune disorder characterized by the inability to digest gluten proteins in genetically susceptible individuals, resulting in chronic inflammation of the small intestine and mucosal damage. Genetic determinants of the condition are the presence of human leukocyte antigen (HLA) DQ2 and HLA-DQ8 encoding genes. The global prevalence of CD is around 1%. Currently, the only known treatment for CD is a gluten-free diet. Triticain-α is a wheat cysteine protease demonstrated in prior research to elicit glutenase activities in the immunodominant 33-mer α-gliadin-derived peptide in conditions simulating the gastric environment of the stomach. In this work, RNA was isolated from germinating Triticum aestivum, cDNA was polymerized, and the Triticain-α coding sequence was amplified with polymerase chain reaction (PCR). The obtained coding sequence was inserted into the expression plasmid aLICator Ligation Independent Cloning and Expression System. Triticain-α was expressed by isopropyl β-d-1-thiogalactopyranoside (IPTG) induction of the lac operon promoter in E. coli (BL2-DE3). Further analysis of enzymatic potentiality of Triticain-α will include immobilized metal affinity chromatography protein purification and incubation of the protein with gluten in gastric conditions. Gluten hydrolysis products will be identified to confirm glutenase activities of
Triticain-α.

Wittig Reactions of Aldehydes in the Teaching Laboratory (Poster Table 2)

Presenting Students: Jacob Stocker, Nathan Brown
Faculty Mentor: Dr. Jerald Simon

Wittig Reactions are an essential part of the organic course. Witting reactions are valuable in synthesis and provide multiple pathways for further reactions due to the production of alkenes and ketones. 4-Nitrobenzaldehyde, 4-Hydroxybenzaldehyde, Anisaldehyde, Cinnamaldehyde, benzaldehyde, and 3-benzyloxybenzaldehyde are the six aldehydes that are going to be utilized. These will be used to produce a substituent change where the aldehyde is. Addition alkenes will be placed on the structure. This alkene will be able to readily react with other compounds. Gas Chromatography and the IR spectrum will be used to view the products that are made. The aldehyde should not be visible in the product and the newly formed alkene should be displayed. Refluxing during the experiment allows for the solvent to heat without boiling off. This is needed for the reaction to accomplish turning the aldehyde into the ketone or alkene. The solution will also be washed and rinsed by ethyl acetate and various compounds utilizing a separatory funnel. Excess water and aldehyde will be removed allowing for only the alkenes to be present. Rotary evaporation will evaporate any solvent leftover as well. A high-yield synthesis can display the witting reaction's simple experimental procedure and can show how beneficial it could be in the teaching laboratory.

COMMUNICATION DEPARTMENT

How Colleges Impact Students' Mental Health (Oral Presentation)

Presenting Student: Trinity Williams
Faculty and Staff Mentors: Dr. Elesha Ruminski, Dr. Susan Mandell

Mental health has a big effect on college students. This presentation will explore what colleges do to help students who are going through mental health crises and how students can practice self-care to prevent crisis and help if they are in a mental health crisis. I will also present on how the CAPS office at FSU works and what they do to help students. Through research and interviews the audience will learn what FSU's CAPS offers as well as what students can do to practice self-care while being in college.

Relational Problems with A.D.H.D. (Oral Presentation)

Presenting Student: Jabari Riley
Faculty and Staff Mentors: Dr. Elesha Ruminski, Ms. Latisha Cooper

This presentation will focus on how to better understand mental illness and how complications with the symptoms of a specific mental illness affects relationships, specifically, the symptoms that come along with the mental illness ADHD. With symptoms such as impulsivity, the inability to sit still, and difficulties paying attention and focusing, how do these symptoms play a role in complicating and straining romantic relationships?

The Effects of Prolonged Power Outages and How Microgrids Improve Resilience (Oral Presentation)

Presenting Student: Michael Hollingsworth
Faculty and Staff Mentors: Dr. Elesha Ruminski, Mr. Timothy Magrath, Mr. Scott Sklar, Mr. Al Delia

This research project will analyze the effects of 3 prolonged regional power outages and identify trends in what is being done to improve resilience in these areas. The first outage this project will analyze took place in Texas following the 2021 Texas Winter Storm. The second outage took place in Louisiana as a result of Hurricane Ida. The third outage took place in Puerto Rico following Hurricane Maria. This project will discuss the causes and effects of the outages and what these regions are doing to improve electrical resilience. A common theme is the use of microgrids to improve resilience at the local level so that when there is a regional outage, critical services can still operate. This project will discuss microgrid costs and benefits with the ongoing Frostburg State University microgrid project as a case study.

COMPUTER SCIENCE AND INFORMATION TECHNOLOGIES DEPARTMENT

Augmented Reality Game for Mobile Devices (Poster Table 5)

Presenting Student: Andrew Sneeringer
Faculty Mentor: Dr. Xunyu Pan

Augmented reality (AR) technology has been used for game development recently, though it is usually only an optional feature for gameplay enhancement and player immersion by utilizing the three-dimensional space surrounding the player. The goal of the project is to employ AR technology as a core element of the game design and have it impact a vital aspect of gameplay. The gaming system is developed on open-source Unity software platform to create a functional AR experience. The game functions on a two-dimensional field and tasks the player with either avoiding or destroying groups of objects that are approaching from the right side of the screen. This is a style of game that has existed for decades but so far has not been combined with AR technology. The project serves as a prototype design and is meant to be accessible for users of all skill levels. The AR experience comes through the use of cameras built into mobile devices as a way of capturing live digital video and displaying it as the background layer behind the moving game objects. The design provides the illusion that the game is part of the real world. In this case, the game requires the user to point the device's camera towards the sky and display the sky in real-time. This acts as a way of simulating that the game objects, which are predominantly aircraft, are flying in the real world. The proposed gaming system has the limitation that the user is only allowed to engage with the gameplay for short interactions, lasting no more than half a minute per game level.

ENGLISH AND FOREIGN LANGUAGES AND LITERATURE DEPARTMENT

Dyslexia, ADHD, and the Damage Teachers Can Do (Oral Presentation)

Presenting Student: Juliana Schmitt
Faculty Mentor: Dr. Amy Branam Armiento

In my essay, I talk about the struggles of going through the education system with disorders such as ADHD and dyslexia. I outline the discouragement of my teachers, the motivation of my parents, and the joy I found in using books and poems to cope.

Effect of Eutrophication on the Biodiversity of Benthic Macroinvertebrates (Poster Table 3)

Presenting Students: Keely Hanes, Cody Rowden, Jason Bryant
Contributing Student: Chandler Nelson
Faculty Mentor: Dr. Molly Hartzog

Eutrophication is a common phenomenon that can often be observed in both coastal and local bodies of water, as well as at large and small scales. Ecosystems are directly affected as a result of the increase in the richness of nutrients such as nitrogen and phosphorus. In this study, water samples were collected from Sand Spring Run located at Frostburg State University in Western Maryland and tested for the presence of nitrogen and phosphorus. Benthic macroinvertebrates were collected from the same sample sites using a d-frame net. The macroinvertebrate sample data were analyzed for the richness of species and this data was cross-referenced with pollution data taking into account severity as well as the Shannon Index in order to examine how each type of pollutant affects the biodiversity of benthic macroinvertebrates. Higher levels of eutrophication resulted in higher levels of biodiversity since data collection is occurring in the spring. The stream is flourishing with algal blooms, but once other underwater vegetation is depleted of oxygen and sunlight, the biodiversity severely decreases.

How Different Beliefs Can Guarantee a Failing Marriage (Gender and the U.S. Short Story, 2) (Oral Presentation)

Presenting Student: Peyton Carroll
Faculty Mentor: Dr. Amy Branam Armiento

This paper explores the marriage between Aylmer and Georgiana in Nathaniel Hawthorne's "The Birthmark." The marriage between Aylmer and Georgiana is set to fail because of the disconnection of their beliefs: science and romance, respectively. Aylmer's belief in science develops an ambitious, overachieving personality that isolates himself from the world and his wife. Georgiana's belief in romance centers around her love for Aylmer and his scientific discoveries, which is enough for her

to remove her birthmark. These beliefs foreshadow the failing marriage, represented through the flower imagery and Aylmer's dream. The paper concludes that the failing marriage is a lesson learned about how much differences can create a gap that, often metaphorically but literally in this text, leads to the death of someone or something. "The Birthmark" by Nathaniel Hawthorne explores the tensions between science, nature, beauty, and reality through its flat characters.

How Has the Pandemic Affected the Frostburg Communities' Perspective on Health? (Poster Table 3)

Presenting Students: Janell Armstrong, Jasmine White, Dharnel Valcin
Contributing Student: Akyian Loney
Faculty Mentor: Dr. Molly Hartzog

The COVID-19 pandemic has heavily impacted everyone's lives and there are multiple sources of literature that used survey data to support this claim, for example, a few sources focused on the growing levels of stress and concerns about the pandemic, the negative effects impacting college students, the mistrust in the vaccine resulting in low vaccination rates, and debates on whether schools should return to in-person classes. We surveyed staff and students at Frostburg State University with Likert scale questions about how often students wear masks when not required and how safe they felt about others having the option to not wear masks. Our data can help inform the school officials such as the University President and SGA (Student Government Association) about how students feel so officials will have an idea of what could be improved to make students and staff feel safer on campus.

How to Learn a New Language (Oral Presentation)

Presenting Student: King Awenate Khama
Faculty Mentor: Dr. Amy Branam Armiento

Growing up in a multilingual country it was expected that you spoke English and a local dialect proficiently. My mother had a strict no English spoken at home rule in order to get my cousins and I to speak our native dialect well. I discuss some of the methods used to try to get us to learn the language and its effects on how we learnt the language.

Living in the Ideal: The Fluidity of Gender and Hollowness of Patriotism (Gender and the U.S. Short Story, 3) (Oral Presentation)

Presenting Student: Ian Wroblewski
Faculty Mentor: Dr. Amy Branam Armiento

My paper covers the portrayal of gender roles and patriotism in William Dean Howell's brilliant short story, "Editha", and how both those aspects make the story relevant in the modern era. One of the points I make is how "Editha" has commentary on gender roles that is still extremely relevant today

because of how the story captures the fluidity of gender in modern society. I write about the title character's masculine side, specifically her "glorification of violence" and her feminine side, focusing on her conforming to the male gaze. I then take a look at how these ideas are present at the same time, especially when Editha threatens to leave George. My essay then shifts to a more political commentary, where I focus on "its views on patriotism and how hollow it can be." I compare Editha's political mindset to that of a Trump supporter, focus on how "patriotism is really a mask for personal power" and finish off by discussing how "a patriotic mask begins to rot once those who have worn it are negatively affected by it." The above points lead to the conclusion that ""Editha" shows that fluid gender roles and a weakened patriotism are not new or trendy ideas, rather, a query that has been deep in humans for centuries."

Nicotine and Subjective Sleep Quality in FSU Students (Poster Table 3)

Presenting Students: Kathryn Kemp, Katlin Salcutan
Faculty Mentor: Dr. Molly Hartzog

Vaping has quickly become the predominate way young adults consume nicotine. With its ease of use, it is seemingly a "low risk" activity to the average college student. Its uptick in popularity and cultural acceptance raises questions about its impact on overall health, but specifically how it affects day to day functioning. Quality of sleep is an immediate side effect that would be of interest to the vaping, college student population. Our study examined the relationship of student nicotine use and their subjective sleep patterns, among a pool of Frostburg State Students. In order to collect our data, we created a survey, for both non-nicotine users and nicotine users alike allowing us to compare data from the two groups. The survey contained questions related to sleep quality; to establish a connection, or lack thereof, between the consumption of nicotine and its effect on sleep in Frostburg Students. We surveyed a total of 80 students to make our data statistically significant. In our results, we found that Frostburg students that partook in vaping, on average, had worse subject sleep than those students who did not vape.

Pansye Atkinson: Who Was She? And How Did She Do It? (Poster Table 13)

Presenting Student: William O'Boyle
Faculty Mentor: Dr. Amy Branam Armiento

Pansye Atkinson was a role model and individual of great leadership and devotion to the well-being and treatment of students at Frostburg State University. Earning her Master of Education degree at FSU, she taught music in various schools in the country before returning to campus in 1969 as Coordinator of Integration as part of Governor Mandel's executive order to desegregate State colleges in Maryland. She opened many doors to FSU for students regardless of who they were or what they looked like so long as they were ready to learn. She was not afraid to step on toes to get what was needed done and stood for students and their need for education.

Percy Shelley's "Mont Blanc" and the Invocation of Exciting and Disquieting Emotions (Poster Table 13)

Presenting Student: Jake Bowman
Faculty Mentor: Dr. Amy Branam Armiento

Poetry in the late eighteenth and early nineteenth centuries generally conformed to the characteristics of the Romantic movement. Four "keystone" authors of the movement published their opinions on the characteristics of Romantic poetry in their own essays, but all agreed on the main characteristic: to invoke a certain emotion or series of feelings within the reader. William Wordsworth, Samuel Taylor Coleridge, Mary Wollstonecraft, and Edmund Burke stress in their own essays the importance of a poet to engage their reader with strong emotions, and it is this engagement that makes their poems classified as Romantic poetry. Percy Shelley encapsulates the four writers' ideas in his poem "Mont Blanc"; the poem's intense imagery invokes a variety of emotions within the reader.

Regional Cultures and Their Effects on Caregiver Decisions in American Literature (Gender and the U.S. Short Story, 1) (Oral Presentation)

Presenting Student: Jules Buttner
Faculty Mentor: Dr. Amy Branam Armiento

This paper analyzes the misconceptions about "bad caregivers" in American literature written by various authors. In Bret Harte's "The Luck of Roaring Camp," Kentuck risks his life to save baby Luck in the flood and abandons the gold that would have brought them a better life. In Kate Chopin's story "Desiree's Baby," Desiree does not want her, and her child separated or subjected to the unjust Louisiana race laws. Maxine Hong Kingston's "No Name Woman" highlights the potential banishment and harsh life the narrator's aunt would have faced if she kept the child alive in a culture that only supported men. While it can be assumed that the caretakers themselves chose the worst outcome for their child, their actions show more love than keeping the children alive.

Replacing *To Kill a Mockingbird* with a Novel by an African American Writer (Poster Table 13)

Presenting Student: Sara Shroyer
Faculty Mentor: Dr. Amy Branam Armiento

To Kill a Mockingbird is accepted canonical literature used to represent African American suffering in the South. However, Lee's depictions are damaging in that that support stereotypes. Therefore, the book should be replaced in curricula with a novel by a representative author, such as a work by Toni Morrison.

The Effect of Stressors on College Student Mental Health (Poster Table 3)

Presenting Students: Stephen Jones, Theodore Hoxie, Skyler Slimmer, Jaidah Martin
Faculty Mentor: Dr. Molly Hartzog

The mental health of students has become a primary concern at many institutions, and support services (E.g., counseling centers) are available on many campuses to assist students, though commonly they fail to consider all external and internal stressors students cope with, making them inadequate for most students. The purpose of this study was to analyze the various impacts multiple stressors had on college students' mental health. The study conducted examined stressors Frostburg State University's (FSU) students contend with and how they affect their mental health. A survey was emailed across campus to obtain a representative sample of the student population, which contained a fixed set of questions regarding specific college internal and external stressors, and follow-up questions regarding how they influence the respondent's mental health. Stressors from the survey that have a significant impact on FSU students were analyzed for patterns affiliated with certain groups. The significant patterns revealed which specific groups (E.g., student athletes, specific majors, working students, etc...) of students endure the most stress, as well as identify which stressors are most prevalent amongst the student population, and this could help guide the development and distribution of college support services. We found that most students were taking at least 12 credits and the majority of surveyed students reported struggling with their mental health (57.14%), and the main causes were stress stemming from the COVID-19 pandemic, academics, and job-related stress. Students also felt that FSU would not implement necessary support services until "something serious" happens, this emphasizes the importance of proactive measures taken by colleges to ensure that the students struggling with mental health issues receive help.

The Effects of Invasive Species on Native Riparian Communities (Poster Table 8)

Presenting Students: Trinity Jordan, Aaron Graham, Curtis Yourishin
Faculty Mentor: Dr. Molly Hartzog

Japanese Knotweed (*Reynoutria japonica*), the Multiflora Rose (*Rosa multiflora*), and the Japanese Barberry (*Berberis thunbergii de Candolle*) are mostly used in landscaping, but invasive species when introduced to the wild, causing massive effects to the native riparian plant communities. This study focuses on the Japanese Knotweed, Multiflora Rose and Japanese Barberry and how they affect the native riparian plant communities in the Arboretum riparian corridor that runs along the Sand Spring Run in Frostburg, Maryland. Twenty different one by one meter plots, each five m. apart from one another were surveyed. Any of the invasive species found in these plots were marked and estimated for each individual species. Upon surveying invasives were found to dominate 80% of the sites, with native species dominating the remaining 20%.The invasive species found on the site were species that grow to shrub height such as the Japanese Knotweed, which could explain their dominance as they have crowded out the understory not allowing native species the light they need

to grow. This data could be used to establish an eradication and management plan for the reclamation of this riparian corridor.

The Effects of Salt Runoff on the Biodiversity of Freshwater Organisms in Sand Spring Run (Poster Table 8)

Presenting Students: Sabrina Morgan, Nathan Bowman, Jarrett McKenzie
Faculty Mentor: Dr. Molly Hartzog

The use of road salt is necessary to protect human life during the winter months, but how much does it affect non-human life? Salt runoff into freshwater rivers and streams can negatively affect the copious amount of life found living in them. This changes the water quality of these areas and has a great number of impacts to the organisms within, not only reducing the numbers of species but also harming them if they survive. These problems do not only harm individual organisms but also impacts their entire food chain. So how does salt runoff effect the biodiversity of freshwater organisms in Sand Spring Run, a freshwater stream that runs near Frostburg State University? To answer this question, we will go out to two sections of Sand Spring Run, one near a road where salt would run into it, downstream from FSU, and one far enough from a road that it would be less affected by salt runoff, in the woods near Lions Park. We will then set fish traps with bait and use nets to attract the fish and catch the macroinvertebrates in each section. Our results will be the number of species and the number of individuals of each species living in each section of the stream. We will compare that species evenness and richness in order to determine which stream had the higher biodiversity level to determine if the salt runoff is negatively affecting it. The problems these freshwater organisms are facing are significant, and with more studies going into it we can further understand how best to solve them and stop it from getting worse, potentially saving many organisms and their entire communities.

The Effects of Smartphones on Productive Study Habits (Poster Table 8)

Presenting Students: Elizabeth Jenkins, Kamara Jeremiah, Sadie Powell
Faculty Mentor: Dr. Molly Hartzog

The increasing appearance of cell phones today has led to a negative impact on the quality of studying among college aged students. Problematic smartphone usage creates a butterfly effect that leads to procrastination and stress. This in turn results in lower academic activities such as studying, completion of assignments, listening during class, etc. So, how does direct phone use impact a student's effective study habits? In this experiment, we sat in a room with Frostburg State students while they studied and observed them for a period of time. We took note of how many times the students became distracted by their phones, and for how long. We also noted if cellphones were being used for the task at hand or if students were simply getting distracted. The students were also given pre/post surveys regarding the study session to help us determine if they met their study goals. The data showed that the less time spent on phones for things outside of studying/homework the more productive the study session was and the more confident the students felt with the

material afterwards. This shows that phones create an unproductive environment when trying to complete school activities such as studying or doing homework.

The Perceived Effects Caffeine Has on Sleep Habits of College Students (Poster Table 8)

Presenting Students: Teiona Hamilton, Laura Knotts, Cheyenne Garrett, Alex Donley
Faculty Mentor: Dr. Molly Hartzog

Caffeine consumption is known to impact sleep and can cause sleep deprivation for the individual who consumes it. However, caffeine is still used to counteract the effects of sleep deprivation. College students will consume more caffeine than most groups due to the stress and lack of sleep they often experience during college. At Frostburg State University, a voluntary survey was given to students, asking questions about their sleep habits and caffeine intake. The survey was conducted at two different locations on campus, where students were asked if they wished to participate. In this survey, we aimed to determine how many college students consume caffeine and their methods and reasons for consumption, so that the perceived effects on their sleep could be analyzed. This study and review were conducted to give a synthesized perspective on caffeine's effects, upon which FSU support materials and programs can be based. Results indicated a correlation between students' caffeine consumption and sleep deprivation, as well as between their caffeine consumption and age.

GEOGRAPHY DEPARTMENT

Hypoxic Zones in the Chesapeake Bay and Sustainability (Poster Table 10)

Presenting Student: Cameron Newrones
Faculty Mentor: Dr. Jennifer Reynolds

The Chesapeake Bay is loved by many in the District of Columbia, Maryland, and Virginia. The entirety of the watershed includes 64,000 square miles incorporating 18 million people across 6 states and the District of Columbia. However, the Chesapeake Bay watershed has experienced large land cover changes due to growing populations and communities. Nitrogen and phosphorous naturally exist as nutrients across the land and in waterways. The issue of excess nitrogen and phosphorous being introduced into the Chesapeake Bay and its watershed is a threat to wildlife and the natural environments in streams, rivers, and the bay. The areas in dire need of implementing sustainable policies span the entirety of the Chesapeake Bay watershed. Agriculture, wastewater treatment plants, urban/suburban runoff, and air pollution all contribute to excess nitrogen and phosphorous in the watershed which can have severe, detrimental effects. Hypoxic zones, or dead zones, are areas in the water which have little to no oxygen. These areas experience large blooms in algae growth which is broken down by bacteria. The process of the algae expansion and bacterial decomposition blocks sunlight from reaching the native grasses and plants in the waterways. Introducing excess nitrogen and phosphorous into the Chesapeake Bay watershed is an issue which deserves more attention to continue to preserve the ecosystems, organisms, and local industries which depend on the Chesapeake Bay. Sustainability and conservation of the Chesapeake Bay and the Chesapeake Bay watershed is crucial. The best time to implement sustainable policies and regulations to protect the Chesapeake Bay is now.

One Tree at a Time: A Brief Examination of Shade Equity in Frostburg, MD (Poster Table 10)

Presenting Student: Andrea James
Faculty Mentor: Dr. Jennifer Reynolds

When examining social inequities, we have historically overlooked trees as critical infrastructure that all people and neighborhoods need and deserve. American Forests demonstrates through their extensive research that all too often maps of tree cover often become a map of income and race. Their tree equity scores show a correlation to a lack of trees in low-income neighborhoods and some neighborhoods of color. These areas with sparse tree cover may be deprived of the health, economic and climate benefits that trees provide. Through ArcGIS Online I examined the Tree Equity Score for Frostburg and Cumberland, MD to see if they did correlate with the lower-income areas and neighborhoods of color. I also examined the areas that are generally dominated by student-housing and discovered that these areas in Frostburg tended to be very sparse vegetation and a lack of trees. I have also highlighted some of the ways that we can remediate and improve the tree equity score for Frostburg, MD.

The Map that Changed the World! (Poster Table 15)

Presenting Students: Logan Carlile, Trevor Frissell, Alexis Pate, Jenna Riley, Sarah Smith, Miranda Teats, Madison Toothman
Faculty Mentor: Dr. Phillip Allen

To know where you are, where you are going, you need to know where you have come from.
Techniques and methodologies that are universally employed in the Earth Sciences are frequently taken for granted by those who apply them. Yet these applications often resulted from a paradigm shift in Earth Science philosophy, which changed underlying assumptions about how the planet is perceived. For example, the Plate Tectonic revolution of the mid 1960's is widely known, yet the success of this concept is built on the foundations of other lesser-known significant developments. One such foundation technique is geologic mapping, which today is routine; however, the appearance of this technique changed the perspective and discipline of Earth Science. Identifying and understanding the emergence, development, and universal acceptance of such a profoundly important technique is a critical element of the history of the Earth Sciences. One way of emphasizing the importance of lesser remembered paradigm shifts is to replicate the original. The first geologic map was published in 1815 by William Smith and was so visually imposing and accurate that the technique was universally copied so rapidly, that the impact of this technique has been diluted and lost to the annuals of history. Reproducing the original map in exact dimensions (2.6mx1.8m or 8.5 ft X 6ft) can provide people today with the experience of physically interacting with such an imposing illustration. This experience generates discussions regarding the legacy effect of the skills and techniques needed to map the Earth, and now other planets. Remembering and reviewing the history of any discipline is essential in truly understanding where it came from, where it is and where it can go. The reproduction of the Smith map will be a conversation piece for future generations of Earth Scientists at FSU.

Using the Past to Guide the Future: Reconstructing the Environmental History of Finzel Swamp from Multi-Proxy Data for Future Management (Poster Table 15)

Presenting Student: Colin Eason
Faculty Mentor: Dr. Phillip Allen

Finzel Swamp located in Western Maryland is situated within a frost pocket and is described as a remnant boreal fen from the Pleistocene Epoch. The lower temperatures create a cold climate refugia resulting in distinct biodiversity, which is being actively managed by the Nature Conservancy. Vegetation reconstructions via palynology have been undertaken in the Appalachians but have not been applied to Finzel Swamp. A multi-proxy approach was employed to reconstruct vegetation histories and develop a chronology to examine changes through time. Five 1 m sediment cores were extracted, and plant macro fossils were used for radiocarbon dating, resulting in a basal date of 10,910 BP. Pollen samples were taken at 5mm intervals from targeted areas of the cores. The vegetation history suggests early dominance by pine and sedges with establishment of a more extensive range of mixed deciduous woodland, including oak, beech, and sweet chestnut from circa

7100 BP, before returning to pine dominance. The vegetation succession of Finzel Swamp has evolved under different climatic conditions, yet the cold air drainage has been tentatively interpreted as a dominant factor for vegetation type, although the role of fen hydrology cannot be diminished and requires further investigation. Yet Finzel swamp serves as a unique lens into the past vegetation history of the central Appalachians, which is critical to understand to allow for sensible planning of landscape resource management in the future.

Wanted Dead or Alive: Mapping the Exploits of the Outlaw Jesse James (Poster Table 10)

Presenting Student: Sean Gizzi
Faculty Mentor: Dr. Jennifer Reynolds

Through the use of ESRI's ArcGIS StoryMaps we take a geospatial dive into the life of America's first celebrity criminal, the outlaw Jesse James. Here we can explore the locations of his criminal exploits which includes 25 heists across 9 states. His story has been dramatized and memorialized in numerous ways. James is often perceived to be part of the lawlessness of the "Wild West" the untamed territories west of the Mississippi River. Upon mapping his robberies and death it is apparent that this was not the geographical area of frontier boomtowns composed of prospectors and pioneers, rather a confederate insurgency that occurred hardly as far west as many envisioned. This StoryMap allows us to interactively explore all these locations.

HISTORY DEPARTMENT

Baltimore as a Title Town (Poster Table 9)

Presenting Students: Thomas Hall, Kyle Harrington
Faculty Mentor: Dr. Eleanor McConnell

The focus of our research is on how the height of the Colts and Orioles in the late 1960s and early 1970s impacted the city of Baltimore and the surrounding area as a title area. This marked the beginning of title towns in sports with the Colts and Orioles playing in five title games in three years, and winning the 1970 World Series and Super Bowl V. These titles would lead to growth and support for the teams. The players, coaches, and managers, like Earl Weaver, Johnny Unitas, Don Shula, and Jim Palmer impacted Baltimore in their own ways. However, there was also television broadcast was changing at the time with added color to the television broadcast and more national coverage. Then the impact the Memorial Stadium had on the city of Baltimore including both Senators teams leaving and the Orioles taking control of the region. All these small stories help shed light on the cultural history of Baltimore.

Believe What You Will (Poster Table 9)

Presenting Student: Ishmael Dorsey-Bey
Faculty Mentor: Dr. Eleanor McConnell

Maryland is a place where there is some very interesting history behind it. And a part of that history includes folklore. Maryland folklore can be traced back to legends brought over by immigrants, haunted places, and even it being associated with Edgar Allen Poe. My project will be about the different folklore in Maryland and try to figure out when the stories first started to circulate. Learning about Maryland folklore is important because it represents the culture of the people and what they believed in. And seeing what the people are like and seeing what they believed I will tell you about the place that they are from and in this case Maryland.

Deep Creek Lake: The Past, The Present, and The Future (Oral Presentation)

Presenting Student: Samuel Beeman
Faculty Mentor: Dr. Eleanor McConnell

Deep Creek Lake in Garrett County Maryland is a magnificent place that contains 65 miles of shoreline, covers 3,900 acres, and contains a state park. But how was this lake developed? How has this manmade lake changed since its completion in 1925? And what is its importance to Maryland? Finding the answers to these questions can help understand this beautiful lake and top vacation spot. This ninety-seven-year-old lake is the home to many types of plants, fish, birds, and other wildlife. With a ski resort in the wintertime and the lake atmosphere and perfect weather in the summer, Deep Creek has become a well-known vacation spot.

Frances Ellen Watkins Harper (Oral Presentation)

Presenting Students: Olivia Cooper, Alexandria Ritte, Kori Striano, Alison Cutter
Faculty Mentor: Dr. Eleanor McConnell

Our project examines the lives of women who were important activists in the women's suffrage movement through the lens of Maryland-born abolitionist Frances Ellen Watkins Harper. Frances Ellen Watkins Harper was a reformer who was instrumental in the women's suffrage movement and the abolitionist movement. Though she did not always live in Maryland, she was born in Maryland and lived the first twenty-six years of her life there. An educated black woman born to free parents in Baltimore, Maryland, Frances Ellen Watkins Harper was a writer, poet, and educator along with fighting for women's rights. In addition to these accomplishments, Frances Ellen Watkins Harper was the first African American woman to publish a short story and she was the co-founder of the National Association of Colored Women's Clubs. She also helped to form the American Women's Suffrage Association with Frederick Douglass. Frances Ellen Watkins Harper's life tells us about the trials of being a free black woman in Maryland during slavery and after slavery was abolished.

Geography of Anne Arundel County (Oral Presentation)

Presenting Student: Amber Mazan
Faculty Mentor: Dr. Eleanor McConnell

The topic which I am submitting for the symposium is the history of Anne Arundel County as well as its historical geography. My research will focus on statistical data regarding issues such as unemployment rate, graduation rate, environmental impacts, and industrial/manufacturing growth abilities within the county. Examining this information will help us understand the foundation and background of many issues plaguing Anne Arundel County, such as unemployment, which is higher than state average. By looking into the background of Anne Arundel County with reference to its geography, we can answer many different questions. For example, this project could place a foundation to deal with specific issues and discuss policies which could help do so. My project discusses funding and encouraging economic growth within Anne Arundel County, as well as targeting specific areas of trending growth including technology and medicine.

How Social and Economic Factors Influenced the Growth of Cumberland (Poster Table 9)

Presenting Students: William Kerns, Jared Owens
Faculty Mentor: Dr. Eleanor McConnell

Within this research project, we aim to answer a question regarding the growth of the city of Cumberland, more specifically: how influences through social and economic means helped the city to grow to Maryland's second largest at one point in time. This project involves delving into the history of the city to its origins as a simple fort along the Potomac through to its apex and slightly

beyond, wherein we shall discuss the diversity seen today. By doing this research, we will be able to ascertain how patterns of growth in western Maryland compare to those near the eastern shore. This will provide information regarding the movement of populations throughout history to areas which, in the modern day, see little in the way of active internal migration when compared to more bustling urban centers.

John Wilkes Booth: The Life of the Maryland Actor (Oral Presentation)

Presenting Students: Aaron Morphew, Noah Cassidy, Robert Bole
Faculty Mentor: Dr. Eleanor McConnell

Many of us know the name, but do many of us know the story behind the name?
Born to a famous, but distraught, family – shaped in his formative years among a growingly divided nation – John Wilkes Booth, The Maryland Actor, handsome, athletic, and renowned throughout the United States, committed his "greatest" performance, shocking the nation, and helping to define reconstruction of a battered country. This presentation analyzes John Wilkes Booth's upbringing, how his childhood in Maryland and early adult years transformed him into a devoted Southern sympathizer and known Lincoln dissident. We look at his actions and beliefs that pushed him to the breaking point. Furthermore, we analyze his fateful night of April 14th, 1865, his plans of escape, his goals and overall hopes, and his demise after one of the largest manhunts in United States history. Lastly, we look upon his legacy, directly or indirectly, in the North and the South. What was the immediate effect? What was the long-term effect on the healing nation? In what ways did Booth transform the future's potential after four long years of bloody battle? We seek to further explain the man in our history books, how he became who he was, his actions, his impact on Maryland, and the future of a changing nation.

Major General Isaac Trimble, Marylander in the Confederate Army (Oral Presentation)

Presenting Student: Taylor Parker
Faculty Mentor: Dr. Eleanor McConnell

I will be doing a project and presentation on Major General Isaac Trimble, arguably the most famous Marylander that fought for the South but also one of the most colorful personalities in the whole war. Trimble was not a Marylander by birth but adopted the state later in his life. He was an important Railway engineer and executive pre-war, helping build the B&O and was an executive on other lines pre-war. In a war where generals were half his age, the 60-year-old Trimble was just if not more energetic than most of his younger peers and was an outstanding Brigade and Division commander. It's going to be fun telling tales about him in general, but Trimble as an individual; that being his own views and why he sided with the Confederacy, add layers to our own understanding of the complexities of the war itself. I'll leave that to be found out later during my presentation. In short, Trimble's tale is worth telling in my opinion, not only because he was probably the third most famous Marylander of the war (behind Booth and Taney), but because he perhaps represents

something about Marylanders themselves as a whole. A true madlad, worthy of a paper and presentation in my opinion.

The History of an Abused Watershed (Poster Table 9)

Presenting Student: Dick Inman
Faculty Mentor: Dr. Eleanor McConnell

The Chesapeake Bay has offered the inhabitants of Maryland much of the resources they've needed to survive and prosper. Before the Europeans the bay was a place like no other, oyster reefs that would cause ships to run aground, water as clear as a bottle of water, even dolphins called this bay home. Then over time it served man and man abused it like an undisciplined stepchild. In my research project I intend to delve into the history of the health of the bay, how conservation efforts heal the bay and businesses efforts to combat conservation efforts, and invasive species. It's a broad topic but it will be refined over time.

The History of the Ulster-Scots People in Maryland (Poster Table 14)

Presenting Student: Noah Cook
Faculty Mentor: Dr. Eleanor McConnell

Maryland has served as central location for waves of immigrants from the European continent ever since its creation in the 17th century. Among the variety of old-world immigrants are the Ulster Scots. Also known as the Scots Irish or Scotch-Irish, the Ulster Scots were a people whose descendants migrated from northern England and the Scottish Lowlands to the Ulster Plantation in what is now Northern Ireland. From there, some traveled to the colony of Maryland in 1649 before major migration began in 1670. As was the fate of many non-Anglo individuals, the Ulster Scots worked as indentured servants on the many tobacco farms located throughout the Chesapeake Bay area. Ulster Scots continued to migrate to the colony and settle past the Potomac and Patuxent Rivers. Indications of Ulster Scots settlement throughout Maryland is seen in the establishment of Presbyterian churches throughout the colony. Decades of migration to Maryland resulted in the Ulster Scots carving out a legacy in the colony and becoming one of the most substantial migrant groups in the colony's history.

The Life of an African American Coal Miner (Poster Table 14)

Presenting Students: Matthew Worgan, Anthony Zeltwanger
Faculty Mentor: Dr. Eleanor McConnell

The topic we are going to cover in this presentation is the life of an African American Coal miner pre-civil, compared to that of the life of an African American coal miner post emancipation. Through research that we have conducted thus far, we have found that there was a clear view between the two eras. Pre-civil war, coal miners' wages were straight, meaning that there were no high or low

wages. However, post-civil war we saw the wages dramatically increase for white coal miners, where in many cases those wages of African Americans were still extremely low. This forced to seek housing wherever they could, and many times would work in the mines injured due to the fact that they could not afford good doctors on the wages they were being supplied. This is similar to what we saw within the pre-civil war era in which African American slaves were forced to work for free in horrendous conditions and often died due to injury. We look forward to presenting both the similarities and the differences between the two distinct Eras. What our goal is to do is to examine the similarities and differences between life of the African-American Coal miner pre-civil war and post-civil war.

Ways that Roger B. Taney's (Maryland Background) Impacted Some of His Most Important Decisions as Fifth Supreme Court Justice of the United States (Poster Table 14)

Presenting Student: Trevor Craig
Faculty Mentor: Dr. Eleanor McConnell

The entirety of this project is to research the life and Maryland background of fifth Supreme Court Justice Roger B. Taney. By drawing upon previous work performed at a young age and within the state of Maryland, I will see if I can determine any strategics, preferences or special abilities that led to his success within the U.S. government. Using Taney's work within the state of Maryland will show the impact that this state had not only on his career, but our nation as a whole.

MATHEMATICS DEPARTMENT

Catalan Numbers (Poster Table 5)

Presenting Student: Ashley Armbruster
Faculty Mentor: Dr. Mark Hughes

The k^{th} Catalan number is 1/(k+1) times the quantity 2k choose k. A definition by Frazer Jarvis says that the k^{th} Catalan number is the number of ways we can multiply k symbols. Since their first unofficial appearance in the 1730s and the deliberate mention in a letter correspondence in 1751, Catalan numbers continue to provide questions for mathematicians and will most likely continue to puzzle those willing to try to understand their numerous interpretations. If you have ever struggled with having the correct amount of parentheses to have balanced parentheses, you have encountered Catalan numbers! We investigate the existence and plethora of combinatorial applications of Catalan numbers.

Representation Theory of the Symmetric Group (Poster Table 5)

Presenting Student: Alexander White
Faculty Mentor: Dr. Mark Hughes

Representation theory is a branch of mathematics which is concerned with how to represent the elements of abstract algebraic structures in the language of linear algebra. The symmetric group is one such algebraic structure. More specifically, we show how the symmetric group S3 consisting of permutations of three objects can be represented by the general linear group GL(2,2), which consists of certain 2 x 2, invertible matrices. These groups can be viewed as giving the symmetries of an equilateral triangle. Likewise, the symmetric group S4 can be represented by the projective general linear group PGL(2,3), in addition to the symmetries of a cube. Furthermore, we describe a convenient way to represent elements of the symmetric groups S3 and S4 through what is called cycle notation. Lastly, we show how the structure of the symmetric group connects to a branch of mathematics called number theory, which studies patterns within the fundamental building blocks of math.

PHYSICS AND ENGINEERING DEPARTMENT

Case Solved (Poster Table 16)

Presenting Students: Michael Ames, Timothy Chan, Nathan Rabenhorst
Contributing Student: Zachary Arnold
Faculty Mentor: Dr. Zhen Liu

Case-Solved will present a higher performing battery casing for electrical vehicle applications. Battery casings are typical made from aluminum, creating a base layer of protection against any damage brought upon a car battery. Case-Solved will create an innovative battery casing made from Kelvar, Carbon Fiber, and Kapton Tape to replace the standard aluminum. The comparison of materials used will be displayed from data found by various tests we will conduct. This change will likely increase the casings puncture resistance, structural integrity, and thermal insulation.

Determining the Thickness of a Medium Using Interference Patterns Produced by Interferometers (Poster Table 19)

Presenting Student: Virginia Aust
Faculty Mentor: Dr. Eric Moore

Interferometry is a useful tool in characterizing various properties of materials. Interference patterns are observed from the path difference introduced by the Mach-Zehnder and shear interferometers. An interferometer is challenging to construct and produce interference patterns, particularly for a Mach-Zehnder interferometer. The methodology is constructing an interferometer using coherent light of wavelength 300 nm is presented. Once constructed, a shear plate collimation tester is inserted in the beam path. Rotating the plate produces patterns of dark and bright fringes that move across a screen. The angle of incidence, the angle of transmission, and the number of fringes that pass by a point on the screen are used to derive a mathematical model used to calculate the thickness of the lens. Coherent light of wavelength 300 nm was used. The methodology in constructing the interferometers, aligning the optics, and collecting the data are presented. Mathematical models were then developed to calculate the thickness. Preliminary results are discussed throughout the project.

Intruder Avert Door Barricade (Poster Table 18)

Presenting Students: Cameron Bohrer, Drew Pedneau, Josh Marsh, Robert Hood, Randall Ganoe
Faculty Mentor: Dr. Jamil Abdo

Purpose
The purpose of our capstone is to design and develop a door locking system that would provide an exponential increase in security to a room and be able to be remotely activated from a remote or from a central system. The product would be used primarily for high risk areas for active shooters.

Schools would be our targeted audience. The system is meant to be much faster than its competitor, Nightlock, due to the remote activation while still having a manual override.

Procedures Used

The engineering design process taught by Dr. Jamil Abdo was followed for this project. We first started out with the conceptual design where we defined our problem and looked at existing products on the market. The next step was to research the market and see what the consumers wanted to be improved. We then came up with different design parameters that allowed us to produce different concepts for the product. Using a Pugh Chart, Decision Matrix, and the Analytic Hierarchy Process, we were able to produce the best design to solve our problem. The next step was the embodiment design. This is where we design the physical arrangement of parts, materials, and manufacturing needs. Next, we produced engineering drawings with tolerances where applicable. Finally, we built a prototype and tested it to produce a proof of concept.

Results

We created an electrical/mechanical locking mechanism for a door. The locking mechanism is activated by an actuator that provides an activation time (time to lock) in approximately 2 seconds, and is activated by a key fob. This electrical/mechanical combination of the lock has made it achieve the same strength and functionality as Nightlock, a benchmarked device, while having a faster activation time. The strength of Intruder Avert will most of the time outperform the mounting hardware and door. Unless it is a solid door, a hollow framed door will most likely fail before Intruder Avert fails.

Conclusion

Overall Intruder Avert provides the security of Nightlock with a faster activation time. This product was put through several different engineering processes to find the best combination of activation time, strength, security, and ease of use for the consumer. This product was designed with safety in mind and includes a manual override where the product can be used even if power is lost to the device and provides higher security as the door will fail before Intruder Avert fails.

Laptop Cooling Pad (Poster Table 17)

Presenting Students: James Mills, Brady Shaffer, David Lewis, Koloina Rakotomalala, Luke Russell
Faculty Mentor: Dr. Jamil Abdo

During Spring 2022, our team focused on a laptop cooling pad. We found out that a high percentage of gamers in Maryland are experiencing overheating laptops after using them for a longer period. Laptop cooling pads are already available in the current market, but the most significant problem seen is a subpar cooling ability coupled with weak frames causing the pads to break easily and not perform the required function of cooling the laptop. The primary function of a cooling pad is to further assist laptops in their ability to handle large workloads and still be able to function to the best of their ability without the device overheating due to the load. To meet customers' needs, our team decided to improve the current laptop cooling pad by using the thermopile to cool the back of the laptop using a wall outlet to provide power to the thermopile. The laptop would rest on a flat aluminum plate and a plastic frame to provide even cooling for the back of the laptop. After the frame is 3D printed and the laptop cooling pad is assembled, tests will be done using temperature sensors placed on the laptop while a video game or intensive computer program is running. The

result will be compared with the laptop running these games or programs without the cooling pad. With this data a conclusion can be made on whether the cooling pad makes enough of a difference to the laptop's performance and internal temperature.

Reverse Engineering Spiral Galaxies (Poster Table 20)

Presenting Students: Christopher Thomas, Matthew Foster
Faculty Mentor: Dr. Jason Speights

Galaxy disks can lower their energy state yet conserve angular momentum by material flowing inwards at smaller radii and outwards at larger radii. This is tested for a small sample of spiral galaxies by fitting models of rotation and radial flow to the observed velocity of CO, H-alpha, and stellar spectral line data from the Atacama Large Millimeter Array and the Multi Unit Spectrograph Explorer for the Very Large Telescope of the European Southern Observatory. The results are complimented with stellar density profiles using data from the Spitzer Space Telescope.

Smart Window (Rain Sensing) (Poster Table 18)

Presenting Students: Michael Crane, Ryan Crane, Jared Hose, Tyler Malone, Dominik Wolters
Faculty Mentor: Dr. Jamil Abdo

Many car owners find themselves the victims of foul weather even when they’re not behind the wheel. How is this possible you might ask? Many drivers make the mistake of parking their vehicle with the windows down on a nice spring or summer afternoon only to find that when they return a passing shower has drenched the interior of their vehicle. This can be a huge inconvenience as well as a costly fix if the vehicle needs detailing or components replaced. What if this unfortunate event never had to occur? What if there was a way for the car to detect rain and roll the window up even when the driver wasn’t present. Our project “The Smart Window” does exactly that. Currently no manufacturers in the market integrate this into their vehicles, however, utilizing the existing components within vehicles we can implement a few pieces of modern technology such as mini computers like the arduino to make this possible. Our goal was to find a solution to a problem many of us have faced that would also allow us to utilize our electro-mechanical knowledge gained throughout our course work. In the process we developed a low-cost, fully integral prototype that with further development could be taken to market.

Standalone Water and Power Supply (SWAPS) Design – Arundel Mills Team (Poster Table 20)

Presenting Students: Brendan Curley, Ryan Graham, Joseph Marcellino, Joshua Rochon, Samson Takang
Faculty Mentor: Dr. Oguz Soysal

Senior engineering majors in Electrical Engineering concentration on Arundel Mills campus will present their capstone project to develop a standalone mobile unit powered by solar energy. The system is intended to supply essential equipment and provide clean water at disaster areas, agricultural, commercial, or recreational facilities at remote locations, or in situations when the utility services become unavailable for a long time. The presenters are developing the subsystems outlined below in their "ENEE408 - Capstone Design Project in Electrical Engineering" class. Brendan Curley designed the user interface using an Arduino single-board microcontroller with LCD screen is used to display electrical system metrics and status. The Arduino communicates with the PV charge controller via an RS-485 serial interface to capture system metrics, such as voltage and current of the PV array, batteries, and system load. The net current flowing through the system batteries is measured with a DC ammeter shunt resistor and 16-bit analog-to-digital converter connected to the Arduino. The water level from the storage tank is also measured using a water float sensor. Ryan Graham designed the pumping subsystem to pump water to the SWAPS, water treatment subsystem to treat and filter the water into potable drinking water, and a water tank to store the water for future use. Pump is submersible and AC powered for higher efficiency. Joseph Marcellino designed the electrical components and BOS (Balance of System) requirements which includes selecting the solar panels, charge controller, battery bank (chemistry, nominal voltage, and capacity), all DC and AC wire sizing, and DC/AC overcurrent protection. Joshua Rachon will complete the finalized system drawings. This will consist of the drawing plan of the project, as well as a 3D model. Using SolidWorks to complete the 3D drawings of what the final product will look like and using AutoCAD to have schematics of where certain components will go. Samson Takang designed the Dc input into the battery bank from the PV which goes through the charge controller then to the storage battery. The charge controller will regulate the charge to the battery bank and ensure that proper charging. The DC to AC converter (inverter) delivers a 110 to 120 V from the 24 DC battery voltage to operate the water pump and power outlets for users. The team is building a prototype to test the operation and performance of the designed system.

Standalone Water and Power Supply (SWAPS) Design – Frostburg Team (Poster Table 20)

Presenting Students: Ana Alvarez De La Cruz, Jacob Dobbins, Taylor Frailey, Brynn Lewis, Jair Samuel
Faculty Mentor: Dr. Oguz Soysal

Senior engineering majors in Electrical Engineering concentration on Frostburg campus will present their capstone project to develop a standalone mobile unit powered by solar energy. The system is

intended to supply essential equipment and provide clean water at disaster areas, agricultural, commercial, or recreational facilities at remote locations, or in situations when the utility services become unavailable for a long time. The presenters are developing the subsystems outlined below in their "ENEE408 - Capstone Design Project in Electrical Engineering" class. Ana Alvarez De La Cruz: designed the PV array design to supply electricity in any situation. The design consists of modules connected to a combiner box which will act as a safety precaution for the connected equipment. Wiring is sized to ensure a safe and lasting connection to all equipment according to the National Electric Code (NEC). Other safety precautions include equipment grounding and lightning protection for the system. Jacob Dobbins designed the energy storage system to store power safely and effectively. The system includes a battery bank and a charge controller. The sealed deep cycle batteries stores the power generated by the PV array and supplies the electronic converters that delivers various voltages. The charge controller is responsible for keeping the battery healthy by preventing overcharging. This will greatly increase the battery life. Taylor Frailey designed DC/DC converters and DC/AC converters are used to adjust voltage levels for specified uses. An DC/DC converter will convert 12 volts coming from the battery bank to 5 volts. A DC/AC converter (also known as inverter) will convert DC battery voltage to 115 volts AC. Converted voltages will power water pumps, help water treatment, load management, and multiple USB outputs. Brynn Lewis: Energy Management and User Interface consisting of multiple LCD displays and sensors to provide efficient data to the user on energy management/control and water level monitoring. For energy, accurate readings of voltage, power, current, and state of charge will be provided, including any warning signals if necessary. For water, feedback on critical water tank levels and ability to shut off water pumps and filters will be implemented. For emergencies, a complete turn-off option will be provided in case the system would cause harm to the user. Jair Samuel designed the water collection and storage system. The unit will be able to fill a pressure-controlled tank from a lake, stream, or rainwater collector. Collected water will be filtered and purified to supply drinking and cleaning water. The team is building a prototype to test the operation and performance of the designed system.

Supporting Cement Crystalline Structure with MWCNT (Poster Table 21)

Presenting Students: Tiyana Bumbray, Dakota Colby, Elijah Ehrhart, Jason Liddic, Sean Young
Faculty and Staff Mentors: Dr. Zhen Liu, Dr. Dale Schulz, Ms. Kayla Ross, Mr. Scott Hemphill

Introducing 20-30 nanometer multi-walled carbon nanotubes (MWCNT) into the crystalline structure of cement will reinforce the strength in the tensile direction, create a plastic region, and increase the modulus of elasticity. To achieve this, a four-point bend test will be used, while measuring deflection, with strain gauges underneath the cement strips. Utilizing Vernier software and technology, the stress-strain curve will be plotted to show if a plastic region has formed instead of an immediate failure. Deflection and strain data are used to solve for the modulus of elasticity. MWCNT enhanced mechanical properties increase the overall strength of the cement strips thus increasing the tensile strength and the modulus of elasticity of cement.

Thermal Properties of Aerosol Polymers (Poster Table 22)

Presenting Students: Cameron Nichols, Ethan Eby, Duncan Poler
Faculty and Staff Mentors: Dr. Zhen Liu, Mr. Duane Miller

The premise of our capstone is to see how the application of different aerosol polymers affect the thermal inertness of different blends of materials. The polymers we will be testing are Boron Nitride, Silicon Spray, and PTFE. These sprays will be applied to patches of wool, polyester, and nylon with variations of the amount of coating. This will be done to see which combination of cloth, polymer, and layers have the best impact on thermal inertness.

Utilizing FluxTeq to Analyze Heat Transfer (Poster Table 19)

Presenting Students: Cameron Bohrer, Michael Crane, Ryan Crane, Randall Ganoe, Robert Hood, Jared Hose, Tyler Malone, Josh Marsh, James Mills, Cameron Nichols, Andrew Pedneau, Duncan Polar, Luke Russell, Brady Shaffer, Andrew Smith
Faculty Mentor: Dr. Julie Wang

The project demonstrates the utilization of FuxTeq computing hardware and software to measure heat transfer in a number of different capacities. Topics studied with this program include: the three modes of heat transfer (conduction, convection, and radiation) in particular direct conduction heat transfer, conduction heat transfer through a thermally resistive surface, fin heat dissipation and fin efficiency, and conduction heat transfer through multiple thermal resistances with varying thermal resistivity. The project will demonstrate how we have utilized this technology to enhance and further both our conceptual and analytical understanding of the course material.

PHILOSOPHY DEPARTMENT

Felon Disenfranchisement: Five Million Denied is Five Million Silenced (Poster Table 4 and Oral Presentation)

Presenting Student: Delanie Blubaugh
Faculty Mentor: Dr. David Atenasio

In the American prison system, convicted felons face significant punishment for their crimes, from serving harsh prison sentences to being completely stripped of their rights as an American citizen. Voter disenfranchisement of felons has the potential to be permanent, as some felons may serve life sentences or will face huge obstacles to restoring their voting rights after being decarcerated. This paper and presentation discuss the effects voter disenfranchisement has on representation, recidivism, and nationwide voter turnout. Furthermore, I will contend that felon disenfranchisement is an inherently racist practice that directly seeks to oppress people of color through coercive means in addition to mass incarceration and the war on drugs. Because of this system of oppression that partially removes voting rights to many facing incarceration, probation, or parole, people of color and minorities most greatly impacted by the American prison system are permanently immobilized. Finally, I will offer solutions to felon voter disenfranchisement that seek to diminish the negative impact on representation and restore constitutionally-deserved voting rights following decarceration of citizens.

POLITICAL SCIENCE DEPARTMENT

The Effects of Political Will on Environmental Policy (Oral Presentation)

Presenting Student: Samantha Diehl
Faculty Mentor: Dr. John O'Rorke

This research project looks at the effect of political will on the success of environmental policies. In order to determine this, two variables are measured- political will and success. To measure political will, three assessments were used which were the political assessment, the process assessment, and the programmatic assessment. To measure success, the major goals of the policies were researched to see if there is statistical data on whether they were achieved or not. From here, the data was analyzed in order to determine whether the successful policies score the same as unsuccessful policies. The Montreal Protocol, the Clean Air Act, and the Superfund Act are the policies this paper looked at and it is determined that political will does impact the success of policies, with scoring high on the political assessment and the programmatic assessment having the most influence on whether a policy is able to succeed.

PSYCHOLOGY DEPARTMENT

Ecological Risk and Protective Factors for Mental Health and Substance Use among Sexual and Racial Minority College Students (Poster Table 4)

Presenting Students: Sarah Loveless, Adam Brode, Alexis Layton, Sondra Wine
Contributing Students: Ferneacia Chapman, Sabrina Morton, Elizabeth Prather
Faculty Mentor: Dr. Renae Mitchell

Lesbian, gay, bisexual, transgender, and queer people of color (LGBTQ POC) exist at the intersection of sexual orientation and racial/ethnic minority statuses. Each of these minoritized identities (sexual orientation and race/ethnicity) is associated with increased experiences of bias, prejudice, and oppression; which, in turn, are associated with negative mental health outcomes and substance abuse (Meyer, 1995; Dyar et al., 2014). Having multiple minoritized identities likely compounds these effects for LGBT POC (Cyrus, 2017). Microaggressions are an insidious form of oppression, characterized by small actions that convey negative messages based on an individual's minority status. According to research based on the Minority Stress Theory, there evidence of a positive correlation between microaggressions and psychological distress and substance use among both sexual and racial minority individuals (Woodford et al., 2014). College students are in a unique position as they grapple with identity development across multiple domains (Erikson, 1963). However, there is a dearth of research regarding the experiences of sexual minority college students of color. The limited information available suggests LGBT students of color experience many forms of microaggressions on campus, and that these experiences may be associated with negative mental health and low academic performance (Woodford et al.,2015). Although there is little research regarding substance use among sexual minority students of color, there is evidence to suggest drug use is more common among LGBT students than their heterosexual counterparts (Eisenburg & Wechsler, 2003). However, there is also evidence that racial identity can be a protective factor against substance abuse (Banks et al., 2021). Thus, the potential relationship between microaggressions and substance use among LGBT students of color remains unclear. There are potential mitigating factors in the relationship between minority stress and negative health outcomes. Social support and individual resilience have been implicated as possible protective factors among both sexual and racial minority groups individually (Wong, 2015). Among LGBT students, social and community support may contribute to positive mental health and resilience through comfort and protection from the effects of heterosexism (Friedman, et al.,2009). Resilience might be able to decrease the likelihood that college students in various minority groups will participate in substance abuse (Kim & Cronley, 2020). For students in racial minority groups, having social support and a sense of belonging within one's racial group might increase their resilience and therefore decrease harmful behaviors (Banks et al., 2021). However, there is almost no research regarding this relationship among sexual minority college students of color. The proposed study will investigate the relationship between microaggressions and mental health symptoms in the context of resilience and perceived social support among LGBT POC in college. Proposed survey items, recruitment methods, and data analysis strategies will be discussed.

Racial Differences in Conspiracy Theory Belief, Cynicism, and Subclinical Paranoia (Poster Table 4)

Presenting Students: Angel Young, Alexis Layton, Qianli Chen, Abigail Wellings
Faculty Mentor: Dr. Alan Bensley

Believers of conspiracy theories have been found to be more cynical, paranoid, and distrustful, but seldom have these variables been examined in relation to race. We found, using measures of specific and generic conspiracy theory belief, that African American students endorsed false and fictious conspiracy theories more often, were more likely to endorse a true African American conspiracy concerning the Tuskegee Syphilis Study, and more strongly endorsed true conspiracies in general as compared to White students. Additionally, African American students demonstrated significantly higher scores on measures of cynicism and subclinical paranoia compared to White students. We briefly discuss what might account for the differences we found.

The Better-Than-Average Effect Demonstrated with Negative Dispositions Related to Critical Thinking (Poster Table 4)

Presenting Students: Qianli Chen, Alexis Layton
Faculty and Staff Mentors: Dr. Alan Bensley, Mr. Cody Watkins

We previously found the better-than-average effect (BTAE) with positive dispositions related to critical thinking. Specifically, students rated themselves as significantly more open-minded, fair-minded, intellectually engaged, and disposed to think critically in general as compared to the student's own ratings of the average student. In the present study, we examined whether the BTAE would also be found with negative forms of dispositions related to critical thinking (CT). We found that general psychology students rated themselves on a series of 7-point Likert scales as significantly less close-minded, gullible, biased, and prejudiced than they rated the average student. These results are consistent with our earlier findings of the BTAE occurring with socially desirable CT dispositions.

SOCIOLOGY DEPARTMENT

Is Representative Democracy An Illusion? (Oral Presentation)

Presenting Student: Courtney Tipton
Faculty Mentors: Dr. Robert Moore, Dr. Angela Luvara

"It's your civic duty." "It's a privilege that has been denied to many." "Our democracy depends on it". How many times have we heard, or muttered these words ourselves, when the discussion topic is focused on voter registration or the act of voting itself? Pollsters, advisors, teachers, professors, social scientists, along with others, stress the importance of registering to vote and the importance of casting your ballot to ensure your voice is heard, but less emphasis seems to be placed on being an *informed* voter. Yet, what if the information sources we use only allow information *they* deem worthy to be common knowledge? How much power does Big Tech really have on our everyday lives and decisions, including our voting decisions? While some scholars have begun to study and quantify just how intrusive Big Tech has been, the same Big Tech and "media industrial complex" have quashed any constructive discussion around privacy intrusion or their ability to modify the decisions or behaviors of the public. In this study, I analyze data I gathered from Frostburg State University students enrolled in Sociology classes to determine if there are trends connecting internet usage and/or information source to voter participation.

The Hidden Sociological Concepts in Southern Hip Hop (Oral Presentation)

Presenting Student: Katherine Reyes
Faculty Mentor: Dr. Angela Luvara

Southern hip hop as an art form is frequently overlooked and critiqued by many, on the grounds of the artists' music being vulgar, unrelatable, and difficult to understand. What many do not consider are the various artists' ability to be personal while also demonstrating strong technical ability in the art of making music. A brief deep dive into the history of the South and an inspection of the common themes in Southern rap artists' music will reveal the cultural response to the circumstances, and how the artists choose to respond to it, all while making a distinct sound unique to the South. In this study, I employ content of several songs of southern hip hop artists to explain the importance of telling one's story utilizing sociologist Patricia Hill Collins' dual intellectual citizenship, exploring the matrix of domination and how that influences the individual, and in turn, their music.

WOMEN'S STUDIES PROGRAM

We Rely on the Streets: A Content Analysis of Southern Hip Hop and Police Brutality (Oral Presentation)

Presenting Student: Haley Fuentes
Faculty Mentor: Dr. Angela Luvara

Police brutality and racial injustices are nothing new to the world we live in now. We have seen just how much these social issues have plagued the world we live in today, but we have people who challenge these issues and fight for change. We have heard the stories of the Underground Railroad, the Civil Rights Movement, the riots in both L.A. and Baltimore, and more recently, the Black Lives Matter Movement. Each and every time we have seen police brutality and racial injustices in the Black and Brown communities all over the world, it is clear these issues are not taken lightly. In 1991, a song came out that would change the face of music, and the way we fight back. A group of four men from Compton, California, showed the world just how much attitude they had, and just what the community was feeling. "Fuck The Police" by N. W. A. gave a sound to what the communities were going through, and artists still to this day, decades later, have taken what they have done, and continued on. They put music to the hurt, the anger, the pain, and they have given a sound to the movements fighting against these injustices and crooked systems. The West Coast is notorious for the numerous artists and groups who have a violent, gangster type of flow, and that is exactly what West Coast Rap is known for, gangsta rap. The south has always had a different flow to their music, a flow you hear in parties, a flow you dance to, not a flow used to fight against the system. In contrast to these stereotypes about southern hip-hop, Geto Boys, a group reigning from Houston, Texas, has used their music to let the world know that community is all they have, and they can only trust themselves to keep them safe, and alive. In this study, I conduct a content analysis on two Geto Boys songs, *G Code* and *Crooked Officer* in effort to show just one example of the political messaging put forth by southern hip-hop artists.

FSU Undergraduate Research Working Group

Karen Keller, Biology (Chair)
Jamil Abdo, Physics and Engineering
Phillip Allen, Geography
Matthew Crawford, Chemistry
Justin Dunmyer, Mathematics
Rebecca Flinn, Computer Science and Information Technologies
Robert Hein, Visual Arts
Erica Kennedy, Psychology
Zhen Liu, Physics and Engineering
Marc Michael, Mathematics
Duane Miller, Physics and Engineering
Eric Moore, Physics and Engineering
Jill Morris, English and Foreign Languages and Literature
Xunyu Pan, Computer Science and Information Technologies
William Seddon, Biology
Rebekah Taylor, Biology

Michael Mathias, Interim Provost
(Opening Remarks)
Lacey Shillingburg, Office of the Provost, Executive Administrative Assistant I

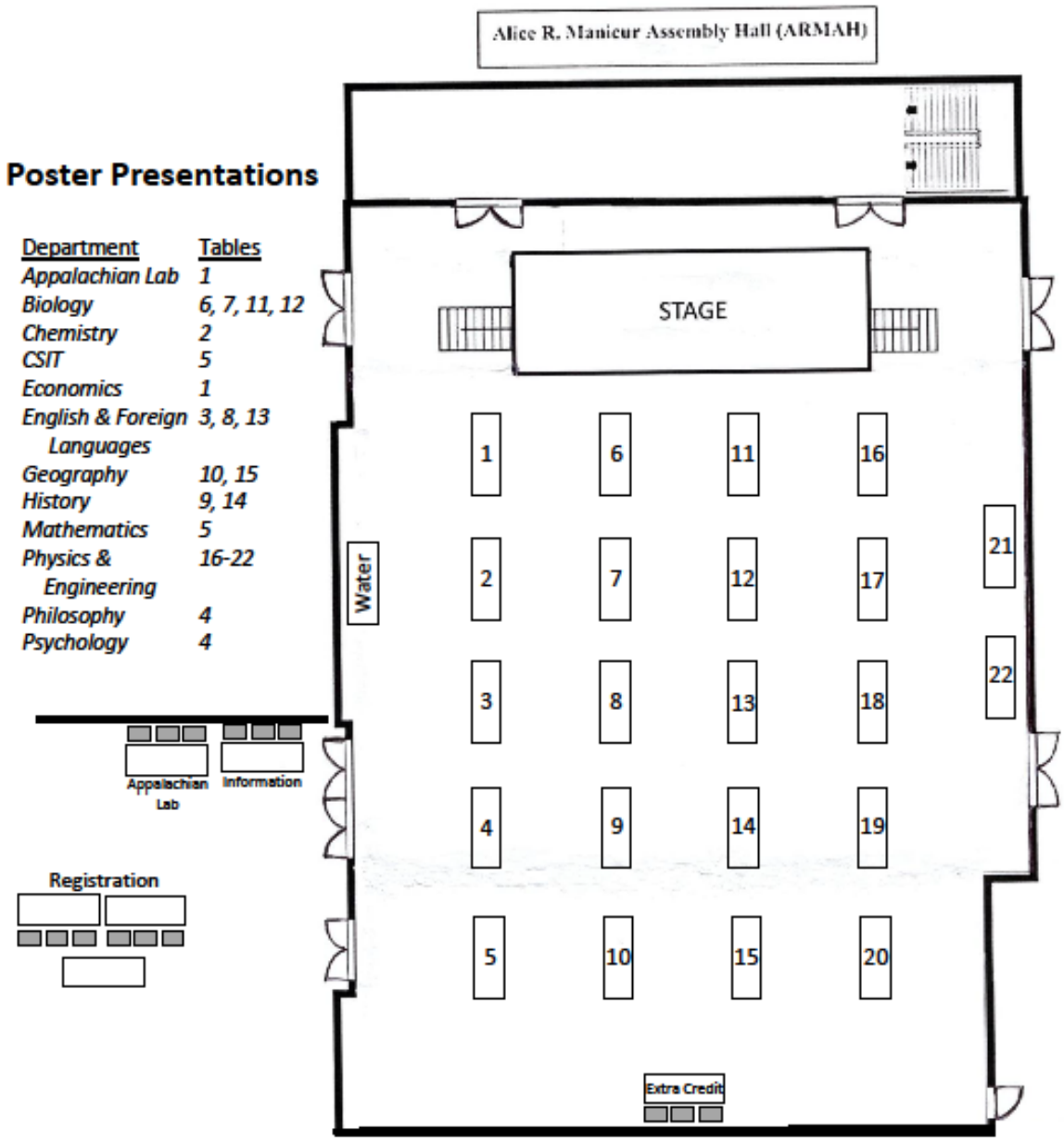
SPECIAL THANKS

Additional funding for the Symposium was provided by The FSU Foundation. In addition, many projects featured in the Symposium were funded by Foundation grants, Faculty Development grants, PELEF grants, and the Student Government Association.

We would like to thank the staff of the Print Shop, the Lane Center, the Physical Plant, the FSU Foundation, and Chartwells for all of their assistance in the preparation of the Symposium.

Most importantly, we would like to thank the Students and their Faculty and Staff Mentors for making the Symposium possible.

Frostburg State University
Undergraduate Research Symposium 2022



Poster Presentations

Department	Tables
Appalachian Lab	*1*
Biology	*6, 7, 11, 12*
Chemistry	*2*
CSIT	*5*
Economics	*1*
English & Foreign Languages	*3, 8, 13*
Geography	*10, 15*
History	*9, 14*
Mathematics	*5*
Physics & Engineering	*16-22*
Philosophy	*4*
Psychology	*4*

Oral Presentations are in Rooms 108, 109, 110, 111, and 113

LANE CENTER ROOM 108	
Time	**Oral Presentation and Presenters**
11:30-12:00	Felon Disenfranchisement: Five Million Denied is Five Million Silenced ***Delanie Blubaugh***
12:00-12:30	Is Representative Democracy an Illusion? ***Courtney Tipton***
12:30-1:00	We Rely on the Streets: A Content Analysis of Southern Hip Hop and Police Brutality ***Haley Fuentes***
1:00-1:30	The Hidden Sociological Concepts in Southern Hip Hop ***Katherine Reyes***

LANE CENTER ROOM 109	
Time	**Oral Presentation and Presenters**
12:00-12:30	Deep Creek Lake: The Past, The Present, and The Future ***Samuel Beeman***
12:30-1:00	Geography of Anne Arundel County ***Amber Mazan***
1:00-1:30	Major General Isaac Trimble, Marylander in the Confederate Army ***Taylor Parker***

LANE CENTER ROOM 110	
Time	**Oral Presentation and Presenters**
11:30-12:00	The Effects of Prolonged Power Outages and How Microgrids Improve Resilience ***Michael Hollingsworth***
12:00-12:30	Relational Problems with A.D.H.D. ***Jabari Riley***
12:30-1:00	How Colleges Impact Students' Mental Health ***Trinity Williams***
1:00-1:30	Cloning, Sequencing, and Assessing the Gene Expression of Different Strains of *Cannabis sativa L* ***Nicole Felton***

LANE CENTER ROOM 111	
Time	**Oral Presentation and Presenters**
11:30-12:00	John Wilkes Booth: The Life of a Maryland Actor ***Aaron Morphew, Robert Bole, Noah Cassidy***
12:00-12:30	Frances Ellen Watkins Harper ***Olivia Cooper, Alexandra Ritte, Kori Striano, Alison Cutter***
12:30-1:00	Dyslexia, ADHD, and the Damage Teachers Can Do ***Juliana Schmitt***
1:00-1:30	How to Learn a New Language ***King Awenate Khama***

LANE CENTER ROOM 113	
Time	**Oral Presentation and Presenters**
11:30-12:00	Regional Cultures and Their Effects on Caregiver Decisions in American Literature (Gender and the U.S. Short Story, 1) ***Jules Buttner***
12:00-12:30	How Different Beliefs Can Guarantee a Failing Marriage (Gender and the U.S. Short Story, 2) ***Peyton Carroll***
12:30-1:00	Living in the Ideal: The Fluidity of Gender and Hollowness of Patriotism (Gender and the U.S. Short Story, 3) ***Ian Wroblewski***
1:00-1:30	The Effects of Political Will on Environmental Policy ***Samantha Diehl***