State of North Carolina
Undergraduate Research & Creativity Symposium

■ CALL FOR ABSTRACTS ■

SNCURCS 2021

Abstract Deadline:
Sept. 13 to Oct. 15

Student Preview:
November 12

Live Event Date:
November 13

Undergraduate students from all public and private institutions in North Carolina are invited to submit abstracts based on original research and creative projects.

SNCURCS 2021 will be presented virtually.

Abstracts and submissions will be available for seven days after the live event.

Visit sncurcs.org for more information.

Twitter: #SNCURCS2021

CATAWBA COLLEGE est. 1851

ELON UNIVERSITY

LIVINGSTONE COLLEGE

State of North Carolina
Office of the Governor

Roy Cooper
Governor

20301 Mail Service Center
Raleigh, N.C. 27699-0301

November 13, 2021

Dear Friends:

As Governor, it is my great pleasure to welcome you to the 17th Annual State of North Carolina Undergraduate Research and Creativity Symposium. I applaud your determination and collaboration in hosting the Symposium virtually and keeping students and faculty safe during the COVID-19 pandemic. I know that everyone is even more excited to be able to participate in this important event this year.

I sincerely appreciate the hard work by Catawba College, Elon University and Livingstone College to provide this opportunity for our undergraduate students to present their research in their chosen fields. North Carolina is fortunate to have outstanding public and private institutions of higher education that co-sponsor this event each year. Our talented students have great projects to share, and I am proud of all of you for the presentations you are making today.

My best wishes to all the participants and others involved in this year's exciting event.

With kind regards, I am

Very truly yours,

Roy Cooper

RAC/sm

Location: The State Capitol Building, Raleigh, N.C. 27602
Phone: 919-814-2100

CATAWBA COLLEGE

OFFICE OF THE PRESIDENT

November 8, 2021

Dear Undergraduate Researchers, Faculty, and Guests,

On behalf of Catawba College, I am delighted to welcome you to the 2021 North Carolina Undergraduate Research and Creativity Symposium. We know that undergraduate research and creativity are a primary means of student success in each of our learning communities, so we are grateful for the strong tradition of sharing and celebrating student work among our institutions here in North Carolina.

We are glad to co-host this virtual event with our colleagues at Elon University and Livingstone College, and we are grateful for each student participant in the symposium. Your curiosity, ingenuity, and creativity inspire us.

To each sponsor, faculty mentor, staff member, and volunteer, thank you for your investment in our students.

Warm Regards,

David P. Nelson
President

ELON UNIVERSITY
Office *of the* President

November 13, 2021

Dear Undergraduate Researchers, Faculty, and Guests,

On behalf of Elon University, I am pleased to welcome you to the 2021 State of North Carolina Undergraduate Research and Creativity Symposium (SNCURCS). As one of the nation's premier institutions for undergraduate research, we cultivate campus-wide student involvement in high quality scholarship and creative endeavors every day. Outstanding teacher-scholar-mentors partner with intellectually curious students to engage in critical analysis and inquiry that leads to new scholarly insights and the creation of new work. Elon University looks forward to gathering with scholars from across the state of North Carolina for this exciting day of learning.

In partnership with Catawba College and Livingstone College, Elon is proud to host this year's symposium, and we look forward to your engagement in this virtual event as we celebrate undergraduate research and intellectual development. The research presented and discussed during the symposium involves represents the positive potential of engaged faculty mentoring, investigation, and creative inquiry.

We are grateful for this year's conference organizers, faculty mentors, student participants, sponsors, and volunteers, and applaud your efforts to advance learning in this important way.

Sincerely,

Connie Ledoux Book
President

Livingstone College
Office of the President

701 W. MONROE ST.
SALISBURY, NC 28144

November 13, 2021

Greetings!

On behalf of the entire Livingstone College community, I am delighted to welcome you to the 2021 (virtual) State of North Carolina Undergraduate Research and Creativity Symposium (SNCURCS). Livingstone College is committed to its mission to promote lifelong learning, and to develop student potential for leadership and service to a global community. It is with this in mind that we know, student engagement in undergraduate research plays a critical role in both the development and success of our students.

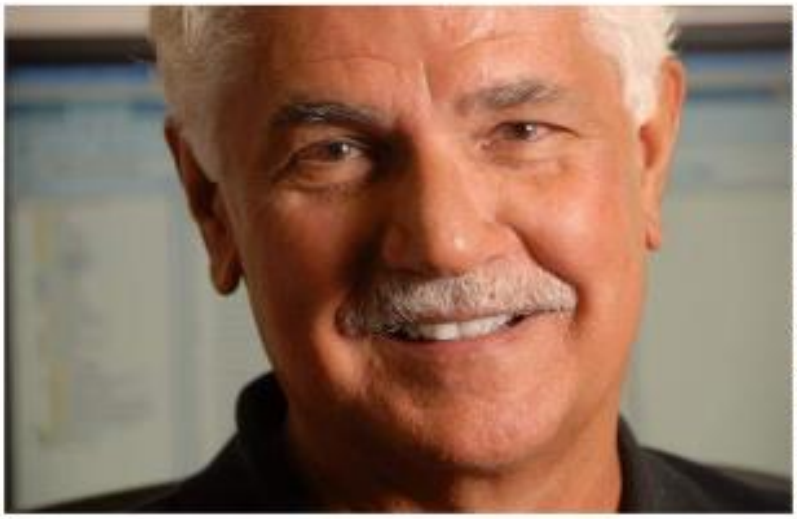
Livingstone College is proud to co-host this year's symposium in partnership with Catawba College and Elon University. I would like to thank all of the individuals who have made this experience possible for our students.

Respectfully,

Jimmy R. Jenkins, Sr., Ph.D.
President

JRJ:tj

George Barthalmus Undergraduate Research Awards 2021-22



Dr. George T. Barthalmus (1942-2011) was the driving force behind the creation of the State of North Carolina Undergraduate Research and Creativity Symposium. He had a passion for encouraging undergraduates to pursue their interests through the process of research, be it in the sciences, humanities, or through artistic expression. He was an advocate for early involvement of students in the research process as a way to engage and retain students in academics. To this end, the George Barthalmus Undergraduate Research Awards have been developed to promote early involvement in the research process through support of sophomores in a research project of their design.

These awards are designed to assist students with development and engagement in undergraduate research. Students from all disciplines are invited to apply for the awards. The winners of the grant will present their research at the next Annual SNCURCS event in 2021.

Award Recipients

The following students received the 2021-2022 George Barthalmus Undergraduate Research Award:

Name	Institution	Discipline
Clara Kennedy	UNC Greensboro,	Visual and Performing Arts
Sadie Flagg	High Point University	Chemistry
Kaitlyn Llewellyn	UNC Asheville,	Chemistry

Poster Presentations
By Disciplines

Arts, Design, and Performing Arts

Biological & Life Sciences

Business & Economics

Chemical Sciences

Communication & Journalism

Computational Sciences

Cultural & Language Studies

Education

Engineering

Environmental Sciences

Humanities

Mathematics & Quantitative Studies

Medical & Health Sciences

Physical Sciences & Astronomy

Social & Behavioral Sciences

2021-001	Exhibit	Arts, Design, and Performing Arts

Student Presenter: **Barnes, Mac; *North Carolina School of Science and Math***
Mentor: **Alter, Carrie; *North Carolina School of Science and Math***

A Walk in Their Shoes

The fiber arts pose a unique opportunity to have a niche role in the conversation of social progression. Pieces within "A Walk in Their Shoes" highlight North Carolina community individuals with unique and diverse perspectives, experiences, and outlooks on American culture/society. To further develop the quilted applique technique new materials were introduced such as vinyl, recycled materials, different colored threads, paint, and others. The addition of new materials is solely to better communicate the individual's ideals/outlooks and narratives to the viewer and to distinguish my style of work from other quilt-based artists. In "A Walk in Their Shoes", gained points of view could be insights into social barriers, strong emotional feelings, prospective wisdom, or messages of acceptance and validation that are novel to the viewer. From the public perspective, quilted portraits are an often unseen medium (i.e, not "just another oil painting"). Furthermore, the "WOW-factor" that comes with the illusion of paint in creating such works with fabric further draws in the attention of the viewer. It is the artist's desire that visual messages create a better sense of mutual understanding and acceptance around social issues and injustice. Furthermore, it is the intention that these works inspire new conversations and spark new ideas or collaboration that may not have previously occurred.

2021-002	Oral Presentation	Arts, Design, and Performing Arts

Student Presenter: **Gatewood, Willow G.; *Catawba College***
Mentor: **Burgess, Phillip E.; *Catawba College***

Playing Plants; Artistic and Educational Applications of Biosonification

Data sonification allows us to sonically or musically represent scientific data; further, a subset called biosonification depicts biological data, usually gathered in the form of organismal energy or chemical signals, through sound. Biosonification has many potential applications in the realms of arts, science, and science or environmental education, with an equally great potential to connect the disciplines. By musically presenting the electrical activity of easily overlooked organisms — plants and fungi — this project aims to examine ways in which modern technology allows us to explore the biological world through sound and the resulting avenues created for teaching science to the public. Furthermore, this project looks critically at the uses and misuses of this technology through media review and suggests areas for further research and future applications. This presentation will include a musical demonstration of a biosonification device that utilizes midi technology and a digital audio workstation.

2021-003	Oral Presentation	Arts, Design, and Performing Arts
Student Presenter:	**Kamer, Paul; *Duke University***	
	Ross, Eleanor	
Mentor:	**Sorensen, Lee; *Duke University***	

Dictionary of Art Historians: Researching African-American Art Historians

African-American art historians have made meaningful contributions to the field of art history, yet there is an alarming lack of biographical literature documenting the work of these scholars. The Dictionary of Art Historians (DoAH) is a student-designed research project to highlight art historians from all backgrounds. Our initiative this semester is focused on African-American art historians who have largely been neglected in academic discourse. Until this point, there has been no research centered around African-American art historians. Consequently, investigating these intellectuals has proven difficult as resources are sparse.

While finding and creating biographies of African-American art historians has been laborious, the DoAH research team has located scholarly resources and identified periodicals that have allowed us to build our online database. Some of our prominent successes include Freeman Henry Morris Murray, Elsa Honig Fine, Alain Locke, and Samella Lewis. Through probing archives, borrowing books from Duke University's extensive library collections, and exploring online, we have been able to credit these historians with their work. As we expand the database, we plan to develop infographics and add a social media presence so the public can become familiarized with the research of these art historians.

2021-004	Oral Presentation	Arts, Design, and Performing Arts
Student Presenter:	**Morris, Miranda; *Greensboro College***	
Mentor:	**Kuo, Dr. Henry; *Greensboro College***	

Aristotle Needs an Update: Analyzing Spectacular Tactics in 21st Century Broadway Musicals

The Merriam-Webster definition of spectacle is "something that is unusual, notable, or entertaining." My thesis borrows from this definition to provide a fresh take on spectacle—rather than viewing spectacle only in the sense of production elements, and only as a technical capability, this thesis contends that anything can be spectacular, and I'm studying a pool of 42 successful Broadway shows to find trends in spectacularity.

Some musicals may draw the attention of an audience but are not considered "good" musicals (a notable example from this period being the infamous Spider-Man Turn Off the Dark). In finding a more objective framework for conceptualizing this, I drew upon Longinus's concept of the sublime—something that elicits an emotional response from the viewer. I'm analyzing these shows with the framework that these instances of spectacle are tactics to achieve the sublime, and I'm using any primary-source data I can find (video clips, production photos, interviews with the cast and crew, etc.) to determine what spectacular tactics are being used on stage in the 21st century.

To put it a simpler way, this thesis aims to determine what tactics 21st century Broadway producers are using to draw the audience's attention, and whether or not those tactics led to sublime theatre, and what that says about 21st century Broadway theatre-goers.

2021-005	Oral Presentation	Arts, Design, and Performing Arts

Student Presenter: **Murphy, Dylan; *UNC Greensboro***
Mentor: **Hudson, Andy; *UNC Greensboro***

Psychoactive Verbs in Clarinet Pedagogy: A Case Study Utilizing a New Work by Sharneisha Joyner

Verbs invoke people to take action. Actors are trained to use this technique very effectively and subsequently their performances bring great emotion. This technique somewhat neglected in the music field. Subsequently, musicians will typically rely on their emotions to bring about the same result. This can bring about massive amounts stress and tightening in performers. “Integrative Alexander Technique Practice for Performing Artists: Onstage Synergy” by Cathy Madden sums this phenomenon up extremely well. She states “emotions may result from the actions of a performance, but genuine emotions can’t happen unless actions are played.” To explore the effect of psychoactive verbs on musical performance and pedagogy, UNCG sophomore clarinetist Dylan Murphy has crafted lesson plans for private clarinet instruction that deploy psychoactive verbs to aid students as they prepare for performance. To establish a
control in this process and ensure that no student has previously engaged with the work, Murphy has commissioned a work by London-based African-American composer Sharneisha Joyner (who is also a UNCG Alum, having graduated from UNCG in 2019). Murphy will teach ten students two hour-long lessons each on this newly-commissioned work. Finally, Murphy will present his findings in the Greensboro area and will apply to present his findings at conferences of the International Clarinet Association, the College Music Society, the National Conference on Undergraduate Research, and the UNCG URSCO Expo to allow other pedagogues and musicians to benefit from this work. Dylan will also produce a high-quality professional recording of the newly-commissioned musical work by Sharneisha Joyner for independent release that can be used by other teachers as they engage the work with their own students.

2021-006	Oral Presentation	Biological and Life Sciences

Student Presenter: **Avula, Trisha; *North Carolina School of Science and Math***
Mentor: **Mallory, Heather; *North Carolina School of Science and Math***

Co-Culturing of Microalgae for Enhanced Carbon Dioxide Sequestration

As human advancements and subsequently, populations rise, the need for increasing global carbon capture to mitigate the effects of climate change is pertinent to avoid detrimental effects of carbon dioxide emissions on the environment. Several species of microalgae grow bountily in wastewater with minimal growth specifications making it a cost-effective and easily reproducible organism for carbon sequestration. Based on past research, microalgae has been used in combination with bacterial strains in attempts of higher carbon capture, but the concern of bioinvasion paired with meticulous bacterial culturing procedures has led to various difficulties. To combat these issues, two native North Carolina algal species, Chlorella Vulgaris and Chlamydomonas Reinhardtii, were cultured separately and co-cultured to compare their carbon sequestration rates. A closed system was built to measure the overall carbon dioxide capture rates, with each variable (C. Vulgaris, C. Reinhardtii, and co-culture) housed in beakers ran in 24 hour trials while being switched from light to dark every 12 hours. Through placing the algae in a closed system, and measuring the depletion of CO2 per unit time, or the generation of O2, I directly measured primary production. In addition, algal densities of each of the mediums was measured with a spectrophotometer to compare productivity. The data suggests that co-cultured microalgae sequestered the most carbon dioxide and comparatively had the highest productivity. In a broader context, the competition between the two microalgal species may be exploited enough to have a synergistic response in carbon absorption and algal densities in an environmentally optimal range.

2021-007	Oral Presentation	Biological and Life Sciences

Student Presenter: **Baker, Janae; *North Carolina A&T State University***
Mentor: **Maldonado-Devincci, Antoinette; *North Carolina A&T State University***

Intermittent ethanol exposure during late adolescence alters anxiety-like behavior but not ethanol drinking in a sex specific manner

Alcohol consumption during adolescence is a growing issue that can lead to serious long-term consequences. Adolescents may develop alcohol dependence, increased anxiety, or depression. Recently, human data have shown that females binge drink more than males during adolescence. This study aimed to investigate the impact of intermittent alcohol exposure during late adolescence on changes in anxiety-like behavior and voluntary alcohol drinking in adulthood. Male and female C57BL/6J mice were intermittently exposed to binge alcohol in a vapor inhalation model (or air for a control) during late adolescence. Following a brief period of abstinence mice were assessed for anxiety-like behavior using the open field and marble burying tests. Following the behavioral tests, mice were given choice of alcohol and water via a two bottle paradigm with ethanol at 20%. The results show that male mice show a more robust anxiety-like phenotype in both the open field test and the marble burying tests compared to female mice. Our data for alcohol consumption did not show any differences between air-exposed and ethanol-exposed mice regardles of sex. Together, these data show that male and female mice exposed to binge alcohol exposure show anxiety-like behavior, but this effect appears more robust in males. We will continue to test voluntary ethanol during early adolescence to determine its effects on other anxiety-like behaviors and drinking patterns.

2021-008	Oral Presentation	Biological and Life Sciences

Student Presenter: **Bhat, Vanya; *UNC Chapel Hill***
Mentor: **Cohen, Todd; *UNC Chapel Hill***

Examining GFAP expression, C3 expression, IgM granule accumulation, and Tau5 antibody accumulation in a comparison between 3xTg-AD mice and wild-type mice

Alzheimer's Disease (AD) is a neurodegenerative disease associated with β-amyloid plaques accumulation (Bird, 1993). Studies have shown that reactive astrocytes have had a significant impact on neurodegenerative diseases. These astrocytes undergo remodeling in response to injury, disease, or infection of the central nervous system. (Escartin et al., n.d.) This study examines 3xTg-AD mice samples compared to wild-type (WT) mice to find which gene expression profiles define reactive astrocytes in zones of waste clearance. The GFAP and C3 protein expressions are examined, as well as Tau5 antibody accumulation. Results displayed that AD may impede astrocytic reactivity and inhibit the neuroimmune system.
Key Words: Alzheimer's Disease, 3xTg-AD mice, C3, GFAP, IgM, Tau5

2021-009	Oral Presentation	Biological and Life Sciences

Student Presenter: **Chan, Elizabeth; *East Carolina University***
Mentor: **Neufer, P. Darrell; *East Carolina University***

Metformin and mTPP Dose Response in Drosophila

Metformin has been the most used drug to treat diabetes for nearly 70 years, but its mechanism of action is unclear. Research shows that metformin impacts multiple pathways by accumulating in the mitochondria and inhibiting Complex I of the ETC. However, although mM concentrations are required to inhibit complex I in vitro, in vivo metformin only accumulates to µM levels. Metformin carries a formal positive charge and thus it, as well as other cations able to cross membranes, will accumulate in the negatively charged mitochondrial matrix, reducing the net electrochemical charge across the inner membrane. This decreases the efficiency of ATP production, which in the context of a positive energy balance is predicted to promote health span and longevity. The purpose of this study is to test this hypothesis in Drosophila simulans.
In flight muscle of flies (cuticle), titration of metformin (1-200 mM) or methyl-triphoniumphosphate (cation; mTPP; 0.01-0.25 mM) induced a dose-dependent decrease (30-50% max) in mitochondrial ADP-stimulated oxygen consumption rate (JO2; normalized to complex IV activity). To establish the effect of cations in vivo, flies were fasted for 20 hours and then provided food containing mTPP (0-1.0 mM) with blue dye for two or four hours. Surprisingly, despite evidence of food consumption, ADP-stimulated JO2 was not affected, suggesting either flies did not consume enough food, that mTPP was not absorbed, or that it is ineffective in vivo. Additional feeding studies are underway to distinguish between these possibilities.

2021-010	Oral Presentation	Biological and Life Sciences

Student Presenter: **Clark, Fiona; *UNC Charlotte***
Mentor: **Reitzel, Adam; *UNC Charlotte***

DNA Demethylation in Nematostella vectensis

DNA methylation is a key process in the development and expression of genes within multicellular organisms. However, biology has overlooked DNA methylation modifiers in invertebrates but especially marine invertebrates. In an effort to understand the effects of modifiers on marine invertebrates, I studied Nematostella vectensis which was treated with the DNMT inhibitor 5-azacytidine. The DNMT inhibitor 5-azacytidine was used to interrupt DNA methylation during the larval stage of the sea anemone Nematostella vectensis to measure the impacts on survival and successful metamorphosis. Trials were performed to determine the highest concentration larva survived while exposed to 5-azacytidine. The trials resulted in an LT50 of 0.75 µl/mg. Looking for defining concentrations that result in a majority survival gives us 0 µl/mg, 0.1 µl/mg, and 0.5 µl/mg. It should be noted that even with these defined concentrations there appeared to be no stopping point when it came to the death rate in 5-azacytidine, but it became relatively stable after day 6. This observational data suggests that in low concentrations there is a significant loss in organisms as well as a halt in metamorphosis for some individuals.

2021-011	Oral Presentation	Biological and Life Sciences

Student Presenter: **Dudley, Christa; *Fayetteville State University***
Mentor: **Graham, Danielle; *Fayetteville State University***

Searching the Soil to Discover Antibiotics that Target Gram Negative Bacteria

Since the discovery of penicillin, antibiotics have been widely used to treat bacterial organisms. However, antibiotic resistance, which occurs when an antibiotic can no longer inhibit bacterial growth, is a significant problem that increasingly worsens as more bacteria become superbugs. Some of the most dangerous bacteria are classified as Gram-negatives, which are more difficult to treat. Infection with pathogenic Gram-negative bacteria can result in septic shock, which can be fatal. Therefore, the objective of this study is to identify novel antimicrobials that can inhibit Gram-negative bacterial growth. First, bacteria were cultured from soil samples and screened against safe ESKAPE relatives. From this screening, five bacterial isolates demonstrated inhibition against Bacillus subtilis based on the Kirby-Bauer agar test assay. Next, bacteria were confirmed to be Gram-negative through Gram-staining and MacConkey agar test. Further characterization testing showed all five isolates to be non-motile and three to be catalase positive. Furthermore, DNA was extracted from each isolate, and the 16S rRNA gene was amplified via PCR. In conclusion, we discovered five Gram-negative soil isolates that inhibited the growth of the safe ESKAPE relative, Bacillus subtilis. Future studies include further characterization of the bacterial isolates by DNA sequencing.

2021-012	Oral Presentation	Biological and Life Sciences

Student Presenter: **Frost, E. Joy; *North Carolina School of Science and Math***
Mentor: **Mallory, Heather; *North Carolina School of Science and Math***

Temperature Stress and RGA2 Expression in Musa acuminata

Bananas are a staple crop for roughly 400 million people around the world (Dale et al.) and, as a monoculture, are susceptible to mass die-offs caused by disease. While others are searching for ways to engineer immunity to those diseases for Musa acuminata, I seek to determine if temperature affects the expression of a known immunity gene, resistance gene analog 2 (RGA2), in M. acuminata. The question that I pose is: How does cold stress affect the expression of the RGA2 gene in Musa acuminata? I chose to subject the plants to cold shock because M. acuminata is more susceptible to damage from temperatures slightly below their preferred range than to temperatures slightly above their range. Our changing climate increases the possibility of colder winters. To answer this, I cared for 8 M. acuminata subgroup Cavendish Grand Nain plants, extracted RNA from their leaves and quantified it, performed rt-PCR with the extracted RNA, and used ImageJ to quantify RGA2, actin (ACT), and small heat shock protein (HSP) expression. I used an unchanging gene, ACT, and a temperature dependant gene, HSP, as control genes. If the expression of RGA2 is lower than it is in M. acuminata's ideal temperature range, growers would know to check M. acuminata for signs of infection if temperatures dip below 14C.

2021-013	Oral Presentation	Biological and Life Sciences

Student Presenter: **Grace, Sarah; *Campbell University***
Mentor: **Bunn, Jennifer A.; *Campbell University***

Changes in Sleep Quality in Division I Women's Lacrosse Athletes

This study assesses changes in sleep quality in Division I female lacrosse athletes throughout the academic/training year. The athletes (n=34) completed an online questionnaire to rate sleep quality each day of training and games. Sleep quality was rated in arbitrary units (AU) using anchors 0, 25, 50, 75, and 100, with higher scores representing better quality sleep. Friedman's tests were used to analyze differences in weekly sleep quality from the fall and spring semesters. Sleep quality scores in the fall ranged from 78.9-87.3 AU and 80.7-88.6 AU in the spring. There was a difference in sleep in the fall, p=.005, with two weeks in mid-September (78.9-80.9 AU), and one week in mid-October (81.4 AU) having lower sleep quality scores (p=.001-.010). There were also weekly differences in the spring, p=.007, with lower scores during one week in mid-January and three weeks in early to mid-April (78.0-79.3 AU) and higher sleep quality scores were noted during mid- to late-February (83.8-86.5 AU), p=.009-.046. The university was on a COVID-19-related pause for in-person activities during mid-October, just after a week of poor sleep quality. Many mid-term exams took place, and mid-term grades were finalized. Upon return to normal activities, sleep quality also returned to normal levels. The reduction in sleep quality in April aligned with preparation for final exams. These factors likely contributed to the decline in sleep scores. The results indicate that poor sleep quality among the studied athletes was related more to academics and personal life than training load and athletics.

2021-014	Oral Presentation	Biological and Life Sciences

Student Presenter: **Harris, Jayden; *UNC Chapel Hill***
Mentor: **Aponte Diaz, David; *UNC Chapel Hill***

Host c-Fos modulation during enterovirus infection

Enteroviruses are a significant public health concern and currently have no antiviral therapeutics to target them. Enterovirus 3CD viral protein regulates aspects of membrane biogenesis and phospholipid induction and is vital to form virus-induced organelles and virus multiplication. Although the purpose of these virus-induced organelles is not fully understood, the prevailing hypothesis is that these compartments limit innate immune responses by preventing surveillance from pattern recognition receptors. The mechanisms by which enteroviruses hijack cell regulators of lipid biosynthesis are primarily unknown. 3CD co-purifies with c-Fos (a transcription factor), whose non-genomic functions include regulating lipid metabolism. We hypothesize that 3CD engages host cytoplasmic c-Fos to orchestrate signaling cascades associated with lipid metabolism and membrane biogenesis promoting replication organelle formation and viral genome replication. Here, we have engineered a vector encoding a bi-cistronic RNA to produce two distinct proteins simultaneously. We also constructed an IRES-only RNA-encoding vector that exploits IRES-mediated translation machinery in cells. We use these versatile constructs to deliver both viral and host factors into cells. mRNA transfections are quick in producing detectable protein via fluorescence imaging. Several techniques may be applicable with a fluorescence reporter in the second cistron, including cell sorting for isolating transfected cells, tracking transfection efficiency, and live-cell imaging. The pIRES expression system is helpful in the context of delivering proteins into infected cells when the virus inhibits the cellular translation machinery. Our initial studies focused on the successful ectopic expression of c-Fos using both a bi-cistronic and a pIRES construct.

2021-015	Oral Presentation	Biological and Life Sciences

Student Presenter: **Kantamsetty, Saishreeya; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***
Mentor: **Tyler, Lori; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***

Identifying Parasites with the Potential to Block Allergy-Inducing Proteins from Shellfish

Shellfish allergy is prevalent in today's modern world, as 10.3% of the general population is affected by it. This allergy can have adverse allergic reactions to the human body, which is why it is crucial to find a solution to prevent the allergic reaction from even occurring. The effects of the allergy-inducing proteins from the shellfish can potentially be alleviated with a parasite that has a protein sequence close to that of the allergy protein. This research provides information on which are the best parasites to remove the reactions of allergy-inducing proteins. Four parasites and their protein sequences were used with four different proteins on six types of shellfish and their protein sequences. A BLAST search was done to find the best statistical matches between shellfish and parasite proteins to identify the best parasite candidate for future studies. Of the four parasites examined, Ascaris lumbricoides and Ancylostoma duodenale were deemed the best potential candidates to prevent the allergic reactions caused by shellfish due to similarities in their structure.

2021-016	Oral Presentation	Biological and Life Sciences

Student Presenter: **Kauffman, Heidi; *North Carolina School of Science and Math***
Mentor: **Monahan, Kim; *North Carolina School of Science and Math***

Induced Resistance to Alternaria Alternata in Tomato Plants by Gamma-Aminobutyric Acid

Alternaria Alternata is a necrotrophic fungus that causes black spots in crops around the world. Fungicide is mainly used to combat this fungus but can run off into local aquatic ecosystems and kill the naturally occurring fungi that are important for balanced aquatic ecosystems. GABA is an inhibitory neurotransmitter that accumulates in plants in response to stressful conditions and when exogenously applied to plants it can induce resistance to A. Alternata with concentrations from 10, 100, and 1000 µg ml^{-1} with 100 µg ml^{-1} being the most effective. To optimize GABA's anti-fungal effect, a smaller range of GABA concentrations were tested. Forty grown tomato plants were sprayed with varying GABA concentrations: 0, 100, 300, and 500 µg ml^{-1}. 24 hours after application, liquefied A. Alternata spores at a concentration of 1 x 10^{24} spores ml^{-1} were injected into all forty plants. At 7 days post-infection, plants were assessed for their green percentage on their leaves. A. Alternata incidence in the tomato plants shows as yellowing leaves so if the green percentage is high, the incidence of A. Alternata is less. GABA was the most effective in increasing disease resistance for the GABA concentration of 300 µg ml^{-1} but less effective for the GABA concentration of 500 µg ml^{-1} since the green percentage for 300 µg ml^{-1} was the highest out of the four different concentrations. This means GABA at 300 µg ml^{-1} was the optimal concentration for preventing disease incidence. Further investigation of the GABA pathway could imply what receptors are working to induce resistance to A. Alternata.

2021-017	Oral Presentation	Biological and Life Sciences

Student Presenter: **Khaire, Archita; *North Carolina School of Science and Math***
Mentor: **Walsh, Kyle; *Duke University***

An Integrated Genome and Phenome-Wide Association Study Approach to Understanding Alzheimer's Disease Predisposition

Genome-wide association studies (GWAS) have identified 23 common, heritable alleles that increase risk of late-onset Alzheimer's disease (LOAD). We recently published an analytic approach to integrate GWAS and phenome-wide association study (PheWAS) data, enabling identification of candidate traits and trait-associated variants impacting disease risk, and apply it here to LOAD. PheWAS was performed for 23 known LOAD-associated SNPs and for control SNP-set using UK Biobank. Traits enriched for association with LOAD SNPs were used to generate list of trait-associated candidate SNPs that were tested for association with LOAD risk (17,008 cases; 37,154 controls). LOAD- associated SNPs were significantly enriched for associations with 6/778 queried traits, including three platelet traits. Strongest enrichment was for platelet distribution width (PDW) (P=1.2x10^-5), but no consistent direction of effect was observed between increased PDW and increased/decreased LOAD susceptibility. The genetic determinants of PDW have been studied extensively, and we assessed whether additional PDW-associated SNPs may also contribute to LOAD risk. Of 384 PDW-associated SNPs identified by prior GWAS, 36 were nominally associated with LOAD risk and 5 survived false-discovery rate correction for multiple testing. Associations confirmed previously identified LOAD risk loci near PICALM, CD2AP, SPI1, NDUFAF6, and identified a novel LOAD risk locus in the epidermal growth factor receptor (EGFR) gene. Through integration of GWAS and PheWAS data, we identify substantial pleiotropy between genetic determinants of LOAD and of platelet morphology, and for the first time implicate EGFR – a mediator of β-amyloid toxicity – in LOAD susceptibility.

2021-018	Oral Presentation	Biological and Life Sciences

Student Presenter: **Leon, Anny S.; *Central Piedmont Community College***
Mentor: **Dr. Yu, Shuangying; *Central Piedmont Community College***

Genomic annotation of insulin-like peptide 7 in Drosophila serrata

Studying genes and gaining knowledge of genomics is fundamental to understanding how organisms, populations, and species evolve. The Genomics Education Partners (GEP) and its Pathways Project provide individuals the opportunity to identify genes in the insulin signaling pathway across the Drosophila genus. The gene we chose was an insulin-like peptide 7 (Ilp7), which encodes an insulin-like peptide that binds to the InR receptor to activate the insulin signaling pathway. The Ilp7 gene has not been identified in Drosophila serrata, and our goal was to develop a gene model for Ilp7 in D. serrata. To accomplish this, we used multiple tools provided such as FlyBase, GEP UCSC Genome Browser, NCBI BLAST, Gene Record Finder, and Gene Model Checker. The Ilp 7 ortholog in D. serrata has three coding exons and two introns. It consists of a single isoform. In contrast with the genomic neighborhood of Ilp7 in D. melanogaster, the genomic neighborhood of the ortholog in D. melanogaster includes CG2875, AstA, Parg, and Mnt. However, after navigating the region surrounding the best collinear set of alignments of Ilp7-PA protein in D. serrata to the D. melanogaster, the putative ortholog CG2875 was not found. Instead, the second closest upstream gene identified was Ptpmeg2.

2021-019	Oral Presentation	Biological and Life Sciences

Student Presenter: **Lin, Gracie; *North Carolina School of Science and Math***
Mentor: **Monahan, Kim; *North Carolina School of Science and Math***

Investigation of the joint usage of GSK1016790A and OPC-31260 on restoring mating ability and raising intracellular calcium levels in lov-1 and pkd-2 single and double mutant Caenorhabditis elegans

Polycystic Kidney Disease (PKD) is a disease that is characterized by the accumulation of cysts on the kidneys, which progressively increase in size due to proliferation. Approximately 90% of all PKD cases are Autosomal Dominant Polycystic Kidney Disease (ADPKD), for which there is no effective treatment. Multiple treatments are undergoing clinical trials, and GSK1016790A and OPC-31260 have emerged as effective treatments. However, either drug alone has limitations in efficacy and off-target effects. In order to study these drugs further, the model organism c. elegans can be employed to study ADPKD due to mating behaviors in c.elegans that are dependent on the same genes associated with ADPKD. Utilizing this model, the efficacy of a combination of GSK1016790A and OPC-31260 was quantified by crossing male lov-1 and pkd-2 single and double mutant c. elegans with hermaphrodite c. elegans of the same mutation and treating them with a 2nM GSK1016790A concentration and 0.05% OPC-31260 concentration. If the treatments worked, mating would be restored in these crosses and males would be observed in the F2 population. To support the role of intracellular calcium in the restoration of mating behaviors, worms were also stained using fura-2/AM. A combination of GSK1016790A and OPC-31260 was found to be more effective in restoring mating ability in lov-1 and pkd-2 single mutants, as opposed to either drug alone. Thus, the combination of GSK1016790A and OPC-31260 is an effective treatment for ADPKD, and further trials investigating the combinatorial effects on ADPKD cells should be conducted.

2021-020	Oral Presentation	Biological and Life Sciences

Student Presenter: **Lorio, Caroline; *North Carolina School of Science and Math***
Mentor: **Heather Mallory; *North Carolina School of Science and Math***

Testing the Effectiveness of Phosphorous Mitigation Methods in Hog Lagoons

On a near-annual basis, hog lagoons across Eastern North Carolina overflow and pollute nearby waterways. These overflows can lead to a multitude of complications, including eutrophication (Gilbert 2020) and the overgrowth of phosphorus-limited microorganisms like cyanobacteria. In turn, this “bloom” of cyanobacteria can lead to hypoxic waters and fish kills (Visser et al. 2018). In the absence of more efficient hog waste disposal and storage methods, how can we mitigate the growth of cyanobacteria after an overflow? Unlike many other photosynthetic prokaryotes, cyanobacteria have access to atmospheric nitrogen with the use of specialized cells called heterocysts and are therefore not nitrogen limited., but are often phosphorus limited. By decreasing the amount of available phosphorus in hog lagoons, we will be able to reduce an overflow’s effects on aquatic ecosystems before the overflow occurs. This study seeks to find out the effectiveness of clay minerals like Kaolinite and Bentonite in reducing available phosphorus in hog lagoons. Results show that Kaolinite and commercial phosphate binders can significantly reduce the growth rates of cyanobacteria that have been exposed to a hog lagoon analog, and Bentonite seems to have little effect on the growth of cyanobacterial cultures.

2021-021	Oral Presentation	Biological and Life Sciences

Student Presenter: **Mikula, Olivia; *UNC Charlotte***
Mentor: **Reitzel, Adam; *UNC Charlotte***

Diversity and Functionality of Major Intrinsic Proteins in Early Animal and Cnidarian Evolution

Aquaporins and aquaglyceroporins are Major Intrinsic Proteins (MIPs) that serve as transportation channels that move water and small molecules across the cell membrane through selectively filters. The MIP family has expanded in both prokaryotes and eukaryotes, but remains little studied within marine invertebrates, including cnidarians. Cnidarians are a phylum of animals informative for the evolution of gene families and protein function due to their phylogenetic position as an outgroup to vertebrates and insects. We first determined the diversity, expression, and water transportation functionality of eight MIPs from the sea anemone, Nematostella vectensis. We accomplished this by studying expression data, predicting functionality with protein modeling, and testing functionality using yeast transformation and growth assays. These results showed large differences amongst MIPs from this species, including isolated expression in particular cell types and differences in pore size (e.g., Nematostella's Aquaporin 3 (NvAq3) has a small pore radius and is primarily expressed in a subset of digestive tissues). We predicted the NvAq3 protein would not function as a water transporter due to its small pore size, which we confirmed through experimentation with yeast. However, we hypothesize that NvAq3 may act as a membrane transporter and be functional in transporting an ion or molecule smaller than water. Currently, we are repeating these integrative methods on MIPs of 5 species that represent the transition from unicellular eukaryotes to multicellular animals. The results of this study will be used to understand the evolution of structure-function relationships for MIPs in the emergence of animals.

2021-022	Oral Presentation	Biological and Life Sciences

Student Presenter: **Pearson, Morgan; *Catawba College***
Mentor: **Hartwig, Carmony; *Catawba College***

Investigating the Peroxidation-Associated Mechanism of Artemisinin-heme Adducts in a Yeast Model System

Artemisinin continues to be the most promising antimalarial treatment in human populations, due to its ability to rapidly kill Plasmodium parasites with lower required concentrations. Currently, artemisinin and its derivatives are used in combination therapies, to help stave off parasite pharmacokinetic resistance. Chemically, artemisinin is a naturally occurring sesquiterpene lactone, containing an endoperoxide pharmacophore. Heme iron-mediated cleavage of the endoperoxide within the parasite digestive vacuole is hypothesized to generate cytotoxic metabolites capable of alkylating heme and damaging cellular macromolecules, such as proteins; however, the exact mechanism by which artemisinin exerts its antimalarial activity is still disputed. Our laboratory has demonstrated a previous connection between artemisinin-heme adduct formation and peroxidation of neutral lipids, suggesting a mechanism by which artemisinin activation leads to cellular oxidative peroxidation and death. To further address the question of artemisinin toxicity mechanisms within the malaria parasite, we have adapted our in vitro assay to a yeast model system that serves to investigate the heme-mediated ability of artemisinin to induce cellular toxicity via lipid peroxidation. Specifically, we hypothesize in a heme-enriched environment, that simulates malaria parasites, artemisinin will form heme adducts that will in-turn initiate lipid peroxidation cascades and induce apoptosis in yeast cells, as demonstrated through cell viability and peroxidation detection assays.

2021-023	Oral Presentation	Biological and Life Sciences

Student Presenter: **Putnam, Kendall L.; *Meredith College***
Mentor: **Carter, Andrea A.; *Meredith College***

Analysis and Determination of Protein Function as Related to Structure.

Using computational tools, it is possible to gain insight into a protein's function based upon its structural and sequential components. This is because proteins containing homologous structural and sequential components are more likely to share the same or similar functions. The primary goal of this research project was to propose a function for a particular protein with a known structure. Using online databases such as ProMOL, BLAST, Pfam, Dali, Moltimate, and PyRX, this project has examined the motifs and homologous components of proteins with known functions in order to compare them to the proteins whose function will be determined. The protein that was analyzed and assigned a function throughout this project is 4Q7Q. 4Q7Q is commonly found in soil bacteria, and it's structure was determined by the Midwest Center for Structural Genomics as a part of the Protein Structure Initiative. It was found that protein 4Q7Q belongs to the GDSL hydrolase family, most likely the class responsible for cleaving carboxylic ester bonds. The proposed function of the protein is an acetyl-xylan esterase, an enzyme that catalyzes the deacetylation of xylans (or xylo-oligosaccharides).

2021-024	Oral Presentation	Biological and Life Sciences

Student Presenter: **Rashad, Layla; *Fayetteville State University***
Mentor: **Yuan, Jiazheng; *Fayetteville State University***

Analysis of Wild Soybean Accessions Resistance to PSD

The fungal pathogen Phomopsis longicolla causes Phomopsis Seed Decay (PSD) in soybean. PSD results in seeds to degrade in physical appearance and quality. These degraded seeds will be discolored and misshapen as well as being of low quality, having hard outer coating, and low germination rates. PSD can affect soybean tissue at any stage of growth but the most susceptible near seed maturity. Moisture and high temperature increase the symptoms of PSD and for this reason it is a greater concern in the mid-southern region of the United States. The most common and popular means to tackle PSD is the use of plant resistant cultivars, regular crop checks, rotation between soybean and non-soybean crops as well as keeping to a strict harvesting schedule to minimize infection rates. Studies in this area of fungal pathogens are relatively sparse, particularly in the United States, making it a crucial subject for research. Another issue is the lack of genetic variation amongst soybean seeds. In the United States 99% percent of today's soybean families can be traced back to 80 soybean ancestor accessions. To improve the genetic variability of current soybean germplasm, it will be very important to select PSD resistant accessions from the USDA Soybean Germplasm Collection. The objective of this study is to assess PSD resistance using soybean wild accessions (Glycine soja) to evaluate the genetic variation of these lines against fungal pathogen P. longicolla and thereby enhance soybean disease resistance at Fayetteville State University (FSU).

2021-025	Oral Presentation	Biological and Life Sciences

Student Presenter: **Reyes, Sandibel; *North Carolina Central University***
Hart, Chay'la
Mentor: **Silver Key, Catherine; *North Carolina Central University***

An Interdisciplinary Approach to Studying Alcohol Abuse Disorder using Drosophila melanogaster.

Approximately 14.5 million Americans suffer from alcohol use disorder (AUD), but only one million receive treatment. To facilitate treatments and preventive measures, it is imperative to understand the genetic causes of AUD. The DaBuGs research internship uses an interdisciplinary approach to discover these causes. Through behavioral genetics, researchers aim to pinpoint alcohol-resistance SNPs associated with AUD genes. Since Drosophila melanogaster (fruit fly), has 60-75% gene homology with humans, it is a useful model organism. In fact, a living library of genetically different flies, the Drosophila Genetic Reference Panel (DGRP), is found to have varying response rates to controlled ethanol exposure. In this study a subset of the DGRP strains were exposed to alcohol using the Ethanol Mobility Behavioral Assay (EMBA) and sedation times (ST) were compared to the control w1118 fly strain to determine alcohol sensitivity or resistance. The EMBA results for the following DGRP strains will be discussed: DGRP-882, DGRP-437, DGRP-639, DGRP- 555, DGRP-304 and DGRP-315. In collaboration with FabLab and electrical engineering, a behavioral apparatus was created using TinkerCAD and 3D printing to automatically disturb the flies with consistent force and timing: aiming to reduce error and increase assay efficiency. The device consists of a 3D-printed plastic foundation and an Arduino board equipped with a timer, linear actuator, and an LCD screen. The prototype apparatus should facilitate accurate DGRP data collection. The completed data set will be analyzed using a Genome Wide Association Study (GWAS) to identify genes involved in AUD in flies and translate it to humans.

2021-026	Oral Presentation	Biological and Life Sciences

Student Presenter: **Rosas Acosta, Virginia; *East Carolina University***
Mentor: **Peralta, Ariane; *East Carolina University***

Long-term nutrient enrichment effects on soil microbiomes and greenhouse gas production in a coastal plain wetland

Human activities (e.g., combustion of fossil fuels, intensive agricultural practices) lead to changes to elemental cycles. These activities have increased atmospheric deposition of nitrogen and phosphorus onto ecosystems that do not receive direct inputs of agricultural and industrial runoff. Thus, nutrient enrichment to historically low nutrient ecosystems can unintentionally modify critical ecosystem functions such as carbon storage. Slow decomposition rates and high carbon fixation rates are hallmarks of wetland ecosystems. Previous investigations revealed that nutrient additions positively influenced wetland plant biomass and microbial diversity, but fertilization effects on wetland greenhouse gas production (i.e., carbon losses) is unknown. This study examines how long-term fertilization of a low nutrient wetland affects the relationship between soil microbial diversity and greenhouse gas production. We hypothesize that nutrient addition increases microbial activity in ways that enhance greenhouse gas production, which could offset this key carbon storage function. We test this hypothesis using data collected from a long-term wetland fertilization experiment (Greenville, North Carolina, USA). This experiment (est. 2003) examines how nutrient additions (N-P-K fertilizer) and disturbance (by mowing) affects wetland community structure and function. We collect annual soil bacterial community composition and diversity based on 16S rRNA amplicon sequencing and measure monthly rates of greenhouse gases (carbon dioxide, methane, nitrous oxide) using static chamber methods. Results reveal that fertilization increases soil bacterial diversity and carbon dioxide is the main greenhouse gas produced. This ongoing work suggests that nutrient enrichment is supporting increased soil bacterial diversity and could be changing carbon storage potential of this wetland.

2021-027	Oral Presentation	Biological and Life Sciences

Student Presenter: **Shirolkar, Parth; *North Carolina School of Science and Math***
Mentor: **Monahan, Kimberly; *North Carolina School of Science and Math***

Investigation of the synergistic and antagonistic properties of rapamycin and fructose on the longevity of Caenorhabditis Elegans.

Obesity persists to be one of the most prevalent causes of premature death, killing over 2.8 million people a year. Diets high in fructose have been suggested to be a cause of obesity, by increasing fat deposits and thus decreasing lifespan. To model human lipid storage, scientists have used C. elegans, a nematode proven to be a great model organism for both lipid storage and longevity. In C. elegans, fructose has been proven to activate TORC1, a complex known to promote lipogenesis. To quantify the effect of different fructose concentrations and rapamycin on the lipid storage of C. elegans, various amounts of fructose were added to OP50, in concentrations of 0-10% with or without rapamycin. A lipophilic dye(Nile Red) was applied to measure the amount of fat deposits for each treatment. C.elegans treated with lower levels of fructose did not lead to a significant increase in intestinal fat deposits until a 7% concentration; exposure to rapamycin mitigated the effect of fructose on IFDs. In order to study lifespan, C. elegans were treated with 0%, 3%, 7%, and 10% fructose with and without rapamycin. After 30 days, rapamycin prevented the lifespan-decreasing properties of a high fructose diet, and enhanced the lifespan-increasing properties of a low fructose diet. Overall, these experiments suggest rapamycin as a treatment to both the fat-increasing and lifespan-decreasing effects of a high fructose diet. This treatment has the potential to reduce obesity on an international scale, and can serve to lengthen the human lifespan.

2021-028	Oral Presentation	Biological and Life Sciences

Student Presenter: **Sylvestri, Autumn; *North Carolina State University***
Mentor: **Kolar, Praveen; *North Carolina State University***

Comparative analysis and optimization of lignin degradation for the production of high-value end products

As the negative impacts of global warming are observed worldwide, there is an urgent need for sustainable alternatives to traditional petroleum-based energy sources and products. The renewable and abundant nature of lignocellulosic biomass, which is produced as waste from agricultural and forestry processes, makes the conversion of plant biomass into biofuels and other high-value end products an attractive alternative. Though cellulose and hemicellulose bioprocessing has been studied extensively, and these compounds can be effectively degraded into valuable biological products, lignin does not have an efficient processing method, resulting in hundreds of millions of tons being burned as waste annually. Since lignin is a substantial component of lignocellulosic biomass, its underusage is not due to a lack of raw material but the highly complex structure of the molecule. As a heterogeneous aromatic polymer, lignin is recalcitrant to decomposition; current thermochemical processing requires intensive energy input, limiting industrial feasibility. Optimizing the degradation and conversion of lignin into high-value end products is critical for the continued valorization of plant biomass as an eventual replacement for petroleum-derived products. This project seeks to identify and optimize highly specific, cost-effective lignin degradation by two treatments: microbial enzymes and alkaline chemical catalysts. Conditions of maximum efficacy—optimal loading, temperature, and pH conditions—are being determined using gas chromatography-mass spectrometry to investigate the valuable phenolic compounds produced, such as vanillin and benzoic acid. Then, the selectively oxidized lignin samples will be further characterized by X-ray photoelectron spectroscopy (XPS) and time-of-flight secondary ion mass spectrometry (ToF-SIMS) analyses.

2021-029	Oral Presentation	Biological and Life Sciences

Student Presenter: **Torzone, Sarah; *UNC Chapel Hill***
Mentor: **Dowen, Robert; *UNC Chapel Hill***

LIN-61 regulates growth and lipid homeostasis via suppression of DRL-1 in C. elegans

Lipid metabolism and intercellular lipid transport play essential roles in many physiological processes such as growth, reproduction, aging, and cellular and organismal homeostasis. In mammals, lipoproteins transport lipids to tissues for utilization or storage. In C. elegans, a genetic model system used to investigate the molecular mechanisms of cellular homeostasis, lipid transport occurs via vitellogenin proteins, which facilitate transport of lipids from the intestine to the germline. In C. elegans, mutation of drl-1, a MAP kinase orthologous to human MEKK-3, results in a dietary restricted state. Dietary restriction has been associated with reduced risk of metabolic disease and increased longevity in humans for incompletely understood reasons. The drl-1 mutants are slow-growing, lipid-devoid, and have reduced vitellogenin gene expression. We identified lin-61, a chromatin factor that binds to methylated histones (H3K9me2/3), in a genetic screen for mutations that suppress the drl-1 mutant phenotypes. These data suggest that LIN-61 normally antagonizes vitellogenin expression, body size, and growth rates in C. elegans. Future experiments will elucidate the exact mechanisms by which LIN-61 opposes DRL-1 signaling to regulate the metabolic tradeoffs that balance growth, reproduction, and aging. Investigating the molecular controls of lipid metabolism and transport is significant to the understanding of metabolic dysregulation which underlies major human pathologies such as Type II Diabetes, obesity, cancer, cardiovascular disease, and chronic inflammation.

2021-030	Oral Presentation	Biological and Life Sciences

Student Presenter: **Wilson, Edwin; *North Carolina School of Science and Math***
Mentor: **Mallory, Heather; *North Carolina School of Science and Math***

Snails as Bioindicators of Heavy Metals from Coal Ash

Coal ash spills that contain high levels of heavy metals can cause significant environmental damage which is often difficult or expensive to quantify and mitigate. The objective of this study was to assess the ability of native US aquatic snails to exhibit a measurable response to heavy metal (lead, iron, copper, arsenic) exposure for the purpose of determining whether they could reliably function as bioindicators for coal ash spills. It has been hypothesized that snails exposed to increased heavy metal concentrations show increased activity of the Glutathione S-Transferase (GST) enzyme and an increase in the presence of micronuclei– extra smaller nuclei which can develop under toxic conditions– in cells. To test the hypothesis, I kept snails for two weeks in containers with one of three heavy metal concentrations and then conducted a micronuclei count and GST enzyme analysis. Snails exposed to heavy metals exhibited no significant difference in micronuclei frequency than snails not exposed to heavy metals. GST analysis is still underway. In addition to the snail exposure experiment, soil samples were collected from the bank of the Dan River, both upriver and down from the site of a 2014 coal ash spill. Samples were digested by acid and analyzed for heavy metal concentrations using flame atomic absorption spectroscopy, for the purpose of determining remaining environmental damage almost seven years later. My findings thus far suggest that GST and micronuclei analyses may not be reliable markers in snails to determine heavy metal presence, but future research could explore other options.

2021-031	Oral Presentation	Biological and Life Sciences

Student Presenter: **Bland, Jessica; *Meredith College***
Muraco, Kaitlyn
Mentor: **Stutz, Matthew; *Meredith College***

Costal Erosion on the North Carolina Coast

The study of coastal erosion shows the continuously rising sea level. Extensive research and data analysis on coastal erosion of the North Carolina coastline through comparative mapping analysis using Google Earth historical images and path tools helped collect the data. Images from 1994, or the earliest clear image available (2002 in some comparisons), to 2019 were used to analyze the erosion rates. Google Earth's path tool was used to create paths along the wet/dry line in the 1994 image and then again in the 2019 image. Vertical lines were then drawn every 50 km, allowing for measurement between the horizontal path lines. Coastal erosion rate was compared to different locations throughout the North Carolina islands. Comparing the results using graphs provides a detailed and in-depth look at the erosion rates in different areas. From there, it was easier to compare which areas were more affected by costal than others. Other aspects had to be included, such as the replenishing of sand. Islands that experience tourism or inhabited areas have gained land. Due to erosion and government interception on capes/inlets, they have changed shape entirely and have reformed with the tide. A rise in coastal erosion can vary depending on location. Several islands showed a steady incline in erosion rates while others under development commonly showed a decline. Areas without the influence of people show how coastal erosion is affecting those areas and how the implications can affect the island in different ways.

2021-032	Oral Presentation	Biological and Life Sciences

Student Presenter: **Prather, Asia M; *Fayetteville State University***
Mentor: **Chao, Dr. Shirley; *Fayetteville State University***

Efficiency of Clove Oil on Mortality and Repellency on Tribolium Castaneum

Red flour beetles (T. Castaneum) are a pest to stored products and agricultural crops. A hemp-based pesticide (HDX) was developed by Fayetteville State University to combat poultry and agricultural pests with no toxicity to poultry and other vertebrates and livestock. There is not a vast amount of literature on using essential oils when it comes to mortality and repellency on Tribolium species. Clove Oil is the essential oil that was tested alone and in combination with HDX to determine potential synergism. The method that was used to measure the effectiveness of the essential oil along with the HDX was a mortality toxicity test. From conducting the mortality toxicity tests, it is concluded that Clove Oil inhibits acetylcholinesterase by measuring from the Acetylcholinesterase Assay. Clove Oil has had an increase on mortality and repellency on the Tribolium species. When combined with HDX, synergism was not clear but independently, HDX and Clove Oil does cause an increase on this species. To continue this study, repellency will be determined by conducting choice tests to determine efficacy of essential oils and hemp in controlling and/or repelling Tribolium pests. The mode of action will be investigated such as impact on amylase activity due to antifeeding and repellency effects. Liquid formulations will be developed using hemp, Clove Oil, and other possible essential oils.

2021-033	Oral Presentation	Biological and Life Sciences

Student Presenter: **Wallace, Emma; *North Carolina State University***
Mentor: **Burford Reiskind, Martha; *North Carolina State University***

Population Genetics and Sex Determination in Southern Flounder (Paralichthys lethostigma)

Climate change has devastating effects on aquatic species, and the southern flounder (Paralichthys lethostigma) is no exception. The southern flounder is a critical species to commercial fisheries, accounting for $5.77 million dollars in profits, and is a key predator in Atlantic ecosystems. This species is at risk with an insufficient management plan. A key component of juvenile development of this species is temperature dependant sex determination which is affected by rising global temperatures. In favorable conditions, the southern flounder offspring will be ~50% male and ~50% female. Recent unfavorable conditions have caused genotypically female offspring to present as phenotypically male resulting in a skewed sex ratio. I used a population genetics approach to evaluate the population structure of the southern flounder along its native range and conducted an outlier loci analysis to determine if there are genes under selection that play a role in sex determination for this species. I discovered structured populations of southern flounder between the Gulf of Mexico and North Carolina samples that suggested less gene flow between populations than often assumed in aquatic systems. I identified genomic regions that are under directional selection between sexes. I am continuing this research to identify the putative genes in these regions that may influence southern flounder sex determination. Understanding the effects of skewed sex ratios and the overall degree of population structure throughout the wild population is critical for effective management with the goal to maintain favorable sex ratios with adequate genetic diversity and viable population sizes

2021-034	Oral Presentation	Business and Economics

Student Presenter: **Miller, John; *North Carolina School of Science and Math***
Mentor: **Dur, Umut; *North Carolina School of Science and Math***

An Analysis of the Asheville City School Student Assignment Mechanism

Student assignment mechanisms are the processes by which students are assigned to schools based on preference and priority. In many school systems, including Asheville City Schools, student assignment mechanisms dictate magnet school enrollment. However, not all mechanisms are the same, some school systems use processes that are not welfare maximizing (Pareto-efficient) or that force families to game the system (not strategy-proof), these flawed mechanisms lead to unideal student assignments. These mechanisms require insight and study to understand the flaws and how the flaws negatively impact the students. To understand the Asheville City student assignment mechanism, we reviewed their school board policies and interviewed the Director of Secondary Education for the school system. Then we compared the Asheville City mechanism to other mechanisms in literature, both applied and theoretical. Through these comparisons, we determined that the Asheville City school's mechanism is very similar to the Boston student assignment mechanism. Both these mechanisms are not strategy-proof, causing students and parents to be untruthful with their school preferences and to play games with the student's education. To fix the flaws in the Asheville City Schools student assignment mechanism, we suggest the implementation of a new mechanism that focuses on deferred acceptance, which involves tentatively accepting and rejecting students in cycles until all students are placed, while also achieving the system's goals in diversity.

2021-035	Oral Presentation	Business and Economics

Student Presenter: **Porter, Jonathan; *East Carolina University***
Mentor: **Pulido, Corey; *East Carolina University***

Using Virtual Reality to Motivate Remote Employees to Positively Impact the Effects of Burnout

During the Covid-19 pandemic, many businesses made the decision to transfer work positions to a virtual format. Companies have realized the benefits of maintaining remote positions and many plan to retain remote positions following the pandemic. Some employees working virtually have experienced increased levels of burnout and exhaustion without a rigid structure and less interpersonal communication. Identifying ways that managers can motivate these employees and prevent burnout is important to the longevity of these positions. This study identifies and highlights the implications of virtual reality (VR) as a means of reducing and managing stress factors contributing to burnout. Research highlights the successes of virtual reality in modifying psychological factors and denotes potential applications of virtual reality to curb burnout in remote workers.

2021-036	Oral Presentation	Business and Economics

Student Presenter: **Walker, Alexis; *Fayetteville State University***
Mentor: **Wenzel, Nikolai; *Fayetteville State University***

Examining Immigration from Central America

Immigrants from Central America, specifically from countries like Guatemala, Honduras, and El Salvador, have been arriving in the United States in increasing numbers. These Central American countries are known as the Northern Triangle. According to the World Bank, during the period 1987 to 2019, these countries' economic standing based on their Gross Domestic Product (GDP) and Gross National Index (GNI) has been on the rise. So, why is there the constant rise of immigrants arriving from these countries to the U.S.-Mexico Border? To answer this question, we will look into each of these countries' economic and political standings from 2008 to the present time (2021). Next, since these immigrants are coming to the U.S., I will analyze what each U.S. Administration did to curb immigration, and what type of foreign policies were implemented. Lastly, I will conduct an in-depth analysis on the root causes behind the increased immigration challenge, and also explore potential solutions that could reduce migration from the Northern Triangle.

2021-037	Oral Presentation	Chemical Sciences

Student Presenter: **Augoustides, Victoria; *North Carolina State University***
Mentor: **Praveen Kolar; *North Carolina State University***

Sythesisis of Glucose and Biochar from Pinus taeda residues

The confluence of the pine and swine sectors is the subject of this research as there is a growing movement towards building a circular bioeconomy in North Carolina. In swine farming, the traditional business model known as contract farming tasks the grower with waste treatment. Hog production yields wastewater that is teeming with ecologically hazardous chemicals, and growers are interested in lowering the cost of effluent treatment. Using biochar derived from lignocellulosic Loblolly pine biomass to eliminate those harmful chemicals might be a promising solution for this issue. This study seeks to valorize the biomass residue further by isolating the carbohydrates present and then synthesizing valuable glucose to be sold as a precursor to other bioprocesses. A bioprocess that involves enzymatically hydrolyzing cellulose from lignocellulosic Loblolly pine biomass into glucose, and subsequently producing biochar has been developed. Each step of the bioprocess has been chemically characterized using acid value, point of zero charge, elemental analysis, scanning electron microscopy and Time-of-Flight Secondary Ion Mass Spectrometric Analysis to obtain a snapshot of the chemical and physical changes the biomass is undergoing. Additionally, glucose has been successfully generated and quantified from the lignocellulosic biomass. The previous results are being presented in addition to further investigation into the potential of this biochar to adsorb pollutants of interest in batch adsorption testing as well as the value of the spent biochar to be reused as a crop fertilizer.

2021-038	Oral Presentation	Chemical Sciences

Student Presenter: **Barbee, Brianna; *Elizabeth City State University***
Mentor: **Kumar, Bijandra; *Elizabeth City State University***

Cu and Ni co-sputtered Heteroatomic Thin Film for Nonenzymatic Glucose Detection: Synergistic Effect

Cu and Ni co-sputtered Heteroatomic Thin Film for Nonenzymatic Glucose Detection: Synergistic Effect
Brianna Barbee, Baleeswaraiah Muchharla, Wei Cao, Hani E. Elsayed-Ali, Adetayo Adedeji, Abdennaceur Karoui, Kishor Kumar Sadasivuni and Bijandra Kumar
Abstract: Diabetes is a chronic disease that spreads because of having too much sugar in blood. Millions of people across the globe suffer health condition due to diabetes. Continuous blood glucose monitoring is a key to detect and treat patients in early stages of diabetes. In this work, we report the synthesis and characterization of nickel (Ni) and copper (Cu) heteroatomic thin films using RF magnetron sputtering technique. As prepared Ni-Cu thin films were utilized as sensing platform for nonenzymatic glucose sensors. A comparative study with pristine Ni and Cu films evidence that Cu-Ni heteroatomic film exhibits synergistic effect for glucose detection in basic media. It also displayed applicability for glucose detection with varying concentration from 10 µM to 5 mM. The developed sensing platform with superior selectivity and enhanced stability can be used for realistic application.
Key words: heteroatomic thin film, Nonenzymatic, Glucose sensors, Copper, Synergistic effect

2021-039	Oral Presentation	Chemical Sciences

Student Presenter: **Chamarty, Meghana; *North Carolina School of Science and Math***
Mentor: **Tim Anglin; *North Carolina School of Science and Math***

Selective and Cost-Effective Depolymerization of Polyolefins via a Tandem Dehydrogenation and Metathesis Dual Catalyst System.

Due to its low cost and ease of production, polyolefin waste is abundant, making up about 57% of the 380 million tons of plastic waste produced annually. Currently, the plastics economy is a linear system. Each step in the linear plastics economy system uses lots of energy and produces waste, making this process highly unsustainable. An efficient method of recycling that can transform the polymer structure of plastic polyolefins into small monomer alkanes will allow for the plastics economy to be transformed into a circular economy. This research aims to develop a cost-effective metathesis- dehydrogenation tandem catalyst system composed of relatively safe and abundant first-row transition metals that can selectively depolymerize polyolefins into particular smaller molecular hydrocarbons. This process will not only break down the polymers in an efficient manner but will also create monomers that can be used in the plastics economy to produce plastic consumer products. In the present work, cobalt and nickel pincer ligand catalysts for dehydrogenation were synthesized, purified, and their efficacy for olefin dehydrogenation and metathesis tested as part of a tandem catalyst system with Re_2O_7. Each of these potential catalysts is evaluated in terms of their extent of degradation of polyethylene (PE) and the nature of products produced.

2021-040	Oral Presentation	Chemical Sciences

Student Presenter: **Chapel, Valen S.; *North Carolina School of Science and Math***
Mentor: **Bruno, Michael; *North Carolina School of Science and Math***

The design and synthesis of copper transporter 1 inhibitors to mitigate α-synuclein aggregation

Parkinson's Disease is denoted by the neurotoxic aggregation of α-synuclein, which has been demonstrated to increase with increasing levels of intracellular copper. The protein copper transporter 1 (CTR1) completes copper (Cu^+) uptake in cells, therefore serving as a possible drug target to help lower α-synuclein aggregation. This project focused on the design of a compound that could inhibit copper transporter 1 to lower copper uptake and consequently lower α-synuclein aggregation. Azo-stilbene structures, which are straightforward to synthesize, were computationally developed and docked to the crystallized structure of a Salmo salar copper transporter 1 that contains a binding site with 93% homology to human CTR1. Docking scores were compared to known inhibitors and two compounds were selected based on improved docking scores relative to the known inhibitors and an analysis of Lipinski's rules. A successful synthetic route has been predicted, starting with an aniline (o-anisidine, 2,4-dimethoxyaniline) and 2-methylresorcinol. A reaction with boron-tribromide will then complete the O-demethylation of the resulting compound. The compounds will next be assayed in vivo to evaluate the inhibition of CTR1; inhibition of CTR1 could prove to be a viable therapy to prevent α-synuclein aggregation and treat the symptoms of Parkinson's Disease.

2021-041	Oral Presentation	Chemical Sciences

Student Presenter: **Doki, Aniruddh; *North Carolina School of Science and Math***
Mentor: **Bruno, Michael; *North Carolina School of Science and Math***

Development of a Biodegradable Membrane-Disruptive Polymer for the Treatment of Cancer

Targeting therapies directly to cancer cells is important as it decreases unwanted interactions with healthy cells. pH-sensitive therapeutic targets are an area of interest when designing strategies to selectively target and kill cancer cells. This project aims to develop a pH-sensitive biodegradable polymer that interacts with the lipid bilayer of cells in acidic environments, insert into the membrane of tumor cells, and form pores that would kill the tumor cell. Computational tools were used to design a polymer that was hydrophobic, acidic, and selectively cationic in low pHs, and the polymer was successfully synthesized and characterized using FTIR. This synthesis was largely successful and could be tested using E. coli to demonstrate its potential as a novel treatment of cancer.

2021-042	Oral Presentation	Chemical Sciences

Student Presenter: **Huesa, Ana; *North Carolina School of Science and Math***
Mentor: **Michael Bruno; *North Carolina School of Science and Math***

Development of Colorimetric Sensor Array to Detect Irregularities in Honey Bee (Apis mellifera) Queen Reproductive Health

A major threat to honey bee (Apis mellifera) populations is a rise in queen infertility rates and the resultant increase in the frequency of supersedure, or replacement of a queen. Irregularities in queen fertility are indicated in queen bee pheromone composition, specifically QMP (queen mandibular pheromone) which is impacted by several mating and insemination factors. Worker bees are sensitive to these differences, influencing their behavior and the social organization of the hive. This project aimed to create a colorimetric sensor array that detects key components of QMP, homovanillyl alcohol (HVA) and methyl 4-hydroxybenzoate (HOB), which are decreased in low-quality queens. An array of 10 metalloporphyrin dyes were spotted onto a silica plate and exposed to desired volatile analytes, such as methyl benzoate which has a nearly identical structure as HOB. Color change patterns as a result of ligand binding were quantified by differences in RGB values using image processors. These methods can support the visual identification of QMP components and assess the performance of commercially available QMP supplements. This sensor could be used by beekeepers as a noninvasive marker of queen reproductive health.

2021-043	Oral Presentation	Chemical Sciences

Student Presenter: **Karnley, Nathlita; *Fayetteville State University***
Mentor: **Wilson, Mark.; *University of Nebraska- Lincoln***

Structure and Iron-binding of a Divergent Isocyanide Hydratase Homolog From Bacillus

Isocyanides are compounds containing a triply bonded carbon-nitrogen functional group that often possess antimicrobial or transition metal-binding activities. Isocyanide hydratase (ICH) is DJ-1 superfamily enzyme that hydrates isocyanides to yield the corresponding N-formamide. ICH is commonly present in the genomes of pseudomonad bacteria that are likely to encounter isocyanides, suggesting that the enzyme is needed to neutralize the toxic isocyanide natural products. Here, we report the in vitro enzymology and three-dimensional structure of a divergent ICH homolog from Bacillus anthracis (BaICH). BaICH purifies with a deep red color due to iron binding as determined using inductively coupled plasma mass spectrometry. BaICH crystallizes and diffracts X-rays to high resolution and is expected to lead to a three-dimensional structure. Unexpectedly, BaICH does not possess ICH activity in a standard assay. The purpose of this research is to identify the structural determinants of iron binding in BaICH and to understand the divergence of function in ICH homologs.

2021-044	Oral Presentation	Chemical Sciences

Student Presenter: **Li, Runzi; *UNC Greensboro***
Mentor: **Hematian, Shabnam; *UNC Greensboro***

Dioxygen Reactivity of Copper(I)-Manganese(II) Porphyrin Assemblies

The binding, reduction, and activation of dioxygen (O_2) at metalloenzyme active sites are vital for aerobic life. In particular, manganese has been found to interact with O_2 and its reduced derivatives (e.g., $O_2{\cdot}-$ and $O_2^{2}-$) in biological systems in numerous ways to promote a variety of essential functions in Mn-containing enzymes, including manganese superoxide dismutase (SOD), manganese catalase, oxygen-evolving complex (OEC) in photosystem II, and Mn/Mn or Mn/Fe ribonucleotide reductase (RNR). The nuclearity of these Mn sites varies significantly and typically the more complex redox processes are achieved at the multinuclear sites with two or more metal centers. Due to the unique O_2-reactivity of manganese and the catalytic advantages of multinuclear sites, we are interested in the dioxygen reactivity of a synthetic porphyrin- manganese(II)-copper(I) assembly. In this study, the formation of a (TPP)Mn/Cu/O_2 adduct (TPP: tetraphenylporphyrin) was investigated at room temperature and –90 °C. [(TPP)MnII] and its monopyridine complex have been shown to bind reversibly with O_2 at low temperatures. Interestingly, the reaction of O_2 with equimolar amounts of the corresponding reduced copper and manganese porphyrin complexes at low temperature leads to the formation of an intermediate species. This intermediate then isosbestically converts to a second species. Our spectroscopic results and nature of the O_2 intermediates involved will be discussed.

2021-045	Oral Presentation	Chemical Sciences

Student Presenter: **Loeb, Avery;** ***North Carolina School of Science and Math***
Mentor: **Bruno, Michael;** ***North Carolina School of Science and Math***

Design of a small molecule azo-stilbene inhibitor for α-Synuclein

Parkinson's disease is caused by the aggregation of toxic α-Synuclein fibrils and oligomers through the amyloidosis pathway. It has been shown that small molecule drugs are effective in binding to the protein and inhibiting the production of fibrils and oligomers. This project focused on the computational drug design and subsequent synthesis of drug candidates. Over 10,000 drug candidates were designed and assessed using Schrödinger Maestro computational software and two high-performing candidates were identified. These small molecules outperformed previously-identified natural inhibitors and their analogs. Both candidates were synthesized using a successful two-step synthesis. These drug candidates could be tested with an aggregation assay and in vivo to determine the effect they have on the amyloidosis of α-Synuclein and its toxic aggregates.

2021-046	Oral Presentation	Chemical Sciences

Student Presenter: **McAfee, Julia;** ***UNC Asheville***
Mentor: **McMahon, Caitlin;** ***UNC Asheville***

Expression of LuxS and Synthesis of SRH Based Covalent Inhibitors of Quorum Sensing in Bacterial Biofilms

Antibiotic resistance is a growing issue worldwide so there is a pressing need to find a new strategy to fight off bacterial infections. Antivirulence is a strategy designed to disarm rather than kill bacteria, eliminating the bacteria's evolutionary pressure to become resistant. Biofilms form as a bacteria layer within a hydrated matrix of polysaccharides and proteins enabling them to defend against antibiotics and the host immune system. Bacteria use quorum sensing to communicate through signaling molecules called autoinducers (AI) triggering gene expression change causing biofilm formation. The AI-2 pathway is Gram positive and negative bacteria, making it an attractive target for broad spectrum biofilm inhibition. The AI-2 signaling molecule derives from 4,5-dihydroxypentane-2,3-dione (DPD). The substrate S-ribosyl-L-homocysteine (SRH) is cleaved by LuxS into homocysteine and DPD which is the precursor for the AI-2 molecule. The main goal of this research is to inhibit LuxS through covalent inhibition. To create a covalent inhibitor for the LuxS protein, different inhibitors will be synthesized to mimic SRH with different electrophiles (alpha-beta unsaturated carbonyls) to find which best attach to the nucleophilic cysteine in the active site of LuxS. Enzyme activity assays will be run to evaluate the efficacy of the different inhibitors.

2021-047	Oral Presentation	Chemical Sciences

Student Presenter: **Roychoudhury, Hrishika; *North Carolina School of Science and Math***
Mentor: **Bruno, Michael J; *North Carolina School of Science and Math***

Green Synthesis of Biogenic Silver Nanoparticles using agri-food byproducts as a novel reducing agent

Silver nanoparticles exhibit unique properties and antimicrobial activity that allow for the potential to be developed as an anticancer agent. However, the synthesis of silver nanoparticles often employs complex methodology and hazardous chemicals. It is thus desirable to identify mechanisms of green nanoparticle synthesis which are simpler, safer, cost-effective, and environmentally friendly. This study aims to use a biological eco-synthesis of silver nanoparticles using agri-food byproducts as the source of the reducing agent necessary for synthesis. Three locally sourced food waste products, from muscadine grape skins, blackberry bagasse, and pecan shells, that are readily available in North Carolina and are known for being rich in antioxidants, were chosen for this study. The antioxidant potential of the three chosen agri-food byproducts was determined by ORP Sensing and a DPPH free-radical scavenging assay. Based on the results, Pecan shells were determined to have the greatest antioxidant activity and were chosen as the food byproduct to use as the reducing agent in the green synthesis of the silver nanoparticles. Pecan shell extract was able to successfully reduce silver nitrate to silver nanoparticles and will be further optimized for shape and efficiency. This project concludes that the green synthesis of silver nanoparticles using pecan shells as a reducing agent could be viably used as an alternate cost-effective and eco-friendly option in North Carolina.

2021-048	Oral Presentation	Chemical Sciences

Student Presenter: **Smith, William; *North Carolina State University***
Mentor: **Maggard, Paul; *North Carolina State University***

Visible-Light-Driven Water Splitting via Metal Oxide Semiconductors

Throughout this project, I investigated the synthesis of a small-bandgap metal oxide semiconductor capable of simultaneously reducing and oxidizing water into molecular hydrogen and oxygen, respectively. Currently, there is still no oxide with a suitably small bandgap to efficiently capture visible light for photocatalytic applications. Previous research has shown that exchanging Sn(II)-cations into the lattice of perovskite oxides results in a significantly decreased bandgap and allows for the absorption of visible light for photocatalytic applications.
Under UV-irradiation, my starting material, the (111)-layered perovskite Ba5Nb4O15 has shown to be very active for water splitting. By low-temperature ion exchange with a Sn(II)-halide flux, Sn(II) was exchanged for Ba2+ cations in the lattice of the starting material. This exchange resulted in a reduction in the material's wide bandgap, decreasing from ~3.90 eV to ~2.69 eV, measured via UV-Vis diffuse reflectance spectroscopy.
This reduction was also evident in the proceeding experiments. The Sn(II)-exchanged semiconductor was suspended in an aqueous solution of AgNO3 and irradiated with a simulated solar spectrum. The produced gases were collected volumetrically and characterized by gas chromatography. Throughout these experiments, a direct relationship between the amount of Sn(II) exchanged into the lattice and the amount of gas produced was observed. Additionally, when Ba5Nb4O15 was irradiated with only visible light the semiconductor was unreactive. Contrastingly, the reduced bandgap of the Sn(II)-exchanged samples allowed for the absorption of visible light, permitting photocatalysis.

2021-049	Oral Presentation	Chemical Sciences

Student Presenter: **Vaughan, Sophie; *North Carolina School of Science and Math***
Mentor: **Anglin, Tim; *North Carolina School of Science and Math***

Sustainable Combination Drug Therapy for the Inhibition of Acetylcholinesterase and Butyrlcholinesterase in Alzheimer's Disease

Alzheimer's Disease (AD) is the most prevalent form of dementia, currently affecting 50 million people worldwide with an expected 82 million people diagnosed by the year 2030. The projected increase is attributed to the rising levels of dementia in low- and middle-income countries with little access to possible AD therapies. This demographic led to the search for an abundant natural starting compound as it is cheaper to acquire, contributing to future sustainability and widespread treatment of AD. The only inhibitory drug of the 5 drugs currently available on the market is an inhibitor for acetylcholinesterase (AChE), the primary protein responsible for the breakdown of the neurotransmitter acetylcholine. Due to the multifactorial nature of AD, this treatment does little to halt the progression of the disease. Previous work has shown that butyrylcholinesterase (BChE) is responsible for the breakdown of acetylcholine when AChE levels drop. This project utilizes knowledge of these pathways to design a combination drug therapy for the inhibition of both AChE and BChE. Beginning with the compounds curcumin and gingerol derived from turmeric and ginger root, respectively, a merged framework and a reaction-based enumeration process were used to computationally model possible structures of an AChE or BChE inhibitory drug. Ligands have been selected for further optimization as determined by their binding affinity compared to tacrine, a known binder of both AChE and BChE, and are in the synthesization process. Future testing will be done to determine the in vitro inhibitory effects on each respective target of the designed structures.

2021-050	Oral Presentation	Chemical Sciences

Student Presenter: **Volety, Uma L; *North Carolina School of Science and Math***
Mentor: **Anglin, Tim; *North Carolina School of Science and Math***

Novel design of an inhibitor for treatment of Human Papillomavirus through the inhibition of the E6/E6AP/p53 ternary complex

Human papillomaviruses (HPVs) are small double-stranded DNA viruses that cause infections in epithelial cells. HPV infections are the most common sexually transmitted disease with around 92% of sexually active adults having contracted a strain in their lifetime. While most HPV infections are harmless in the realm of malignancies, there are four strains that are considered high risk and cause cancer. HPV-16, 18, 31, and 45 are the strains and they cause 100% of invasive cervical cancers. Through the mode of action for HPV, p53 - a protein that mediates apoptosis and cell cycle arrest, is degraded through the formation of the E6/E6AP/p53 ternary complex preventing the apoptosis of malignant cells infected with HPV. This leads to genomic instability and carcinogenesis. Based on this information, this project aimed to design an inhibitor of the E6/E6AP/p53 ternary complex in silico and confirm its efficacy. In silico design was completed using Schrodinger Maestro using the docking score, HERG score, and multiparameter optimization score for constraints on viable ligands. After in silico structural modifications, a 5-step synthetic scheme was identified for the most successful compound, Compound I. Compound I, the product of this proposed successful synthesis, aims to be tested using recombinant E. coli and a histidine pull-down assay to show the increased levels of p53 after the E6/E6AP/p53 ternary complex has been inhibited.

2021-051	Oral Presentation	Chemical Sciences

Student Presenter: **Vu, Catherine; *North Carolina School of Science and Math***
Mentor: **Bruno, Michael; *North Carolina School of Science and Math***

Identification and Investigation of AChE Inhibiting Compound(s) within Lepidium Meyenii (Black Maca)

Alzheimer's Disease (AD) is the most prominent neurodegenerative disease, yet no true cure for it has been found. The overactivity of acetylcholinesterase (AChE), which breaks down the neurotransmitter acetylcholine (ACh), leads to the neurodegeneration that contributes to Alzheimer's Disease, and thus AChE inhibitors are often used as treatments for AD. This project demonstrates that Lepidium meyenii (black maca), a Peruvian root traditionally used in teas, has AChE inhibition activity and seeks to isolate and investigate the active compound/compounds. Black maca powder was successively extracted with dichloromethane and ethanol/water (70:30) and assayed for its AChE inhibition activity. That extract was then fractionated with silica gel chromatography and the components assayed for AChE inhibitory activities. The compound isolated from black maca could prove to be a viable, naturally derived alternative to the AChE inhibitors that are currently popular treatments of Alzheimer's disease due to its natural derivations and potentially limited side effects.

2021-052	Oral Presentation	Chemical Sciences

Student Presenter: **Wang, Alan; *UNC Chapel Hill***
Mentor: **Knight, Abigail; *UNC Chapel Hill***

A DNA-driven assembly strategy for a decodable biohybrid block copolymer library

Soft materials made from synthetic copolymers are applicable to a broad scope of biomedical applications, particularly in peptide stabilization for peptide-based therapeutics. However, identifying specific copolymers that best serve a desired application is currently a time-intensive process. One approach to identifying copolymers is to screen a copolymer library, but due to synthetic restrictions and the use of low-throughput screening methods, current library strategies are limited in size to several hundred members.

To overcome these challenges, we are currently developing a novel library of biohybrid block copolymers, where DNA tethers are responsible for both directing copolymer assembly and barcoding the identity of each copolymer. This strategy allows us to quickly synthesize a library of over 10,000 members at once and screen the library at high-throughputs using next-generation DNA sequencing.

Our DNA-driven copolymer assembly strategy was studied computationally using NUPACK, a published algorithm used to predict the binding interactions of a set of nucleic acid strands. We modelled our biohybrid copolymers as a test tube of DNA strand sequences which were then analyzed using NUPACK. Results verified that our barcoded DNA sequence design drives favorable and specific assembly of each copolymer member. These promising results allow us to move forward with implementing our DNA sequence design in library synthesis, which we will use to screen copolymers for peptide stabilizing activity.

2021-053	Oral Presentation	Communication and Journalism

Student Presenter: **Clemons, Dallas M.; *North Carolina Central University***
Mentor: **Robinson, William R.; *North Carolina Central University***

Justification in Presentation: Examining American News Media's Role in Black Stereotypes and Victimhood

American media have long upheld the racial stereotype of Blackness and criminality, dating as far back as eras of slavery and segregation. The divided nature of contemporary American media, particularly news media, fills a salient role in presenting its subjects. Black Americans are disproportionately depicted as perpetrators and as victims but in contrastive ways, especially recognizable in instances of police brutality. This provokes the question: do American news media perpetuate racial stereotypes of Black Americans? The following seeks to carefully study the connections, if any, between the portrayals of Blacks and criminalization. By textually analyzing several news stories, this piece will investigate the mediated images of Black Americans which may uncover patterns that substantiate this notion. Using George Gerbner's cultivation analysis and Erving Goffman's framing theory, this work will be qualitative in essence by exploring a variety of news media texts to address this research problem.
Keywords: Criminality, Stereotypes, Race, Racial Media, Cultivation Theory, Criminal Justice System, News, Police, African American, Black, Framing Theory

2021-054	Oral Presentation	Communication and Journalism

Student Presenter: **Gelman, Lindsay; *Elon University***
Mentor: **Xu, Qian; *Elon University***

Persuasion Strategies in Building Campaign Discourse on Social Media: A Comparison of Donald J. Trump and Joe Biden's Ads on Facebook

Political advertising on Facebook has been part of presidential candidates' campaign strategies during the past several election cycles (Swant, 2020). In these campaigns, Facebook has played essential roles in facilitating political participation and encouraging connections between voters and candidates (Porsmita, 2016). This project focuses on studying the persuasion strategies used by Donald J. Trump and Joe Biden in their Facebook campaign ads during the 2020 Election. A content analysis was done on 310 randomly selected Facebook ads published in October by these two candidates. In this sample, we found that Trump used more videos whereas Biden used more images in their Facebook ads. Following the definitions of ad functions proposed by the Functional Theory of Political Campaign Communication (Beniot, 1999, 2019), we discovered that overall, Biden used more acclaim ads whereas Trump used more attack ads. Both candidates favored the use of videos in attack ads. However, Biden relied more on images to produce his acclaim ads, whereas Trump relied heavily on videos in his acclaim ads. Trump's attack ads mentioned more about the candidate's characters than those of Biden's. Biden used more pathos (i.e., emotional appeal) in the acclaim ads, whereas Trump used more pathos in the attack ads. There was no significant difference between the two candidates in terms of filter usage for acclaim ads. But for attack ads, Trump used filters more frequently than Biden. The findings of this project provide practical implications for communication professionals to develop more effective political campaign messages on social media.

2021-055	Oral Presentation	Communication and Journalism

Student Presenter: **Jordan, Kayla; *North Carolina Central University***
Mentor: **Robinson, William R.; *North Carolina Central University***

Social Media Impacts on The Justice System: A Comparative Study of the Deaths of George Floyd and Philando Castile

Police brutality in America started many decades ago and continues to be prevalent. Black men and women are being murdered by the very people who are appointed to protect them, and there are minor legal repercussions for their actions, even when their actions are unjustified. This project will historicize the murders of George Floyd and Philando Castile. Additionally, due to the omnipresent nature of social media and the exponential reportage of their deaths, this project will explore its inner workings. Social media impacts many aspects of the human experience. “New media has altered the way we consume information, and it also allows users to create “media hypes” comparable to news waves generated by news media” (Roese, 2018). According to media scientist Roese “media hype” represents how users of social media have the potential to create viral content and structure accidental media hype. “Social media has profoundly changed the way the world is connected and empower regular people to be the media themselves” (Roese, 2018).
The focus of this research project will examine the effect of new media coverage in matters of police brutality and the legal outcomes. This project, qualitative in nature will examine high-profile press coverage of incidents of police brutality and the possible legal impact of pre-trial publicity. Engaging the disciplines of journalism, mass communication, and media studies, this work will be theoretically informed by agenda-setting theory as well as critical race theory.

2021-056	Oral Presentation	Communication and Journalism

Student Presenter: **McLean, Joshua A.; *North Carolina Central University***
Mentor: **Robinson, William R.; *North Carolina Central University***

Examining Professional American Athletics Through a Racial Lens: Sports Media Commentators’ Depiction of Black Athletes v. White Athletes

In Raymond E. Rainville and Edward McCormick’s dissertation, they argue that sports media commentary can reinforce the stereotypes regarding a Black athlete's natural physical talent and lack of cognitive skill through a qualitative research analysis of professional football quarterbacks and race. This differs from the intelligent and passionate leaders white professional athletes are depicted as in sports media (Rainville, R. E., McCormick, E., 1977). Consuming sports media is a common pastime for Americans. According to Know the Fan’s Global Sports Media Consumption Report overview (2014), 70% of the adult population followed sports and 42% of all fans consumed sports content using a mobile device. Know the Fan also found that the average sports consumer spent 7.7 hours a week engrossed by sports content. This research will focus on how American sports media commentators depict Black professional athletes differently than their white counterparts. The study will use a qualitative research analysis by examining the various phrases and verbiage used by commentators when referring to certain athletes in sports media broadcasts from the years 1970 to 2000. The study will also use a textual analysis of academic literature relating to race and sports media. This research will be conducted through the theoretical lens of critical race theory (CRT) and cultivation theory, arguing not only that sports media commentary can reinforce negative racial stereotypes, but also that sports media consumers can adopt and retain the concepts expressed in such commentary.

2021-057	Oral Presentation	Communication and Journalism

Student Presenter: **Taft, Chelse; *North Carolina Central University***
Mentor: **Robinson, William R; *North Carolina Central University***

#Cancelled: An investigative analysis of cancel culture and social media

"If you didn't show up today with HIV, AIDS, or any of them deadly sexually transmitted diseases that make you die in two to three weeks, then put your cell phone lighter up...Fellas if you ain't sucking d--k in the parking lot, put your cell phone lighter up!" (King, 2021) These are the words of Charlotte-based rapper, DaBaby from his July of 2021 concert. The backlash was swift after the video made the rounds on social media. Not only did the rapper lose partnership deals but thousands of dollars in concert revenue as well. The public rant became the focus of comedian Dave Chappelle's recent Netflix comedy special, The Closer. During Chappelle's routine he pointed out that members of the LGBTQ+ community were quick to cancel DaBaby, yet slow to question violence with the Black community. This investigative project addresses the cycle of cancel culture, specifically the workings of how it is executed in the realm of social media.

This project by way of case study methodology will compare two instances of high-profile cancelations; that of hip-hop star DaBaby and the current efforts to cancel Dave Chapelle. In doing so the researcher will investigate this project using the media lenses of agenda-setting theory as well as framing theory.

2021-058	Oral Presentation	Communication and Journalism

Student Presenter: **Reyes, Zava A.; *North Carolina Central University***
Mentor: **White, Shauntae Brown; *North Carolina Central University***

I Like the Way She Moves: Misogyny in Hip Hop, Country and Rock

The hegemonic ideology that women are expendable sex objects to be used, abused, and disregarded by men is present throughout all genres of mainstream music. An example of this ideology's dominance in music can be found in songs from some of the world's most beloved acts, such as Elvis Presley and The Beatles. These songs include lyrics about men murdering their female romantic partners and their messages have larger implications as they greatly influence gender relations in society. The media tends to focus only on the genre of hip hop which is comprised primarily of African American artists. Misogyny within the genre of hip hop has been well-researched as it is the one that is most often criticized in the media. Yet very few studies have been conducted to examine misogyny within predominantly white genres; i.e. country music. We developed a simple unit of analysis to qualitatively examine misogynistic content across the various genres. This work will discuss misogynistic content in hip hop, rock, and country music spanning almost seventy years to reveal the scope of misogyny in music.

2021-059	Oral Presentation	Computational Sciences

Student Presenter: **Crawford, Khali A.;** ***Fayetteville State University***
Mentor: **Bhattacharya, Sambit;** ***Fayetteville State University***

Semi-Autonomous Robotic Tank Swarm

The NASA Artemis Mission is an ambitious project to return to the moon by the year 2024. However, unlike previous voyages, this one will be for scientific discovery, economic benefit, and a gateway to interplanetary colonization. The primary goal of this endeavor is to establish sustainable exploration by the end of the decade, an objective that has many obstacles that need to be overcome. The challenge the Intelligent Systems Lab (ISL) choose to focus on was the "Extreme Access" side of the mission. This refers to the difficulties that come with operating, within a scientific definition, in a foreign environment. To this end, ISL proposed the construction of a semi-autonomous robotic tank swarm, otherwise referred to as the 'TankBot'. This swarm makes use of Ultra-Wide Band (UWB) communications/ positioning and onboard sensors for terrain mapping. In addition to the TankBot Swarm, ISL constructed a drone to simulate satellite overflight. It would be used to compensate for the varied terrain of the lunar surface by gathering data on elevation to improve the accuracy of the TankBots. This project was broken up into two parts, one side for the TankBots and another for the Drone but are built to work in tandem with each other to create tightly-knit communication and mapping system. However, during the process of the bot's construction, we had come to realize the challenge that came with building our own robots from scratch and decided to shift our focus to more software-focused objectives with pre-built robots.

2021-060	Oral Presentation	Computational Sciences

Student Presenter: **Dixit, Samanyu;** ***North Carolina School of Science and Math***
Mentor: **Gotwals, Robert R.;** ***North Carolina School of Science and Math***

Cheminformatics Analysis of the N-methyl-D-aspartate (NMDA) Receptor Neurotoxicity

Neurotoxicity refers to the collection of disruption and damage that xenobiotic chemicals may cause to neurons. As new compounds are developed, it is essential to understand the potential neurotoxic effects these compounds may have. Traditional in vivo methods require the sacrifice of many animals, are expensive, and are time-consuming. Conversely, computational methods are fast, less expensive, avoid animal testing, and reduce failure chances. Quantitative structure-activity relationship (QSAR) models are statistical/machine learning methods that can learn from previous data and predict the toxicological effects of compounds lacking experimental data. The main goal of this study is to develop models of the N-methyl-D-aspartate (NMDA) receptor, an important protein responsible for multiple physiological functions, such as memory. When unintentionally overstimulated, this target can trigger neurotoxicity. In this study, we have collected, curated, and integrated the largest publicly available data on NMDA from the EPA and ChEMBL databases. In addition, the entire dataset was manually inspected. We developed QSAR models using Morgan fingerprints along with Random Forest, a machine learning algorithm containing thousands of decision trees. This work was executed in KNIME, a data analytics tool that allows the user to create comprehensive workflows with chains of commands that manipulate the data. The result of this project can be conceptualized as a machine learning (mathematical) model which can be employed to predict the safety of new chemicals related to neurotoxicity in the NMDA receptor. The future steps of this project include developing QSAR models for multiple curated datasets to develop a comprehensive neurotoxicity platform.

2021-061	Oral Presentation	Computational Sciences

Student Presenter: **Govil, Shitij; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***
Lee, Aidan
MacQueen, Aiden
Payne, Garrison
Tyler, Lori; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)*
Mentor:

Using DEM Derivatives from Quanergy LiDAR Data to Classify Wetlands through Machine Learning

Wetlands play a vital role in the environment, providing ecological and economic benefits for the people living on or near them. However, they are underrepresented because of outdated data collection methods, which can lead to the destruction of unprotected wetlands. As part of the Clean Water Act of 1972, the Environmental Protection Agency protects natural sources of water such as wetlands. The current wetland classification method (NWI) relies on research teams to survey an area and classify it on foot, which is inefficient and potentially harmful to wetlands. This does not apply to unidentified wetlands, which vastly outnumber the amount of identified wetlands. This project aims to utilize Unmanned Aircraft Systems (UAS) data and Light Detection and Ranging (LiDAR) technology to speed up the process of classifying wetlands and gather more accurate data. We looked at tree-based machine learning algorithms such as Bagging and Gradient Boosting to classify areas within these sites as wetlands, with the highest accuracy of 96%. This study shows a promising future for machine learning and drone-collected data for the purpose of conserving wetlands.

2021-062	Oral Presentation	Computational Sciences

Student Presenter: **Harwell, Kobbe; *Fayetteville State University***
Mentor: **Chan, Albert; *Fayetteville State University***

Visualization of U.S. COVID-19 Cases

The COVID-19 pandemic has dramatically reshaped social habits, financial markets, and medical technology on a global scale. Presenting such a risk to public health has made tracking COVID-19 cases and deaths a top priority for major institutions including the Center for Disease Control and Prevention (CDC), the World Health Organization (WHO), and the New York Times. These bodies publish extensive open-source statistics available for public use.

Clinical research has shown however that data is more impactful when it is presented not just textually, but graphically. Virologists and other medical professionals need information that is both accurate and easy to digest. This research thus focuses on plotting COVID-19 cases/deaths by county on a choropleth map of the United States. The application queries open-source data from the New York Times before generating a choropleth map that users can traverse by date. An animation is included in order to track general trends on a larger timescale. Visualization is handled by the open-source Plot.ly library implemented using the Python programming language. This research has culminated in a powerful utility that will allow researchers to track the spread of COVID-19 more efficiently in order to aid in crafting more effective health policies.

2021-063	Oral Presentation	Computational Sciences

Student Presenter: **Howard, Joseph; *Appalachian State University***
Mentor: **Tashakkori, Rahman; *Appalachian State University***

Honey Beehive Traffic Estimator using a Circular Boundary and a Simple Neural Network

The number of honey bees leaving and returning to their hives throughout the day is a significant indicator of their health. It is important that the bee traffic in and out of their hives is monitored carefully to detect possible problems. We use a honey bee monitoring system that is created in the Visual and Image Processing (VIP) lab in our department to obtain videos from the entrance of the hives. We use a traffic estimator program to analyze video recordings from the hives' entrances and estimate the traffic. The program performs this through background subtraction and movement detection. Background subtraction involves checking every pixel in the video and finding its hue, saturation, and brightness. If these variables are within specified bounds, then they are highlighted by the program in the shape of blobs. Given the specified bounds, these blobs will represent bees in a video. Another part of the program deals with movement detection, which will keep track of the blobs as they change position over the course of the video and record the direction of the movement. The background subtraction and movement detection will notice every time a bee crosses a line that defines the boundary, and movement detection will allow us to know if the bee entered or exited the hive. This research revolves around making the program more accurate using a circular boundary around the entrance. This presentation will share some of the results from three different boundaries used to determine the traffic.

2021-064	Oral Presentation	Computational Sciences

Student Presenter: **Jennings, David; *Elon University***
Mentor: **Paranthaman, Pratheep K.; *Elon University***

Development and Effectiveness of a Gamified Virtual Reality Interview Trainer

Existing literature has investigated the effectiveness of virtual reality (VR) and gamification in fields such as education, job training, and safety training. Interviews are a crucial part of careers, and research has shown the potential for interview training in improving interview performances. However, there is a lack of research into the effectiveness and incorporation of gamification and VR in interview training. In this study, a gamified VR interview training application will be developed and tested for its effectiveness and ability to create an engaging training experience. This application will be compared to a non-gamified version of the application to identify any differences in stress levels, engagement, user experience, and performance. As of now, the application has been planned out and is being developed. After completion of the development stage and upon IRB approval, the two applications will be tested. Participants will later return for a mock interview to further test the impacts of the application on interview performance and preparedness. This research could lead to more information regarding the general effectiveness of gamification and its impacts in interview training. Future research and development in interview training applications may benefit from more information regarding the use of gamification and VR in interview training.

2021-065	Oral Presentation	Computational Sciences

Student Presenter: **Li, Benjamin;** ***North Carolina School of Science and Math***
Mentor: **Gotwals, Robert;** ***North Carolina School of Science and Math***

In Silico Study to Enhance Delivery Efficiency of Charged Nasal Spray Aerosols to the Olfactory Region Using External Magnetic Fields

The blood-brain barrier hinders drug delivery for treating central nervous system diseases. One method to avoid complications is drug transport via the olfactory pathway; drugs can be administered intranasally to the olfactory region using aerosol sprays.

One challenge that is being studied is efficiently transporting aerosol droplets to the olfactory region. Numerous factors, including nasal airflow and parameters of aerosol drug injections, influence drug transport. In addition, the use of external magnetic fields to guide drug droplets to a target location is an ongoing area of research.

This study uses computational fluid dynamics to simulate olfactory drug delivery in order to (1) examine effects on drug deposition when various external magnetic fields are applied to charged droplets, (2) comprehensively study effects of drug injection parameters (particle diameter; injection speed, angle, and position; magnetic force strength and direction), and (3) determine an optimal setup for maximal delivery efficiency to the olfactory epithelium.

Airflow in a nasal cavity model was governed by the Reynolds Averaged Navier Stokes equations, and a realistic inhalation rate was implemented. Droplet trajectories were modeled using a Lagrangian discrete phase model. A current-carrying wire generated a magnetic field to apply force on charged droplets and direct them to the olfactory region.

Once particles deposit in the olfactory region, drug diffusion through mucus to the olfactory epithelium is modeled.

Initial results suggest that injections near the front of the nostril, as well as larger sub-micron droplets and particular magnetic forces corresponding to droplet sizes, increase drug delivery efficiency.

2021-066	Oral Presentation	Computational Sciences

Student Presenter: **Liu, Elaine; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***
Cook, Sam
Kinzie, Maria
Civiletti, Noah
Mentor: **Tyler, Lori; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***

Using Machine Learning Models to Predict Presence of Hereditary Cataracts and Pathogenicity from αB-Crystallin Protein

Hereditary cataracts—where cataracts develop at a young age due to mutations in the αB-crystallin protein—are a relatively unknown, under-studied condition that affects tens of thousands of children per year. The process of detecting such cataracts in babies is also difficult and tedious, often leading to delayed treatment and increased risk of long-term vision problems. Furthermore, due to the lack of research, there is very little conclusive information surrounding detection of and reason for why specific gene mutations are pathogenic. This project dug deeper into such causes, ultimately seeing if a machine learning model could be created to predict the pathogenicity of an αB-crystallin mutation from its biochemical characteristics and detect hereditary cataracts sooner. Using data derived by Biotechnology students at the UNC Wilmington Summer Ventures program, an Exploratory Data Analysis was performed to find notable features like the isoelectric point. Numerous covariate combinations were then tested with various cross validated machine learning classification models. Results suggested that the Support Vector Classification (SVC) model with covariates "isoelectric point" and "evolutionary age as pdel" performed the best overall with an accuracy of 95%, especially when considering feasibility for future data gathering and efficiency. The model had an accuracy that matched those of the runner-up models—K-nearest neighbor and adaptive boosting—and had faster runtimes. The most successful model was then used to create a predictor tool that would classify observations in larger quantities.

2021-067	Oral Presentation	Computational Sciences

Student Presenter: **O'Brien, William R.; *Appalachian State University***
Mentor: **Tashakkori, Rahman; *Appalachian State University***

Estimating the Number of Drones at the Entrance of a Honeybee Hive using Machine Learning Tools

There are three types of bee in a honey bee hive: one queen which is charge of laying eggs and controlling the population of the hive, a large number of worker bees that are all female and hold various responsibilities in maintaining the entire hive, and a small number of drones that are male and their sole job is to mate with queens and spread the genetics of their hive. There are various reasons for having a larger than normal number of drones which may cause a hive to collapse. For example, a bad queen or a worker bee laying unfertilized eggs causes a sharp increase in drones. The number of drones should be monitored carefully as that is a good indicator of the health of the hive. In order to monitor the number of drones, we use a hive monitoring system called Beemon that is created in the Visual and Image Processing lab in our department. This system allows beekeepers and researchers to monitor their hives and will aid in detecting problems before major issues arise. In this presentation, we propose a computer vision program aimed at estimating the number of drone bees in videos that are taken at several honey bee hives. The program estimates the number of drones to assist the beekeepers in finding possible deviations as they occur. This program utilizes Python and OpenCV to classify bees by applying motion detection and background subtraction methods. This presentation will share early results for several hives.

2021-068	Oral Presentation	Computational Sciences

Student Presenter: **Ramamurthy, Sahana; *North Carolina State University***
Smith, Lauren
Mentor: **Lee, Inhan; *miRcore Organization***

Progression of cytokine-mediated signaling pathway activity in the first 24 hours of H1N1 infection

The Interferon Induced Protein gene family (IFIT1, IFIT2, IFIT3, IFIT5) is a group of anti-viral RNA binding proteins which bind directly to foreign RNA to inhibit replication. The Oligoadenylate Synthase gene family (OAS1, OAS2, OAS3) is induced by interferons to activate Ribonuclease L and destroy viral RNA. We analyzed the expression levels of the IFIT and OAS gene families using statistical tools to study their role in the immune response against the H1N1 orthomyxovirus in 6-hour increments for the first 24 hours post-infection.

Although earlier studies indicated that IFIT1 had no antiviral function on orthomyxoviruses, we observed an increased expression of IFIT1 during the immune response to H1N1. While IFIT1, IFIT2, and IFIT3 function together and display similar expression trends, IFIT5 expression pattern varied.

OAS3 is the primary gene responsible for the activation of RNase L and has a significantly increased expression level in comparison to the other genes of the OAS family in our dataset. These findings suggest OAS1 and OAS2 had minimal effect on the activation of RNase L and may have alternate roles.

Further research on the IFIT1, IFIT2, and IFIT3 gene complex and the individual role of the IFIT5 gene will provide insight into the IFIT gene family interactions and reveal unknown attributes regarding its importance in the viral immune response. Research on the combined function of OAS1, OAS2, and OAS3 and the activation of RNase L could provide greater understanding of how the OAS gene family functions together to elicit an immune response.

2021-069	Oral Presentation	Computational Sciences

Student Presenter: **Whitener, Nathan P.; *Wake Forest University***
Mentor: **Khuri, Natalia; *Wake Forest University***

Evaluation of Data Transformation Methods for the Analysis of Single-Cell RNA Sequencing Data

Experimental methods to collect gene expression data have improved in recent years. These improved methods allow for the analysis of gene expression at a single-cell level. Single-cell RNA sequencing (scRNA-seq) experiments generate data that may provide valuable insights into the composition of individual cells in different developmental stages and in different diseases, for example. Analysis of scRNA-seq data is challenging due to their high dimensionality, noise, and sparsity. To circumvent some of these issues, data is transformed into alternative representations, however, systematic evaluation of different data transformation methods and their impact on the downstream scRNA-seq data analyses has not been done. We benchmarked two data transformation methods, namely, the novel data transformation method Gene Frequency - Inverse Document Frequency (GFICF), adapted from natural language processing, and the widely used logarithmic transformation. First, we evaluated how these methods impact the task of dimensionality reduction using Principal Component Analysis, t-Distributed Stochastic Neighbor Embedding, and Uniform Manifold Approximation and Projection. Second, we compared the accuracy of cell-type identification using unsupervised and supervised machine learning methods, cluster analysis, and classification, respectively. Specifically, we tested the k-means and PhenoGraph clustering algorithms and the XGBoost classification algorithm and estimated two performance metrics using the ground truth labels of 13 datasets of varying size and complexity. We found that although GFICF is well-suited for low sparsity datasets encountered in natural language processing, logarithmic data transformation of scRNA-seq data, results in higher accuracy of clustering and classification, as well as better performance in the dimensionality reduction tasks.

2021-070	Oral Presentation	Computational Sciences

Student Presenter: **Barnes, Mac; *North Carolina School of Science and Math***
Mentor: **Gotwals, Robert; *North Carolina School of Science and Math***

Mapping Unbiased Legislative Lines: Implementing a System of Conditional Variational Autoencoders (CVAE's) to Create Equitable Representation

Gerrymandering in North Carolina has historically diminished the voting power of communities of interest (COI's) through racial and political discrimination resulting in targeted voter dilution. Federal regulation of gerrymandering has been discouraged (Rucho v. Common Cause), requiring a state-based approach. Current computational models for detecting gerrymandering take the form of outlier analysis using popular algorithms like the Markov Chain Monte Carlo (MCMC) approach used in Rucho. However, the maps generated in this fashion are discouraged due to the limited number of constrainable variables. Further, humans must examine maps to ensure equal voting power before implementation. Platforms like Dave's Redistricting App enable the visualization that ensures these criteria are met. These platforms, however, require in-depth software knowledge and an understanding of a state's political geography to generate impactful maps. This experiment applies machine learning (ML) to redistricting. Known MCMC methods of map generation created training data for a nestled Conditional Variational Autoencoder network. Maps were constrained to minimize county splits (producing more viable maps) and were matched with computed fairness and cut edges scores. A graphical user interface (GUI) was created so that users can input desired metrics and visualize/download the model's output map for additional changes. The GUI also allows users to learn how changes in metric inputs translate into visual map changes. Additionally, this research serves as the first of hopefully many new ML tools capable of bridging the knowledge and time-efficiency gaps that currently prevent institutions and individuals from combating gerrymandering at their full capacities.

2021-071	Oral Presentation	Cultural and Language Studies

Student Presenter: **Fleming, Asuntha; *Chowan University***
Mentor: **Hayes, Tim; *Chowan University***

Art of War

The Great War witnessed the rise of British soldiers who shared their experience through the art of poetry, conveying personal stories and emotions. Amidst the mutiny and bloodshed, poets like Wilfred Owen and Rupert Brooke rose to fame through their power of word play and vivid imagery. While Brooke's "The Soldier" was famed for its positivity, Owens "Dulce Et Decorum Est" was discernably negative. The poems that emerged during this period were focused mainly on patriotism and dedication. Although, "The Soldier" and "Dulce Et Decorum Est" focus on the common theme of war, they convey different emotions and ideas. There is a change in the writing style along with a shift of perspective as one talks about a soldier's undying love for his motherland, while the other brings out the horrors of war. The poems express unfiltered emotions as these soldiers experienced the disaster firsthand. Undoubtedly, The Great War caused a lot of havoc and destruction, but also put poets like Brooke and Owen on a pedestal to either portray it as a selfless act of passion or intensify it as inhumane mass murder. Either way, through their heart-wrenching experiences, both these poets present two sides of the most unprecedented war in history.

2021-072	Oral Presentation	Cultural and Language Studies

Student Presenter: **Helmlinger, Felicia; *UNC Wilmington***
Mentor: **Scott-Pollock, Julie-Ann; *UNC Wilmington***

Personal Narratives of Transnational Adoption: Navigating Family, Belonging, and Transcultural Connection

Being a transcultural and transnational adoptee is part of my unexplored identity. I interviewed six other transnational adoptees to hear their stories growing up in a culture different from that of their biological family. Dialogic personal narrative research interviews participants to understand their perspective, while allowing the researcher to reflect on their own experiences through "reflexive autoethnography" (Ellis, 2004). Transcribing narrative research through interactional analysis emphasizes a co-constructed story between teller and listener (Riessman, 2005), which can reveal data encompassing a more in-depth awareness of the transcultural adoptee identity. Most adoptees share two common experiences: our adoptive family is our real family, and we are grateful for our current lives. Three other recurrent themes emerged with varying experiences—connection to birth country and culture; connection with biological family; and tension with stereotyping/racism. Some highly valued staying connected to the country they are from; others had no desire to connect. Others connected during childhood and fell out of the habit but want to reconnect now. Some have communication with their biological families. Those who do not have different responses: curiosity and wonder; sadness and grief; and contentedness, with apathy for further answers. Transcultural adoptees experience stereotypes and racism, and their responses vary based on who they are, ranging from rejection, guilt, pain, and irritation. Listening to others, while discovering personal revelations about a shared identity, is a collaborative experience that promotes connectedness and empathy for other transcultural adoptees and raises awareness for people who do not share this experience.

2021-073	Oral Presentation	Cultural and Language Studies

Student Presenter: **Henneberry, Alana C; *Meredith College***
Mentor: **Fischer, Holly; *Meredith College***

Are Gender Stereotypes Tumbling In Gymnastics

In American society, athletes hold a special place in society. Some dedicate their lives to their sport in hopes of representing their county at the highest level. To many, there is no better way to show the world America's power than on an international stage. Compared to their fellow athletes, however, women's gymnastics represents the United States of America in a dramatically different light. Gymnasts for Team USA are popular household names. These women are bold and daring on the competition floor, often performing routines that are incredibly dangerous if done wrong, but viewers admire gymnasts for their beauty and grace. Ultimately, female gymnasts not only represent their country because of their spectacular talent but because they are a microcosm of American attitudes towards women. Once the spotlight fades, many gymnasts return to their private lives to deal with issues including PTSD due to abuse from trusted adults, body image issues, and eating disorders - issues many American women experience too often. Several famous gymnasts are using their fame to demand change within the sport. These changes include standards of conduct for officials and coaches, treatment of athletes, and the education of young girls in nutritional wellness and personal rights. However, concerns such as abuse, body image issues, and eating disorders will continue to plague future gymnasts despite demands for change within USAG because women's gymnastics is a microcosm reflecting the overall treatment of women in American society, and until society changes, women's gymnastics will remain stagnant as well.

2021-074	Oral Presentation	Education

Student Presenter: **Collins, Kasey; *Elon University***
Mentor: **Trocki, Aaron; *Elon University***

Investigating Technology Use in Secondary Mathematics Virtual Classrooms

Although research in mathematics education has documented how technology can be utilized in mathematics teaching and learning, there is limited research on teaching practices with technology in the virtual classroom and the alignment between teachers' beliefs and those practices. This preliminary study investigates how teachers' beliefs align with their practices of using technology to teach mathematics and how teachers engage students in learning in the virtual classroom. Five teachers completed a questionnaire and an interview regarding their teaching practices and beliefs about technology use in the classroom. Two of the five participants were then observed numerous times by the researcher in the virtual classroom held over Zoom. To document how the teachers' beliefs aligned with their practices, field notes were taken to assess how the teacher engaged students in mathematics with the technology. Technologies used for the teaching of mathematics were categorized based on three published frameworks. The results demonstrated that participants believed that technology amplifies the learning of mathematics but struggled to engage students in the virtual setting. These results may assist educators seeking to enhance the teaching of mathematics with technology in both in-person and virtual classrooms.

2021-075	Oral Presentation	Education

Student Presenter: **Delgado, Allison; *Forsyth Technical Community College***
Nguyen, Han
Bunch, Zoie
Thompson, Bailey
Mentor: **Popova, Maia; *University of North Carolina Greensboro***

Analysis of Representations in Chemistry Textbooks: A Literature Review

As part of the Popova Research Group, we completed a rigorous and comprehensive literature review of various chemistry education articles that focus on the analysis of representations in chemistry textbooks to:
a. Detect patterns across the studies
b. Identify research to guide future research
A literature review is an analysis of various research studies, by recognized authors, on a specific topic. We read and wrote a summary for each article to capture the sample and country, subject, research questions/purpose, theoretical framework, methods, main findings, and limitations and implications. From these summaries, we used inductive coding—the use of codes derived from the data itself—to determine patterns across the various articles. The major findings found through coding include the following:
a. Depending on the textbook, there is a wide variation in the distribution of types of representations (e.g., symbolic, macroscopic, and submicroscopic);
b. There is a lack of captions in the representations;
c. There are vague labels for many representations;
Our findings showed both consistencies and inconsistencies across the examined studies, providing brief and succinct determinations of current chemistry education studies for future research to use. In future studies, we would examine a greater number of articles using coding.

2021-076	Oral Presentation	Education

Student Presenter: **Dobson, Alesia; *Fayetteville State University***
Mentor: **Okunbor, Daniel; *Fayetteville State University***

Flipped Pedagogy in STEM Learning at an HBCU

In a traditional learning environment, class time is devoted to learning the course material with the application of the learned material taking place at home through pre-recorded video lectures. The flipped teaching style switches the learning and application portions of the class to maximize student interaction with the material. Through the flipped pedagogy, students can master their ability to manipulate the course material through active learning and group-oriented assignments. The purpose of this study is to determine students' perceptions of flipped pedagogy both before and during COVID-19. Fayetteville State University (FSU) conducted the study prior to and during COVID-19 in three Student-Centered Active Learning Environment with Upside-down Pedagogies (SCALE-UP) classes using focus group research. This study is a continuation of the July 2019 eight student perception research. The focus group questions for the continued research address how COVID affected the flipped learning environment. A series of four Zoom focus group sessions collected the perceptions of an additional ten students from the computer science, biology, pre-calculus, and chemistry flipped courses provided at FSU. The pandemic has caused some professors to alter their current teaching style to accommodate the wavering physical attendance of their students. The students perceived their flipped course as informative but not their preferred method of teaching due to inconveniences in group collaboration and the pace of instruction restrictions in the course. Student perceptions express that COVID has not made noticeable changes to the flipped teaching style, nor has it increased the difficulty of the class.

2021-077	Oral Presentation	Education

Student Presenter: **Fields, Adrianna; *Fayetteville State University***
Mentor: **Bills, Kaycee L; *Fayetteville State University***

DISABILITY COMMUNITY: A SYSTEMATIC REVIEW OF BIOLOGICAL AND ENVIRONMENTAL IMPACTS LEARNING DISABILITIES AND GRADUATING RATES

This study aims to determine how such representations can be better targeted to increase students with learning disabilities (SWD) to graduate at the same time as their peers who do not have learning disabilities. In this context, disabilities are defined as a disorder that makes it harder for the person to perform certain things and communicate with the world around them. Academic success of students without disabilities (SW/OD) is not achieved for those with specific needs. To test the hypothesis does having a learning disability result in being in college longer than students without learning disabilities, a sample for this study was 8,900 (N = 8,900) undergraduate students. Using a "Power Statistic" online dataset software by the National Center Education for Statistics (NCES) to compare the mean graduation rate of people with learning disabilities to students without disabilities. The result suggests that students with learning disabilities are more likely to graduation longer than students without learning disabilities. These results will show that there were statistically significant differences between biological and environmental factors' impacts on individuals with/out learning disabilities.

2021-078	Oral Presentation	Education

Student Presenter: **Nguyen, Han.;** ***Forsyth Technical Community College***
Delgado, Allison.
Mentor: **Popova, Maia.;** ***University of North Carolina Greensboro***

Analysis of Representations in Chemistry Textbooks: A Literature Review

As part of the Popova Research Group, we completed a rigorous and comprehensive literature review of various chemistry education articles that focus on the analysis of representations in chemistry textbooks to:
a. Detect patterns across the studies
b. Identify research to guide future research
A literature review is an analysis of various research studies, by recognized authors, on a specific topic. We read and wrote a summary for each article to capture the sample and country, subject, research questions/purpose, theoretical framework, methods, main findings, and limitations and implications. From these summaries, we used inductive coding—the use of codes derived from the data itself—to determine patterns across the various articles. The major findings found through coding include the following:
a. Depending on the textbook, there is a wide variation in the distribution of types of representations (e.g., symbolic, macroscopic, and submicroscopic);
b. There is a lack of captions in the representations;
c. There are vague labels for many representations;
Our findings showed both consistencies and inconsistencies across the examined studies, providing brief and succinct determinations of current chemistry education studies for future research to use. In future studies, we would examine a greater number of articles using coding.

2021-079	Oral Presentation	Education

Student Presenter: **Sierra, Morgan;** ***Elon University***
Mentor: **Buchanan, Lisa;** ***Elon University***

Teacher Decision Making: What Factors Inform K-2 Children's Literature Selections?

Diverse, inclusive literature is becoming more accessible and utilized in the classroom. But, teachers face a multitude of hurdles in their decisions in choosing quality literature resources. Much of the existing literature on teacher decision-making in children's literature focuses on preservice teachers (Hart & Rowley, 1996, Voleker, 2013). This research project evaluates the attitudes and beliefs that inform teacher decision making for children's literature use in K-2 classrooms. A comprehensive survey of certified in-service teachers was utilized to examine the internal and external factors that shape children's literature selections. From this pool of responses collected through an online instrument, specific trends in the data were analyzed. This project looks at how attitudes and beliefs differ based on experience, access to professional development, race and ethnicity, among other factors. Specific recommendations will be made for improving literature choices and professional development.

2021-080	Oral Presentation	Education

Student Presenter: **Wright, Ashlen A.; *UNC Chapel Hill***
Dailey, Megan M.
Mentor: **Espelage, Dorothy L.; *UNC School of Education***

Education, Stress and the COVID-19 Pandemic: A qualitative analysis

The 2020-2021 academic year brought numerous challenges to teachers across the country as they worked to educate our youth amidst the COVID-19 pandemic. The current study is a secondary data analysis of qualitative responses collected as part of a survey to evaluate a social emotional learning curriculum that was implemented during the 2020-2021 academic year in a western U.S. state. The lived experiences of teachers (N = 52) across 11 elementary schools as they transitioned from in-person to remote learning were captured in open-ended questions. A phenomenological approach was utilized to analyze the challenges expressed by teachers as they faced instability and additional professional demands. Given that stress and other factors that strain mental health exist within multiple layers of an individual's social ecology, a modified social-ecological framework was used to organize the results and themes. Findings suggest that during the academic year, teachers experienced stressors related to their personal lives, and frustrations with administration and other institutional entities around COVID safety measures. However, the most salient themes that emerged were related to teacher concerns for students' wellbeing which extended beyond academics. Without adequate support and teacher voice, job-related stress may lead to teacher shortages, deterioration to teacher mental health, and ultimately worse outcomes for students. Implications for policy, research and practice are discussed.

2021-081	Oral Presentation	Education

Student Presenter: **Alford, Wanya; *North Carolina A&T State University***
Mentor: **Ofori-Boadu, Andrea; *North Carolina A&T State University***

Causes of Learning Motivation Reduction in STEM Students Amid COVID-19 Pandemic.

Wanya Alford - North Carolina Agricultural and Technical State University
Co-Author: Andrea Nana Ofori-Boadu, Ph.D., North Carolina Agricultural and Technical State University, NC.
Rabiatu Bonku, North Carolina Agricultural and Technical State University;

The COVID-19 pandemic has caused large disruptions to global educational systems, with many institutions transitioning to e-learning. STEM students complain about declining motivation to learn and complete STEM course requirements. To better prepare for future pandemics, it is important to gain insights into the causes of declining motivation in STEM students during COVID-19 pandemic. As part of a larger research study, the purpose of this research was to assess the causes of learning motivation reduction in STEM students during the COVID-19 pandemic. Qualtrics-based surveys were administered to STEM students in six US institutions. Using MS excel, data from 183 completed surveys were analyzed. Data analysis of 15 causes of declining learning motivation in STEM students resulted in three key categories: (1) Psychological Challenges; (2) Domestic Challenges; and (3) Institutional Challenges. Only slight differences existed among the mean of means of these three categories with challenges associated with assignment workloads, peer/professor interactions, laboratory experiences, pass/fail option, poor comprehension, study spaces/times, personal habits, media distractions, and technical issues. The development and implementation of early and targeted effective interventions can minimize the negative impacts of pandemics on learning motivation. This will improve student and institutional resiliency and enhance STEM student learning and progression towards the STEM workforce during future pandemics.

2021-082	Oral Presentation	Education

Student Presenter: **Bowman, Marviet C; *Fayetteville State University***
Mentor: **Okunbor, Daniel; *Fayetteville State University***

The Impact of Non-Traditional Teaching and Learning at a Historically Black College

Abstract
Non-traditional teaching methodologies have gained significant momentum in higher education especially at Historically Black Colleges and Universities (HBCUs). There appears to be a disparity in studies on this topic conducted at HBCUs. This research conducted a phenomenological study to explore the impact of non- traditional teaching and learning at a minority institution through flipped pedagogy. Data was collected from a focus group and interviews with undergraduate Science Technology Engineering and Mathematics (STEM) faculty. The results concluded that flipped pedagogy classrooms increased student academic performance, allowed more time for student-teacher engagement, and required more time for instructional delivery and design. The participants communicated that the flipped learning classroom offered students the opportunity to actively engage in the learning process. The study results revealed that a high level of active learning occurred in flipped learning which gave instructors an opportunity to work with students more intimately while providing individualized instruction for those who required additional assistance. Future research may explore additional non-traditional teaching and other areas of active learning beyond flipped pedagogy at an HBCU.

2021-083	Oral Presentation	Education

Student Presenter: **Carter, Charles; *Fayetteville State University***
Mentor: **Wooten, Cynthia B.; *Fayetteville State University***

Reaching Black Males in the Middle School ELA Classroom

Black males are one of the most at risk ethnic groups in the United States. Black males are more likely to be incarcerated and in addition, are more likely to be killed at an early age. More shocking, graduation rates for Black males remain at a persistent low. In fact, Black males in schools in 35 out of 48 states are at the bottom of academic rankings, compared to other ethnicities. To improve the at-risk nature of Black males, the researcher proposes an investigation of strategies that are utilized by teachers to help them learn content. Specifically, this research study examines how the middle school Language Arts teacher engages Black males in learning. Participants for this study will include four middle school Language Arts teachers and 60 Black males. Middle school teacher participants were interviewed concerning how they made learning relevant for Black males. Black male participants were surveyed concerning how their Language Arts teachers made learning relevant for them, or not. Findings of this study related to racial demographics, teacher-student relationships, and the instructional strategies utilized.

2021-084	Oral Presentation	Education

Student Presenter: **Sampson, Saniya; *North Carolina A&T State University***
Ofori-Boadu, Andrea
Mentor: **Ofori-Boadu, Andrea; *North Carolina A&T State University***

Interactions between Social Self-Concept and Overlay Architecture, Engineering, and Construction (AEC) Career Role Interests in Undergraduate AEC Women

In addition to workforce shortages and lack of racial diversity in the architecture, engineering, and construction (AEC) industry, women are underrepresented in AEC professions. Identity theorists advocate that professional identity development could improve persistence into professions. However, little is known about the lived experiences and professional identity development processes in undergraduate AEC women. As part of a larger research project, the purpose of this research is to explore interactions among the lived experiences and AEC professional identity development in undergraduate AEC women. Adopting the Charmaz constructivist grounded theory approach, 40 undergraduate AEC women were recruited from five U.S. institutions and engaged in two rounds of interviews. Interview transcripts were analyzed using the NVivo qualitative analysis software and Microsoft Excel for coding, categorization, memo-ing, and theme-development. Also, 23 women completed Qualtrics surveys requiring them to rank their interests in 16 overlay AEC career roles.

The emergent theme explains how salient social self-concept interacts influences overlay AEC career role interests with the most popular being Feminist, Humanitarian, Globalist, Minority Advocate, Entrepreneur, Environmentalist, and Youth Advocate. Early social engagement and interest may predict overlay AEC career role development in girls. Future work involves investigating how pre-college social self-concept continues to interact with the progression of AEC role identity development in women as they transition from the freshman year into senior year, and then into the AEC industry. In the long term, insights into PID in women could influence educational and industrial transformations that will reduce workforce shortages, improve gender diversity, and foster the innovation of gender friendly AEC products and services.

2021-085	Oral Presentation	Education

Student Presenter: **Vanderpool, Jacob; *North Carolina A&T State University***
Mentor: **Ofori-Boadu, Andrea; *North Carolina A&T State University***

STEM Student Perceptions of Adaptation Strategies for Improved Learning Motivation in Future Pandemics

The COVID-19 pandemic has caused large disruptions to educational systems, with many educational institutions transitioning e-learning. STEM students have complained about reductions in their motivation to learn and complete STEM course requirements due to COVID-19 related challenges. Students have implemented various adaptation strategies to improve their motivation to learn and improve STEM performance. In order to be better prepared for futurepandemics, it is important to understand STEM students' perspectives of adaptation strategies that can improve their motivation to learn and complete STEM course requirements during future pandemics. As part of a larger research study, the purpose of this research is to assess STEM students' perceptions of adaptation strategies that can improve learning motivation during future pandemics. Institutional Review Board approved Qualtrics surveys were administered to gain insights into students' perceptions of adaptations that can improve their own motivation to complete STEM course requirements during future pandemics. Qualtrics survey links were sent to STEM students in six US institutions. Using MS excel, data from 183 completed surveys were analyzed.Results showed that adaptation strategies associated with space adjustment, self-care, stem learning resources, supervised care and time adjustment can improve STEM students' motivation to learn during future pandemics. STEM students, household members, STEM institutional communities, and healthcare professionals can provide critical counselling, resources, and support. This will improve STEM community resiliency and enhance STEM student learning and progression during future pandemics.

2021-086	Oral Presentation	Education

Student Presenter: **Vanderpool, Jacob; *North Carolina A&T State University***
Mentor: **Ofori-Boadu, Andrea; *North Carolina A&T State University***

The AGGIE-National Association of Home Builders' (AGGIE-NAHB) Residential Sub-division Development Competition Proposal

The Aggie National Association of Homebuilders (Aggie-NAHB) student competition team worked on a residential sub-division development proposal for the 2021 national NAHB competition which was to be held in Orlando, Florida. Unfortunately, due to the COVID-19 pandemic, a virtual event was held in February 2021. Funded through an NAHB grant, the 2021 Aggies-NAHB competition team was made up of 10 undergraduate students. The purpose of this poster is to describe the key sections of the 2021 Aggie-NAHB residential sub-division development competition proposal. The proposed project site is a 299+ acre real estate parcel in Concord, NC. Concord's estimated population is 96,341 and is the 10th largest city in NC. Over a period of four months, the competition team developed a 50-page proposal with the following key sections: MARKET ANALYSIS, PROJECT DESIGN AND SELECTION; SITE DESIGN; SUSTAINABILITY; COST ESTIMATE; SCHEDULE; SITE MANAGEMENT AND LOGISTICS; SALES AND MARKETING STRATEGY; and FINANCIAL AND RISK ANALYSIS. The site has a total amount of 782 lots with 318 large lots and 464 small lots. The overall development period of 7 years 7 months run from planning to close out. Site and homes are designed to earn 164 points with the 2020 National Green Building Standard. Home sale prices range from $200K to 500K. Aggressive sales and marketing strategies include social media, community events, and billboards to encourage pre-selling of homes. With a gross sales revenue of $294,120,240, our financial analysis yielded an internal rate of return (IRR) of 24.73% with our breakeven at the 31st month.

2021-087	Oral Presentation	Education

Student Presenter: **Washington. Randolph D.; *North Carolina A&T State University***
Ofori-Boadu, Andrea
Mentor: **Ofori-Boadu, Andrea; *North Carolina A&T State University***

STEM Student Positive Academic and Career Advancement Experiences during COVID-19 Pandemic

The COVID-19 virus has had negative impacts on humanity and caused large disruptions to educational institutions. STEM students complain of learning challenges. Nevertheless, some STEM students had positive experiences during COVID-19. To be better prepared for future pandemics, it is important to understand STEM students' positive experiences for effective decision making that improves STEM learning and performance during future pandemics. As part of a larger and national research study investigating decision-making processes in undergraduate STEM students during the COVID-19 pandemic, the purpose of this research study is to examine the positive experiences of STEM students during the COVID-19 pandemic. Through open-ended questions, 183 research participants from six institutions provided responses to open-ended questions requiring them to describe their experiences during COVID-19 pandemic. Using MS excel, data from 183 completed surveys was analyzed through coding, categorization, and constant comparative analysis. Results revealed 12 emergent categories: Advancing Achievements; Online Vantage; Peer Connect; Professor Connect; Maintaining Grades; Support Networks; Others; Cash Relief; Advancing Careers; Soft Skill Development; Job Offers; and Limited Distractions. Positive academic, social, industrial, and financial experiences improved motivation to complete STEM education requirement and drove academic and career advancements. Insights inform the development and implementation of student, household, institution, and community strategies to improve STEM experiences during future pandemics. This will improve STEM community resiliency and enhance STEM student learning and progression during future pandemics. Future studies will explore correlations between STEM student characteristics and positive experiences.

2021-088	Oral Presentation	Engineering

Student Presenter: **Benedict, Kathryn; *North Carolina State University***
Mentor: **Cole, Jacqueline; *North Carolina State University***

Design and modeling of a novel in vitro platform for mechanistic probing of bone-vascular interactions

Ischemic stroke is the main cause of long-term disability and leads to increased bone loss. From previous research, specific factors contributing to bone loss from strokes are not known. An organ-on-chip device is a microfluidic, in vitro platform that mimics the bone microenvironment with greater control than previous models to better understand cell-cell interactions and causes of stroke-related bone loss. SolidWorks® and COMSOL Multiphysics® were used to develop an in vitro bone-on-chip platform that contains microdevice-compatible mineralized bone scaffolds. The scaffolds were freeze-dried in ratios of 10:0, 8:2, and 6:4 of type I collagen:chitosan, then mineralized to mimic the bone microenvironment. This process produced large pores that mimic native bone and remain mostly intact during crosslinking and mineralizing. The microdevice consists of a top chamber containing the scaffold to support osteoblast cells, a bottom chamber containing endothelial cells, and a semi-permeable membrane that separates the two. This design assessed the effects of chamber height and flow rate. Simulations were performed at flow rates of 100-1200 µL/min and top chamber heights of 1, 1.5, and 2 mm to extrapolate velocity, convective transport, and wall shear stress. Increased flow rates resulted in higher velocities, shear stresses, and convective transport through the device. After 15 minutes, the top chamber was 42-100% filled, where higher percentages resulted from higher flow rates and smaller chamber heights. Targeted wall shear stress was obtained using flow rates of 100-300 µL/min, suggesting this range is optimal for endothelial cell support.

2021-089	Oral Presentation	Engineering

Student Presenter: **Ferrell, Coleman; *East Carolina University***
Carroll, Matthew
Mentor: **Lee, Jinkun; *East Carolina University***

Optimizing Self-driving Parameters in Autonomous Vehicles through Traffic Simulation and CART Analysis

Autonomous vehicles (AV) are becoming more prevalent on our roadways, and the safety of driving alongside AVs is a growing public concern. AV developers tend to program a conservative self-driving algorithm in order to ensure public safety and avoid legal problems. However, a conservative position can significantly worsen traffic flow when AVs are introduced into the traffic network. Therefore, there is a need for a public discussion and agreement so developers can take a more aggressive approach to make AVs drive seamlessly alongside human drivers, while also maintaining safety. With the objective of preventing vehicle collisions while maximizing traffic efficiency, the control parameters of AV models are identified, analyzed, and designed inside a traffic network simulation within the Greenville, NC network. Specifically, machine learning is utilized to create classification and regressions trees (CART), which assist in determining the values of the parameters that achieve the target variables. The outcome of this work, the set of optimal control parameters of AVs determined from this research, will be the decision basis when traffic-related authorities, AV developers, and public representatives are trying to reach a consensus and discuss regulations for all AVs.

2021-090	Oral Presentation	Engineering

Student Presenter: **Frey, Ethan; *North Carolina State University***
Mentor: **Im, Sooik; *North Carolina State University***

Precisely Controlling Stiffness in Double Network Hydrogels Using Metal Redox Reactions

Blending soft and rigid materials is crucial for numerous applications including synthetic cartilage and flexible electronics. However, large gradients in stiffness can lead to rapid delamination under strain. Gradual stiffness gradients allow stress to be distributed evenly and adhesion with the rigid material maintained [1]. Hydrogels, a popular soft material known for their biocompatibility and exceptional ductility, consist of hydrophilic polymer networks that can absorb water and ions. Hydrogels containing both covalent and ionic crosslinks (double network) have previously been demonstrated to have enhanced mechanical properties [2]. This work utilizes redox reactions in hydrogels to create locally tunable stiffness gradients. Double network polyacrylamide-alginate hydrogels containing bismuth particles were reacted with silver nitrate to form silver particles and Bi3+, which crosslinked the carboxylic groups of the alginate. Digital image correlation (DIC) analysis showed that stiffness increased only at the locations of the bismuth particles. Through controlling the viscosity of the precursor solution, curing time, and redox reaction time stiffness gradients could be created at desired locations. For example, allowing the particles to partially settle in the precursor solution created a hydrogel that actuated during the redox reaction due to a difference in elastic modulus. This system allows for stiffness to be tuned down to the size of individual Bismuth particles, offering a solution for the fluid integration of rigid and soft materials.

[1] N. Naserifar et al., Advanced Materials, 2016.
[2] J. Sun et al., Nature, 2012.

2021-091	Oral Presentation	Engineering

Student Presenter: **Karty, Jacob; *North Carolina School of Science and Math***
Mentor: **Su, Jonathan; *Elon University***

Detecting Cyanobacteria Using Lens-Free Holographic Imaging and Machine Learning

Cyanobacteria are a common blue-green freshwater algae which can produce a variety of toxins that can be harmful to birds and mammals. Detection and monitoring of cyanobacterial blooms is therefore an important problem, particularly in North Carolina, which relies on artificial reservoirs for much of its drinking water. Previous studies have shown that lens-free imaging combined with holographic reconstruction can be used to detect and image objects as small as 1µm while maintaining a large field of view. Here we recreate this technology with a phone camera, 3D printed parts, and an LED, and use it to image samples of cyanobacteria in water. We then train a machine learning algorithm to detect cyanobacteria in our images. This machine learning algorithm is not only able to detect cyanobacteria in new images, but is able to differentiate between different concentrations of cyanobacteria in new images. We combine this method of imaging, the machine learning algorithm, and a simple method of auto-sampling using a water pump and chamber to show that there is an inexpensive, autonomous method of detecting and measuring the concentration of cyanobacteria in water. This early detection and monitoring of cyanobacteria can be useful to combat the threat that cyanobacteria poses to drinking water, livestock, and wildlife.

2021-092	Oral Presentation	Engineering

Student Presenter: **Musa, Deeqa; *North Carolina State University***
Mentor: **Cole, Jacqueline H.; *North Carolina State University***

Impact of Tissue Heterogeneity on Vertebral Bone Failure in Finite Element Models at Clinical Imaging Resolution

Trabecular bone is a heterogeneous tissue composed of plate- and rod-like bone struts with different mechanical roles. Plates function as load-bearing structures, whereas rods accrue microdamage to protect plates. Material heterogeneity affects bone's mechanical behavior and arises from bone remodeling in which surface tissue is continually eroded and replaced to repair microdamage. Since newly deposited bone is not fully mineralized and bone mainly derives its stiffness from mineral content, stiffness is lowest at the trabecular surface and increases toward the interior. Plates and rods can be identified in micro-computed tomography (micro-CT) images using Individual Trabecular Segmentation (ITS), and finite element analysis (FEA) used in conjunction enables computational analysis of their mechanical roles while accounting for material heterogeneity. A previous study used high-resolution FE models (17 µm voxels) of vertebral trabecular bone, with and without heterogeneity, to show that preferential microdamage accumulation in rods is enhanced by heterogeneity. The current study is an extension of this work but with coarsened models to make predictions about clinical applications. We hypothesized that images coarsened to mimic clinical CT resolution would produce similar patterns of microdamage accumulation. Downsampled models were created by combining groups of 64 neighboring voxels into one. Microdamage was identified using element principal strains, and ITS was used to identify plates and rods. As in the previous study, microdamage in downsampled models was preferentially accumulated in rods and enhanced by heterogeneity, showing that conclusions from the previous study may also be reached in a clinical context when evaluating bone structural integrity.

2021-093	Oral Presentation	Engineering

Student Presenter: **Pakulniewicz, Zachary; *East Carolina University***
Mentor: **Liu, Yang; *East Carolina University***

An Experimental Study on the Dynamics of Binder Drops Impacting on a Powder Surface in Binder Jetting Additive Manufacturing

Binder jetting additive manufacturing (AM) technology has been widely used for manufacturing complex and advanced structures. The binder jetting method creates 3D structures by jetting binder drops onto a powder bed with subsequent curing. While this method can provide fast and efficient non-contact manufacturing with additional design and material flexibilities, it suffers from several drawbacks, such as coarse resolution and manufacturing inconsistency. These undesired effects are caused by the complex drop-powder interactions during the printing process. In this study, we will experimentally investigate the complex binder-powder interactions during drop impacting and curing processes. While a high-speed imaging system will be used to capture the transient details during the drop-powder interactions, a micro digital image projection (m-DIP) system will be used to quantitatively measure the instantaneous 3D surface morphologies of binder drops impacting on powder surfaces. The findings derived from this study will be of great value to improve the current binder jetting AM procedures and develop more efficient and robust AM techniques tailored for fabricating high-quality functional structures in various applications.

2021-094	Oral Presentation	Engineering
Student Presenter:	**Shishira Somashekar; *North Carolina School of Science and Math***	
Mentor:	**Mahinthakumar, Kumar; *NC State University***	

Water Leakage Detection Using Machine Learning and Internet of Things

As the world's water resources are declining and pipeline infrastructure is growing older, it is essential that a solution is created to reduce water wastage and contamination. This project focuses on addressing the worldwide problem of a lack of an intelligent approach for early detection of pipeline leakages through the use of smart water technologies and artificial neural networks (ANN). Recently, cloud computing technologies and the internet of things has allowed the creation of real time reports of leak locations by using city collected data. In order to generate data for the model, the WNTR software will model water distribution systems using leak and pressure values. Then, a Multi-Layer Perceptron (MLP) model, a type of ANN, will be used to predict which nodes are leak nodes based on an input of pressure values. The data will be split into training and testing data. After training, the model will be optimized through hyperparameter tuning. Specifically, the hyper parameters are loss function, activation function, numbers of epochs, and batch size. The optimized model will be compared to the base model in terms of accuracy in determining leak location. This model will be compared to other machine learning methods like Random Forest Regressor and Naive Bayes Classifier. Ultimately, the goal is to create a user friendly dashboard that displays a water distribution network, leak nodes, and other statistics. Additionally, the model should be able to work with any city's water distribution network, resulting in widespread water conservation and longer lasting infrastructure.

2021-095	Oral Presentation	Environmental Sciences
Student Presenter:	**Ackall, Yasmine; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***	
	van Praag, Micah	
	Lopez Calderon, Katherine	
	Onuoha, Pristine	
Mentor:	**Tyler, Lori; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***	

An Assessment of the Effects of Urbanization on Bolin Creek

Bolin Creek is a creek located in Chapel Hill, North Carolina. It is on North Carolina's 303 (d) list of impaired waters. The objective of this study was to investigate the potential connections between urbanization and the declining water quality of Bolin Creek. Water chemistry tests were performed, as well as analyses of benthic macroinvertebrates in Bolin Creek and two reference sites, allowing water quality to be measured and quantified. A strong negative correlation was found between the percentage of developed land around the stream sites and stream water quality (as measured by North Carolina Biotic Index). Conductivity, dissolved oxygen, turbidity, nitrates, and phosphates were shown to be important indicators of urbanization affecting water quality. Correlational data on conductivity, turbidity, and nutrient pollution indicated that urban runoff with a link to the high percentage of impervious surfaces in Chapel Hill was a major contributor to the degradation of the water quality of Bolin Creek. These results indicated that further action is needed to help improve the water quality of Bolin Creek. Restoring the riparian buffer along Bolin Creek, development changes in Chapel Hill, street cleaning, green roofs, the Clean Water State Revolving Fund (CWSRF), and increased community awareness are options that can be explored as methods to aid in the restoration of the water quality of Bolin Creek.

2021-096	Oral Presentation	Environmental Sciences

Student Presenter: **Barboriak, Josie; *North Carolina School of Science and Math***
Mentor: **Mallory, Heather; *North Carolina School of Science and Math***

Sphagnum Water Remediation Methods for At-Home Removal of Lead

Lead contamination of drinking water is a public health problem in the United States, often with many social and racial implications, that costs upwards of $50 million in health care dollars every year. Lead is a potent neurotoxin that can cause decreased IQ in low levels and kidney damage in higher ones, and the aging infrastructure in low-income communities in which lead contamination does the most harm places low-cost residential remediation in a position of great importance. Green plants can be used to remove lead from drinking water, and bryophytes are especially promising due to their hardiness and semi-aquatic nature. A suspension culture method, in which protonemal cells of F. hygrometrica cultured from spores in agar were then homogenized, suspended in Knop's medium, and placed in a glass column, was previously found to be successful. However, the suspension culture method is costly, complicated, and requires specialized equipment to prepare. This experiment was intended to compare remediation efficacy of the suspension culture method to a novel simplified method, both using Sphagnum moss. The simplified method involved gathering wild moss, washing it to remove dirt, and placing it in a shallow container containing contaminated water. It was found that the suspension culture method with Sphagnum is infeasible for emergency use, and results from the simplified method are forthcoming. Regardless of results, low-cost end-point application of moss remediation abilities must be further investigated.

2021-097	Oral Presentation	Environmental Sciences

Student Presenter: **Donnelly, Abigail; *Elon University***
Mentor: **Nicholas Bussberg; *Elon University***

Water use and the pandemic: How the COVID-19 pandemic shifted water use patterns at Elon University

Since the start of the COVID-19 pandemic, a lot has changed in the world. In many ways, it was flipped upside down. One aspect of life that surprisingly took a large shift was water usage. National trends show a significant increase in water use in residential spaces. People stayed at home and thus our behavior patterns changed, such as how and when we consumed water. We investigated the water use patterns at a mid-sized private university in North Carolina (Elon University), because the restrictions that were put in place to protect the individuals likely affected the water usage patterns around campus. In addition to comparing the overall water usage from before and during the pandemic, we also looked at the changes in usage among building types (e.g., academic buildings vs. residential buildings). We found clear changes in water usage on campus since March 2020, the beginning of the pandemic.

2021-098	Oral Presentation	Environmental Sciences

Student Presenter: **Nimbalkar, Jay; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***
Southwell, Lauren
Narasimhan, Pooja
Mentor: **Tyler, Lori; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***

Comparing the Efficacy of First and Second Generation Biofuels and Analyzing Future Trends in the Field

Biofuels are widely touted as a strong alternative for alleviating the harmful effects of conventional fossil fuels. Existing data on biofuel CO2 emissions, net emissions, land area and land type required, ethanol yield, and energy efficiency metrics for various biofuels are compiled, analyzed, and summarized in this research. Our analysis clearly shows the need to prioritize second generation biofuels and conduct further research into third generation biofuels to maximize the efficacy of this fuel source. Solutions to increase the sustainability and efficiency of biofuels are also proposed in our analysis of the literature explaining applications of biomass residues and emerging biofuel sources such as algae. Residues and algae have significant potential to produce biofuel energy in a more sustainable and flexible way by decreasing the amount of land needed to produce energy. However, significant consideration must be given to the impacts of residue use in the combustion processes and soil, and further research needs to be done with algae to make the harvesting process more cost-effective.

2021-099	Oral Presentation	Environmental Sciences

Student Presenter: **Olepu, Nitya; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***
Amil Elangovan
Kaushik Sriram
Mentor: **Lori Tyler; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***

Climate Conflict: An examination of the political, economic, and social factors that amplify domestic dissension

Most are familiar with the environmental consequences of the climate crisis. However, a less explored facet of this global threat is elevated human conflict, violence, and aggression. The effects of the climate crisis can intensify inherent social tensions and in turn, feed political instability and detrimental effects to the economy. Analyzing the Peace and Conflict Instability Ledger (PCIL), an index that has been able to predict about 80% of instances of political instability around the world, it can be seen that areas with the highest regional concentrations of risk have borne the brunt of multiple unusual climate extremes over the past few decades. Exploring the four Representative Concentration Pathways (RCPs) by the IPCC, it is seen that maize, wheat, rice, and soybean suffer agricultural yield declines, which can increase risk of conflict and inflate food prices. In addition, crime is typically overlooked as a consequence of climate change. The U.K. Hadley Centre's HadCM3 climate model predicts 1.4 million cases of vehicle theft, 3.8 million cases of larceny, 409,000 robberies, 2.4 million simple assault cases, 1.6 million aggravated assault cases, and 216,000 cases of rape this century as a result of global temperature increases. Finally, an analysis of the Climate Risk Index and Global Peace Index demonstrates that nations at greater risk for climate change-caused extreme weather events are more prone to unrest. Our research compiles published scholarly articles and reports that reveal the political, social, and economic factors that can amplify climate conflict.

2021-100	Oral Presentation	Environmental Sciences
Student Presenter:	**Patel, Nikhil; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***	
	Rugani, Oliva	
	Soneji, Vrutika	
	Tyler, Lori; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)*	
Mentor:		

Chronic Obstructive Pulmonary Disease: How Climate Change and Air Pollution Pose Urgent Threats

Chronic Obstructive Pulmonary Disease, or COPD, is a term that encompasses two related conditions, emphysema, and chronic bronchitis, which are characterized by obstructions in the lungs and cause trouble breathing. Because of how much it affects a person's ability to draw oxygen into their body, COPD can severely impact the quality of life and lead to death. Studies have shown that COPD affects 12-16 million people in the United States alone and is the third-leading cause of death globally. Although smoking is a primary cause, ambient air pollution — including particulate matter, carbon monoxide, carbon dioxide, ozone, sulfur dioxide, nitrogen dioxide, and lead — often contributes to COPD development as well. In addition to making air pollution worse, the effects of climate change will negatively impact those with COPD by exposing patients to more extreme weather conditions, such as intense wet and dry conditions and increased heat, and, in some places, increased cold. This report is intended to summarize the literature — peer-reviewed studies and research on COPD, air pollution, and climate change — and show the connections between all three facets of the issue.

2021-101	Oral Presentation	Environmental Sciences
Student Presenter:	**Perdue, Cas E.; *UNC Wilmington***	
Mentor:	**Rowe, Shawna; *Cape Fear Community College***	

Abundance and Occurrence of Microplastics in the Cape Fear River: A Preliminary Study in Southeastern North Carolina, U.S.A

As plastic pollution concentration rises globally, it is crucial to track their abundance and occurrence due to their detrimental impacts on various organisms and ecosystems. Microplastics are vectors of various chemicals, can cause physical blockages in intestines, and inhibit peak reproductive health. This study tests the hypothesis that there are microplastics in the Cape Fear River (CFR). Samples were collected from the CFR for 5 weeks and processed using NOAA's Laboratory Method for the Analysis of Microplastics. Microfibers were found in the abundance that microplastics were hypothesized to be. Microfibers were found in every sample, with an average weight of 0.0013 grams per sample. Future research is necessary to confirm these results, which is expanded on in this study, as well as future recommendations for method execution.

2021-102	Oral Presentation	Environmental Sciences

Student Presenter: **Reese, Leah C.; *UNC Asheville***
Mentor: **Gillette, David; *UNC Asheville***

Using Macroinvertebrates to Determine Effects of Stream Restoration

Stream health is often overlooked because of its fluvial nature and the lack of clear indication of stream integrity. Stream health is important because of its impact on biotic functions of aquatic and terrestrial ecosystems. By looking at small factors in streams, such as macroinvertebrates, it can oftentimes show you a larger picture and give you an overall view of a stream's health. The purpose of this study was to determine the ecological health of restored streams in western North Carolina compared to the previous pre-restoration condition. To find this, we examined macroinvertebrate populations in sections of the creeks. Populations were totaled and evaluated to find the mean percentage of invertebrates in orders Ephemeroptera, Plecoptera, and Trichoptera (% EPT) as well as the tolerance levels. Using the Hilsenhoff Family-Based Index of Biotic Integrity and mean percent EPT allowed for a mean number of tolerance levels for each stream to be found. To understand the causation of the population numbers, we tested substrate composition, flow velocity, water depth, and percent EPT. We found correlation between the levels of flow velocity and water depth in relation to the amount of EPT present and tolerance levels. Sites that had higher levels of flow velocity also had higher levels of EPT and lower numbers of biotic index values. The results of this study, compared to the results of the pre-restoration project, show the changes and effects of the restoration project and determine if the quality of the streams were improved.

2021-103	Oral Presentation	Environmental Sciences

Student Presenter: **Mesimer, Angel; *Catawba College***
Mentor: **Hartwig, Carmony and Bolin, Jay; *Catawba College***

Investigating Dietary and Microbial Community Variation between Urban and Rural Coyote (Canis latrans) Populations

Human populations continue to expand their ecological footprint resulting in habitat loss and change for wildlife species. In Rowan County, NC and around the USA, populations of Canis latrans (Coyote) habitat are shared closely with humans. For omnivores such as C. latrans, human activity may result in alteration of their prey and plant food availability. This study seeks to investigate the urban-rural gradient on C. latrans diet. We collected scat samples across an urban-rural gradient and 1) analyzed the contents via 18S rDNA barcoding and 16S rDNA barcoding to estimate diet and microbial communities, and 2) used direct germination to estimate viable seeds in coyote scat. Differences in the prey choice, germinable seeds, and microbial content of C. latrans scat between the urban and rural environments will be presented to further understand variation in coyote diet across an urban-rural gradient.

2021-104	Oral Presentation	Humanities

Student Presenter: **Burch, Scout; *Meredith College***
Mentor: **Grimes, Shannon; *Meredith College***

Queering the Other: Levinas and Gender Identity

Critical discourse about gender identity has come to the forefront of pop culture conversations. Movies like Ma Vie en Rose, The Danish Girl, and The Trans List explore the experiences of gender non-conforming individuals for audiences outside of the trans community. The goal of these films is to create empathy for the experiences and lives of transgender individuals, something that may be foreign to the audience. This project will explore media's depiction of gender-nonconforming individuals through the lens of Levinasian ethics to assess whether this encounter with gender otherness through film encourages or discourages gender inclusivity through how they portray these characters and storylines.

Because Levinasian ethics critiques egocentric approaches to ethics, in which the recognition of the Other is only achieved through seeing a reflection of the Self, his work is useful in analyzing these issues. Empathic recognition is the avenue that most media takes when portraying the stories of gender-nonconforming individuals; mainstream films attempt to make the inner workings of transgender individuals something that the cisgender population can comprehend, but do their simplifications and generalizations distort the truth to the point where it can no longer be considered accurate or constructive? This analysis will show where efforts to represent gender non-conforming individuals have succeeded and where they have failed to represent this community in a productive way; these moments of failure will be occasions to think about the goals, aims, and methods of representation at the mass level.

2021-105	Oral Presentation	Humanities

Student Presenter: **Jordan, Glenn L; *Chowan University***
Mentor: **Hayes, Tim; *Chowan University***

Ultimate Connection

The Human Hive-mind, the Information Superhighway, the internet has gained many names over the years. Its prominence grew from being seen as a neat idea most people couldn't comprehend to a daily necessity with studies concerned about people spending too much time on the internet. The most important aspect of the internet is the ability to communicate with others from across the world in real-time. The play Water by the Spoonful takes a daring leap and incorporates a chatroom into its staging and action. An unconventional decision, it was even more so ten years ago when the play made its debut. Regardless of age, the play understands the culture of internet friendships and bonds very well. It shows both the value of life in the online world and the necessity of offline living. This wealth of understanding of internet culture is due to Hudes sending many letters while growing up and later transitioning to emails in college. This was so she could communicate with her husband-to-be over long distances (Hudes). There are many studies on the effects of spending too much time online. There are also plenty of discussions over concerns that people are forgetting how to communicate with others offline. Still, there is strikingly little in regards to the way relationships develop and are fostered in an online world. Hudes presents a very honest look at how people communicate and behave online, and she does not shy away from both the good and the bad of life online.

2021-106	Oral Presentation	Humanities

Student Presenter: **Langley, Christian; *William Peace University***
Mentor: **Otis, Katie; *William Peace University***

The Hidden Soldier: Colonial Women During the American Revolutionary War and Early Nationhood

When asked to think about the American Revolutionary War, most people's minds fade to images of George Washington, Redcoats, and blood-soaked battlefields. The contributions Revolution era women made are often overlooked. While some may expect women to provide domestic and financial support, women did much more to support war efforts. From being a spy to taking up a musket against the British, Revolutionary era women assisted in more ways than people realize. Studying the writings, paintings, and drawings provided by Revolutionary War era women, their impact becomes evident. Their impact is not all that becomes evident; the class system that separated colonial women becomes apparent. Studying the contributions of Revolutionary War era women allows their contribution, that for many years went unnoticed, to gain awareness.

2021-107	Oral Presentation	Humanities

Student Presenter: **Marzuk, Rene; *UNC Greensboro***
Mentor: **Kilcup, Karen; *UNC Greensboro***

Rescuing Environmental Children's Literature Created by Writers of Color and Child Authors in Nineteenth-Century America

As an undergraduate contributor to the The Envious Lobster, a searchable, annotated, and open-access anthology that collects forgotten nineteenth- and early twentieth- century American children's writing about nature and the environment, I have rescued primary texts while emphasizing the long-unacknowledged connection between children's literature and nature writing between 1824-1925. Writing for children is writing for the future, and in nineteenth-century America, a period of significant social, cultural, scientific, and economic changes, most writers who wrote for adults also wrote for children. In many cases, such cross-written pieces addressed both audiences simultaneously. Unfortunately, there is currently no print or online resource that gathers and interprets these engaging historically, culturally, and aesthetically important materials. Working closely with my mentor, Dr. Karen Kilcup, Elizabeth Rosenthal Excellence Professor and founder of The Envious Lobster, I have researched, read, and discussed a wide range of primary texts with the goal of expanding the number of texts from writers of color and child authors in the anthology. I have also contributed to the significant interpretive apparatus that accompanies each anthology entry and illuminates its contexts, sometimes in surprising ways--readers can expect, for example, a link to the Audubon Society's recordings of owls' calls among the annotations of a poem that mentions owlets' hoots. Each dive into the archives benefits as much from method as from serendipity, which is why, apart from its intrinsic value, my research for The Envious Lobster is also a useful case study on approaching the public domain archives.

2021-108	Oral Presentation	Humanities

Student Presenter: **Miller, Kayla; *Pfeiffer University***
Mentor: **Thompson, Michael; *Pfeiffer University***

The Geneva Convention of 1954: An Exploration into Multiple Perspectives of the Convention and the Following Implications to the Vietnam War

The Geneva Convention of 1954 was a critical turning point in the events leading to the Vietnam War. Several countries were invited and participated in the discussions to develop the Geneva Accords, which outlined the expected behaviors and plans for the next two years in a newly split Vietnam. Although the Geneva Convention is commonly overlooked in studies of the Vietnam Era, it was vital to the war's development and set the groundwork for the next leaders to follow. It was a vastly political event that entertained multiple perspectives and hidden agendas. Each country's motivation was not explicitly clear and an examination of relative events at the time within each major country involved is necessary to delve deeper into separate motives for each country during negotiations. Through an examination of primary literature, this paper will explore the multiple perspectives and motivations for each major party in attendance of the Geneva Convention and how those agendas affected their decisions in drafting the Geneva Accords, which later set the stage for the United States' entry into the war.

2021-109	Oral Presentation	Humanities

Student Presenter: **Rork, Kerry; *Duke University***
Mentor: **Lee Sorensen; *Duke University***

Women in Art History: 1930-1950: Intellectual Realities

Art history has long since been a male-dominated field, and the discoveries of women are only recently beginning to be appreciated. Recognizing this disparity and hoping to better understand its reality, since summer of 2020, I have worked to pull female-identifying art historians from English-language art journals such as The Metropolitan Museum of Art Bulletin and the Burlington Magazine from the years 1930 to 1950 to answer questions like "What were the most common topics or specialities?," "What were the time periods and factors leading to an increase in women art writers?," and "What time periods saw the greatest increase in women writers?" Institution, journal, year, continent and country of the subject matter, subject, and artistic medium were folded into a database of over 750+ entries, examining and detailing each woman's article in their respective publications with some areas of interest in mind. Initial findings include an emphasis on household goods and decorative arts as well as minimal specialization for women within these various publications. At this point in my research, I am beginning to visualize the data that I collected with hopes that we will further quantify the gender disparities within art history.

2021-110	Oral Presentation	Humanities

Student Presenter: **Sandwar, Vishakh; *North Carolina School of Science and Math***
Mentor: **Marshburn, Drew; *Kaleido: The Blockchain Business Cloud***

The Ethical Implications of Blockchain Application.

Many of the largest markets in the American and global economies have begun rapidly integrating blockchain technology into their companies. Blockchain's decentralized nature and immutable ledger offer levels of trust between two non-trusting organizations like never before. Even though the primary use of blockchains in a corporate environment is for communication and security, it is worth postulating different use cases for a technology in its primitive stages. One of these uses is to prevent and deter unethical behavior, especially in industries plagued with ethical dilemmas. For example, seafood companies are notorious for mislabeling a significant portion of seafood products, and many jewelers cannot trace their diamonds to ethical sourcing. The blockchain applications that have targeted these problems lie in the core facets of blockchain. As every transaction is permanent and linked, the consensus protocol can not approve fraudulent transactions, and companies and authorities can trace the conflicted products to their origins. Unfortunately, most of these blockchain use cases have not been truly explored and are currently theoretical models. This paper will outline a pragmatic discussion of the ethical issues underlying many of the world's biggest industries, acknowledge the blockchain-based technology that could address these problems, and propose how markets ridden with unethical behavior can successfully implemented it. This research hopes to serve as an initial proposal for the growing use case of ethical policing using blockchain-based technology, spark discussion of the intersection between ethics and technology and stimulate additional discourse on unusual blockchain use cases.

2021-111	Oral Presentation	Humanities

Student Presenter: **Savage-White, Krista; *UNC Greensboro***
Mentor: **Girma, Hewan; *UNC Greensboro***

Race and Identity: Finding the North Star Podcast

Finding the North Star is a podcast created to educate listeners on topics revolving around culture, contemporary issues, and history about Black Americans and the Black diaspora. Inspired by the star that was a symbol of freedom for slaves, it revolves around the exploration of one young woman's American identity. While on that journey, I speak on topics from a historical and contemporary point of view in a serious, yet lighthearted way. Over the first eight episodes, the focus is on U.S.-centric topics, ranging from the Black Lives Matter movement and armchair activism to colorism and the history of Black Wall Street.

The script for each episode is based on hours of rigorous research, exploring various academic and popular sources. A challenge was making the material comprehensible, humorous, and of appropriate length for an average non-academic audience. While the research and production of the podcast can at times bring on an emotional rollercoaster, this is a history that needs to be told and retold. As podcasts have become a popular method for storytelling on race-related topics, this presentation explores the appropriateness of this medium to explore such topics. Through this podcast, I hope to encourage people to critically think about the topics presented while finding contentment with my African American identity. The research, writing and production of this podcast, enabled by the generous funding from UNCG's URSCO office, marks the beginning of a future career as a content creator.

2021-112	Oral Presentation	Humanities

Student Presenter: **Sifford, Katelyn; *Pfeiffer University***
Mentor: **Doug Hume; *Pfeiffer University***

Hear Her Story: The Unnamed Woman of Judges 19 and Sexual Assault on College Campuses

This presentation analyzes the purpose behind Judges 19, the story of the Unnamed Woman, and its use for education today. Offering a reading of this text and a view of sexual violence on a college campus, I will argue that we should continue to use it from an educational standpoint to support the idea that things such as this are still evident in today's society and must be acknowledged to be discontinued. In the story, a concubine leaves her master and retreats to her father's house. While bringing her back home from her father's house, her husband takes her to a village where they find safety with an old man offering shelter. That night men come beating on the walls of the house and wish to violate the husband. In order to save himself, he pushes his concubine out of the house where she is beaten and raped all night. At morning the master instructs her to get up; and she does not. He takes her body home and cuts her up into pieces, scattering her all over Israel. This is a story of rape, unjust morals, and acquitted crime in a world where God seems non-existent. Phyllis Trible writes on this text in her book Texts of Terror, in which she focuses on the power dynamics and wording used within the story. Such power dynamics are still apparent, as we have organizations like It's On Us, on my college campus, to educate students on sexual assault. Programs such as these make sure that stories like that of the Unnamed Woman do not go unheard and that they are remembered and used for the greater good of the community.

2021-113	Oral Presentation	Mathematics and Quantitative Studies

Student Presenter: **Bender, Paula A.; *High Point University***
Mentor: **Geiger, Brett; *High Point University***

Mathematical Model of Learning Disabilities

Language-based learning disabilities, such as dyslexia, are prevalent in children, affecting approximately 1 in 5 children in the United States. Researchers continue to attempt to understand the neural functioning of reading, memory, and learning in order to identify differences between children with and without learning disabilities. While mathematical modeling has helped to uncover the inner workings of the brain, there is a lack of models that are specifically connected to learning disabilities. The purpose of our research is to build a mathematical model that will improve understanding of the nature of learning disabilities. We have produced a MATLAB code, using computer science, linear algebra, and differential equations, that simulates neurons recognizing and reading letters. Our neural field model incorporates synaptic plasticity, namely short-term potentiation, and dynamic fluctuations in connection strengths and neural activity. The program can be used to simulate how our brains process and read letters and words. Making alterations to the model can illustrate differences in neural circuitry when a child has a learning disability. Hopefully, this model will shed light on the biology of reading as well as the biological causes of discrepancies in reading ability for children with dyslexia.

2021-114	Oral Presentation	Mathematics and Quantitative Studies

Student Presenter: **Boniface, Erick; *North Carolina State University***
Mentor: **Hong, Hoon; *North Carolina State University***

Choosing a variable ordering for Cylindrical Algebraic Decomposition

Cylindrical Algebraic Decomposition (CAD) is a key algorithm for a fundamental problem in real algebraic geometry, with numerous real-life applications in diverse areas such as real quantifier elimination problems, stability analysis, robust control system design, reachability analysis, parametric optimization, parameter estimation, robot motion planning, computer vision, epidemic modeling, etc. The variable ordering of the input for a CAD calculation significantly impacts the computation time, and thus, numerous authors have worked to solve the problem of finding a good variable ordering. We propose a novel approach for finding a good variable ordering.

2021-115	Oral Presentation	Mathematics and Quantitative Studies

Student Presenter: **Fujita, Takumi; *North Carolina School of Science and Math***
Kim, Sean
Mentor: **Lee, Todd; *North Carolina School of Science and Math***

Minimum number of triangles in a Saturated arrangement of triangles

A saturated plane is defined as an arrangement of equilateral triangles such that the intersection of any two is either empty or a common vertex and every vertex is shared by exactly two triangles. We set out to find the smallest positive integer n such that there exists a saturated arrangement of n equilateral triangles with integer side lengths. We were able to discover several general configurations that we described as the fractal, ring, and quadruple set. By using angle chasing, trigonometry, and algebra, we were able to find n = 10 in a quadruple set configuration to have the minimum number of integer-side length triangles to form a saturated plane.

2021-116	Oral Presentation	Mathematics and Quantitative Studies

Student Presenter: **Magan, Bryant Hank;** ***Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***

Mentor: **Tyler, Lori;** ***Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***

Image Edge Detection using a Modified Ant Colony Optimization Algorithm

Ant Colony Optimization (ACO) is a probabilistic optimization method which mimics the behavior of ant colonies to solve graphical computational problems (particularly the famous travelling salesman problem), and has been established as a viable edge detection algorithm. ACO may be applied to edge detection by modeling an image as a directed graph, in which pixels are represented by vertices and adjacent pixels are connected by edges. Factoring in differences in color intensity among adjacent pixels, the virtual ants are incentivized to corral along edges, thus producing a matrix consisting of the most travelled pixels (and thus the places most likely to be edges). This paper focuses on using a modified version of one such ACO algorithm, which itself was produced as a modified version of the original Ant System (AS) algorithm. Experiments were conducted to determine the optimal constant values and methodology for different applications of the algorithm. This research concludes that ACO is viable in certain applications as an edge detector, and that the methodologies presented are relatively effective.

2021-117	Oral Presentation	Mathematics and Quantitative Studies

Student Presenter: **Rudins, Katie;** ***Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***

Mentor: **Tyler, Lori;** ***Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***

Reading Recall: A Comparison of Reading Comprehension using Electronic and Paper Media

Electronic books, or e-books, have become more popular over the past several years. Questions have come up whether reading comprehension is the same, worse, or better using e-books, as compared with standard paper texts. A study was performed to evaluate this question in the elementary school population. The hypothesis was that the retention of information would be no different when information is read from paper, than from an electronic device. In order to perform this study, four stories were read, alternating electronic and paper media types, followed each time by a five-question test covering the information read. Although the results showed a trend of better comprehension when reading from tablets, there was no statistically significant ($p<0.05$) difference in information retention using the two types of reading media (paper versus electronic) in elementary school students.

2021-118	Oral Presentation	Mathematics and Quantitative Studies

Student Presenter: **Unah, Daniel; *North Carolina School of Science and Math***
Mentor: **Gotwals, Robert; *North Carolina School of Science and Math***

Statistically Analyzing North Carolina Traffic Stop Data

Traffic stops are the most common interaction between citizens and the police. Every year, millions of citizens are stopped, detained, and searched by police. Many people believe that these encounters are driven by racial biases. Our research provides quantitative evidence to show whether there is racial bias present in the behavior of North Carolina police officers. To conduct our research, we use publicly available data, from 2002-2020, cleaned and sampled to include only the officers with the highest numbers of stops in each police department. This step was taken to get rid of outliers in the data and make the comparison of specific officers' statistics easier. After conducting our research, we found that officers conduct a disproportionate amount of searches on black men compared to white men, and these searches do not result in a higher rate of finding contraband. This finding is consistent when you look at the data of individual police departments, indicating that this is a systemic issue.

2021-119	Oral Presentation	Medical and Health Sciences

Student Presenter: **Bhima, Miran; *North Carolina School of Science and Math***
Mentor: **Anglin, Tim; *North Carolina School of Science and Math***

Development of novel small molecule inhibitor for the cancerous mutant protein, NRAS Q61R

Mutations in RAS proteins account for over 30% of all human cancers. Mutations in the NRAS, a type of RAS protein, promote tumorigenesis in about 1 in 5 melanoma cases. Previous literature has claimed for this protein to be undruggable, however with recent advances in drug modeling, there has been some promise. A new drug candidate, BI-2852, has been shown to drug all pockets of the three types of RAS proteins (KRAS, HRAS, and NRAS). However, since this drug has been generalized to drug these three proteins, it fails to take into account the various nuances between the mutations, and there is still no known drug that is able to target the NRAS mutation, specifically NRAS Q61R, the most common cancerous mutation in the NRAS protein. This mutation causes the NRAS protein to constantly stay active which leads to the constant signaling of downstream proteins, leading to uncontrolled cell growth. The development of a viable inhibitor would allow for the inactivation of this mutant cancerous protein. Using computational models for protein-ligand docking in Schrodinger's Maestro, a small molecule inhibitor was developed for the common cancerous mutant, NRAS Q61R. A ligand design process that evaluated over 10,000 structures from a created ligand library, producing a few viable candidates with higher calculated docking scores and other improved and favorable parameters than the original compound, BI-2852. A synthetic route for the most promising ligand, compound 22, is proposed and evaluated in anticipation of future work to measure its NRAS inhibition.

2021-120	Oral Presentation	Medical and Health Sciences

Student Presenter: **Choi, Rebekah I; *North Carolina School of Science and Math***
Mentor: **John Paul Vavalle; *UNC Medical Center***

Impact of Atrial Fibrillation on Outcomes in Patients After MitraClip

Background: The mitral valve controls blood flow from the left atrium to the left ventricle. Mitral valve regurgitation occurs when leaflets of the mitral valve do not completely close during systole, leading to regurgitant flow backwards towards the lungs, causing symptoms such as heart failure. MitraClip is a minimally-invasive procedure to treat mitral regurgitation by closing the valve with a clip without open-heart surgery. Atrial Fibrillation is a common arrhythmia in patients with mitral regurgitation. The impact of atrial fibrillation on the outcomes in MitraClip patients is still being studied.
Methods: MitraClip patients at the Heart and Vascular Center of UNC Medical Center from 20XX to 20XX were identified. Clinical complications and outcomes were compared between patients with preoperative atrial fibrillation and without. P-values for patient outcomes were calculated using a 5% significance level to observe differences.
Results: 117 patients were identified: 48 having no atrial fibrillation and 69 having atrial fibrillation. There was no significant difference between the groups in hospital length of stay, discharge status, 30-day mortality, follow up KCCQ-12 (Kansas City Cardiomyopathy Questionnaire) overall score, residual mitral regurgitation, fluoroscopy time, or ICU hours, suggesting no difference in outcomes in patients with versus without atrial fibrillation after the MitraClip procedure.
Conclusion: This study suggests no impact of atrial fibrillation on outcomes after MitraClip, but is limited by the smaller sample size. Additional research with a larger population would allow for a stronger conclusion about the effect of atrial fibrillation on patients who undergo the MitraClip procedure.

2021-121	Oral Presentation	Medical and Health Sciences

Student Presenter: **Jain, Ananya; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***
Dharmapurikar, Mukta
Kolla, Harvik
Tang, Emma
Tyler, Lori; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)*
Mentor:

The Exploration of the Association between Obesity, Executive Function, and Sleep in Adolescents

The objective of this study was to systematically investigate the association between obesity and executive function as well as between obesity and sleep. Google Scholar and PubMed databases were searched for studies reporting any correlation between executive function and/or sleep and weight status. Studies in dissertations, studies that were not in English, and studies that had no specified measurement of weight status were excluded from the study. A total of 64,508 studies were extracted from the systematic search protocol, of which 16 were then used for further analysis. All studies used some form of executive function tests to measure executive function impairments or measured one or more domains of sleep (i.e.: sleep quality, duration and latency). All studies directed emphasis on impairments in working memory, cognitive flexibility, and inhibitory control. Eight found an inverse correlation between obesity and at least one domain of sleep, and eight found an inverse correlation between obesity and executive function in at least one domain. Although studies varied in their population samples and methods, the findings of this review warrant the need for further research on the ramifications of obesity on executive function and sleep, especially in adolescents using a multitude of neurocognitive tests as well as actigraphies, polysomonographies, and questionnaires to acquire accurate measurements in executive function and sleep quality, latency, and duration respectively.

2021-122	Oral Presentation	Medical and Health Sciences

Student Presenter: **McGarry, Raelyn; *Elon University***
Mentor: **Christopher, Shefali; *Elon University***

Evaluation of running kinematics between postpartum runners and nulliparous controls.

Research on the effects of running after childbirth is limited. Studies have shown that up to 84% of women who return to running postpartum experience pain. When investigating running risk factors, several studies have shown a relationship between landing forces and loading rates associated with foot strike patterns, and injury in female runners. These running kinetics can be affected by the biomechanical, musculoskeletal, and physiological changes that occur during pregnancy and childbirth. The purpose of this study was to evaluate the differences in kinematic variables in postpartum women compared to nulliparous women. To evaluate these variables a force plate was utilized, and participants completed three overground running data sets for each foot. The force peaks were analyzed using a model corrected with body weight and the data was compared between groups using a two-tailed T-test. The analysis included 30 total participants, 15 nulliparous and 15 postpartum women. There was no significant difference in the impact force and the vertical loading rates (PP: 2.09[0.36] N/BW, C: 1.99[0.34] N/BW, p value = 0.43; PP: 69.2[21.2] N/BW*s, C: 71.8[21.5] N/BW*s, p value = 0.75) but there was a difference in the active force between groups (PP: 2.38[0.23] N/BW, C: 2.54[0.15] N/BW, p value = 0.038). The analyzed kinetic data suggests that postpartum women may be at higher risk for running related pain and injuries due to lower active forces. Clinicians might use this information to perform a running gait evaluation before a postpartum runner returns to running to avoid future injury.

2021-123	Oral Presentation	Medical and Health Sciences

Student Presenter: **Patel, Sahil; *John T. Hoggard High School, Issac Bear Early College High School***
Wang, Maximillian
Guo, Justin
Chen, Cuixian; *John T. Hoggard High School, Issac Bear Early College High School*
Mentor:

Machine-Aided Detection of Atrial Fibrillation through R-R Intervals

Atrial Fibrillation (A-FIB) is a heart condition that occurs when the atria fail to beat in coordination with the ventricles, resulting in "irregularly irregular" heartbeats. This can lead to blood clotting and potentially a stroke. Since detecting A-FIB is extremely difficult, a possible solution is an application for devices like Apple Watches to constantly track the heart rate of its user. The program would then use the data collected to predict A-FIB based on the R-peaks and the distance between them, otherwise known as R-R intervals. Various features were used in conjunction with numerous classifiers to create models of prediction. The most prominent among these features was transitions, but all the features combined led to a greater overall accuracy. Out of all the classifiers, Light Gradient Boosting (LGBM) and Extreme Gradient Boosting (XGBoost) had the two highest accuracies, at 97.57\% and 97.56\%, respectively, as well as the two highest sensitivities and specificities. Ensemble models which combined the outputs of many classifiers were also created, none of which outperformed LGBM and XGBoost. Therefore, it was concluded that Light and Extreme Gradient Boosting, when provided with all features, would be the best algorithms for predicting atrial fibrillation.

2021-124	Oral Presentation	Medical and Health Sciences

Student Presenter: **Rose, Jacob; *North Carolina School of Science and Math***
Mentor: **Bruno, Michael; *North Carolina School of Science and Math***

Development of a Bioactive, Biodegradable, and Variable-Density 3D Printer Filament for Patient-Specific Bone Reconstructive Implants

Current orthopedic implants are restricted in the level of patient specificity and biological interaction they can achieve. The demand for more effective and less intrusive reconstructive orthopedic implants has been increasing with an aging population. This project aims to develop a bioactive, biodegradable, and variable density 3D printer filament for use in patient-specific bone implants. Using Polylactic-acid (PLA) as a biodegradable structural polymer, hydroxyapatite (HA) as a bioactive agent to increase osteoclast integration, and a chemical-foaming-agent (CFA) as a temperature-sensitive foaming agent, a 3D printer filament was produced with properties of each component. This filament was assayed to determine how physical properties of 3D printed parts change based on manufacturing temperature. The filament was demonstrated to have controllable density and modulus of elasticity when printing at temperatures chosen based on the decomposition temperature of the CFA. The ability to tune these properties on a patient-specific scale can greatly improve the efficacy of orthopedic implants as surrounding bone tissue will more readily accept material that matches its properties.

2021-125	Oral Presentation	Medical and Health Sciences

Student Presenter: **Sadhwani, Vinay; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***
Clark, Nick
Mentor: **Tyler, Lori; *Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***

Socioeconomic Factors and Their Effect on the Mortality Rate of Covid-19

The Covid-19 pandemic has had an unprecedented impact on the world and has affected essentially every country across the globe. Scientists and researchers are still discovering new things about Covid-19 and are attempting to determine why it has been so devastating. This study focuses on surveying the relationship between the Covid-19 death rate per 100,000 in various countries and several socioeconomic variables within these countries. We looked at a variety of variables including gross domestic product, median household income, unemployment rate, and the “tightness” of a country. Pearson’s correlation coefficient, along with other statistical values, were found in order to determine the relationship between our variables and Covid-19 deaths per 100,000 people in a variety of countries.

2021-126	Oral Presentation	Medical and Health Sciences

Student Presenter: **Shah, Rajit J.; *Duke University***
Mentor: **Newpher, Thomas; *Duke University***

Chronic fatigue syndrome and epigenetics: The case for hyperbaric oxygen therapy in biomarker identification

Chronic fatigue syndrome (CFS) is a poorly-understood respiratory condition that affects millions of individuals. Hyperbaric oxygen therapy (HBOT) is a treatment option being considered to address CFS as it is suggested to combat fatigue and increase oxygenation. HBOT provides two opportunities in advancing research of CFS: it may provide data on symptom amelioration and be utilized in the search for a biomarker. By either identifying biomarkers before using HBOT to compare epigenomes of patients before and after treatment or using HBOT to find epigenetic discrepancies between patients with and without treatment, matching epigenetic regulation with symptom amelioration may significantly advance the understanding of the etiology and treatment mechanism for CFS. EPAS1/HIF-2α is a leading candidate for an epigenetic biomarker as it responds differentially to hypoxic and normoxic conditions, which degrades more slowly in hypoxic conditions. Epigenetic regulation of EPAS1/HIF-2α in such differential conditions may be explored in HBOT experiments. In addition to HBOT as a promising treatment option for CFS symptoms, it may aid the identification of biomarkers in CFS. Further research into both outcomes is strongly encouraged.

2021-127	Oral Presentation	Medical and Health Sciences

Student Presenter: **Sholar, Molli; *East Carolina University***
Mentor: **Michael Wheeler; *East Carolina University***

Vitamin B12 Regulation of PUFA Synthesis

Low-grade, chronic inflammation is associated with a range of diet and age-related disorders, including diabetes, arthritis, and cognitive deficits. Inflammatory cells have the capacity to synthesize complex PUFA called specialized pro-resolution mediators (SPMs) that regulate the extent and duration of inflammatory responses. Humans have a limited capacity to synthesize SMPs, especially as we age, due to decreased expression of the elongase and desaturase enzymes required in their conversion from dietary PUFAs.

It was recently shown that vitamin B12, an essential micronutrient, enhances the cognitive benefits of dietary n-3 PUFAs. It is hypothesized that B12 will increase macrophage SPM synthesis and subdue pro-inflammatory cytokine production.

To test this hypothesis, RAW264 macrophage cell line was stimulated with LPS and gIFN, which promotes robust pro-inflammatory gene expression. Cells were also stimulated in the presence of 50 uM cobalamin (B12). Gene expression profiles were assessed using signal cell RNA-seq.

The addition of B12 had no significant impact on the expression of most prototypical pro-inflammatory genes. However, it was demonstrated that B12 significantly increased elov5 expression, suggesting that B12 does indeed regulate PUFA biosynthesis in macrophages. Moreover, B12 enhances the expression of Trem2, a novel anti-inflammatory transcript associated with neuro-protective effects.

While pro-inflammatory responses in general were not changed, B12 selectively regulated expression of key factors involved in neuro-protective pathways It is concluded that B12 differentially regulates macrophage responses and may be beneficial in mitigating chronic inflammation associated with age-related pathologies.

2021-128	Oral Presentation	Medical and Health Sciences

Student Presenter: **Brantley, DeeAnnah; *Catawba College***
Mentor: **Grieshaber, Amanda; *Catawba College***

Interventions for Geriatric Patients with Alzheimer's

Alzheimer's disease is a chronic and debilitating disease that targets memory and other important bodily functions. "In just 10 years, people 65 or older will account for one-fifth of the population in the United States, and it is projected that by 2025, diagnoses of Alzheimer's disease will increase by nearly 27 percent for this segment of the population, according to a 2019 Alzheimer's Disease Facts and Figures Report by the Alzheimer's Association" (Burow, 2020). Therapeutic recreation, oftentimes referred to as Recreational Therapy, includes the use of interventions, which are evidenced based practices, in order to address the needs of patients who suffer from physical, mental, or psychosocial issues. With interventions run by specialists in Therapeutic Recreation, better known as Activity Directors or Recreational Therapists in long term care facilities, there is a better quality of life available to patients or residents. This thesis will encompass therapeutic recreation, physical, psychological and psychiatric therapies in order to benefit the quality of life in those who suffer from Alzheimer's disease.

2021-129	Oral Presentation	Medical and Health Sciences

Student Presenter: **Jurgens, Hailey E; *Elon University***
Mentor: **Madzima, Takudzwa A.; *Elon University***

The Effects of Tart Cherry Juice and Whey Protein on Exercise Induces Muscle Damage Recovery

BACKGROUND: Nutritional interventions to reduce the effects of exercise-induced muscle damage (EIMD), including natural anti-inflammatories have been found to decrease inflammation and aid in recovery. PURPOSE: To examine the effects of tart cherry juice and whey protein on measures of recovery following fatiguing forearm exercises. METHODS: 20 recreationally active women (age: 21±0.3yr; BMI: 23.42±2.79 kg/m 2) were randomly assigned to either one of two supplemental protocols (S1: 2x8 oz tart cherry juice + 30 g whey protein (WP)/day or S2: 30 g WP/day) for 3 days. Hand-grip strength, wrist circumference (WC), perceived recovery (PRS), fatigue, and muscle soreness (MS) were measured at pre-, 0, 24, 48, and 72h post- wrist-fatiguing exercises. All measurements and exercise sessions were completed virtually over Zoom. ANOVAs were used for analyses. Significance was set at p<0.05. RESULTS: A significant time and supplement interaction was observed in MS (3.1±3.3, 4.0±2.2, 4.0±3.1, 5.0±3.5, 3.6±3.4, and 1.8±2.2, 5.4±2.4, 5.0±3.4, 4.8±3.4, 3.7±3.4, p=0.006) and PRS (7.5±2.7, 4.7±2.4, 7.0±2.6, 7.2±2.2, 7.4±1.8 and 6.8±2.6, 4.8±2.2, 7.2±2.0, 7.0±2.0, 7.1±1.7, p= 0.02) between S1 and S2 at pre-, 0, 24, 48, or 72h post-exercise, respectively. However, no significant time or supplement effect (p>0.05) or interaction was observed for handgrip strength (p=0.70), fatigue (p=0.55), or WC (p=0.64). CONCLUSION: Supplementation of tart cherry juice and WP could be used to reduce the perception of recovery and muscle soreness post-exercise. The addition of tart cherry juice to WP supplementation did not improve handgrip strength, perception of fatigue, or wrist circumference an indirect indicator of inflammation.

2021-130	Oral Presentation	Physical Sciences and Astronomy

Student Presenter: **Darekar, Ayesha; *North Carolina State University***
Mentor: **Bordoloi, Rongmon; *North Carolina State University***

Probing the circumgalactic medium using a quadruply lensed quasar system

Gravitational lensing occurs when a celestial body with large gravitational potential distorts light emitted from an object behind that body. This creates warped and/or multiple images of the background object. Gravitational lensing allows astronomers to use multiply imaged objects to investigate intervening cosmic gas and to probe small spatial scales (which is not possible when observing single background sources) in the circumgalactic medium (CGM), the large reservoir of gas that surrounds a galaxy and fuels star formation. This project is using the Keck Cosmic Web Imager (KCWI) Integral Field Unit (IFU) spectroscopic observations of J1004+4112, a quadruply lensed quasar system at z = 1.73, to probe the circumgalactic medium of the lensing galaxy cluster at z = .68 and galaxies at z < 1.73. We observe 10^4 K cool gas in the halo of the galaxy cluster which is seen in Mg II absorption in three sightlines at the cluster redshift. We analyze the variations among absorption lines at five other absorber redshifts (0.257 < z < 0.833) in the different quasar sightlines. We quantify the spatial coherence of these absorber systems by computing fractional differences in equivalent width between different sightlines. By examining the differences between absorption lines, we constrain the coherence length of the absorbers to < 20 kpc.

2021-131	Oral Presentation	Physical Sciences and Astronomy

Student Presenter: **Keaveney, Aidan; *Appalachian State University***
Mentor: **Rafael Lang; *Purdue University***

Protochime: Testing a New Method for the Direct Detection of Dark Matter

There is overwhelming astrophysical and cosmological evidence for the existence of dark matter (DM). Most direct detection experiments have focused on searching for evidence of models of DM that interact weakly, an assumption not supported by astrophysical evidence. DM necessarily interacts gravitationally, but until recently, directly detecting gravitational interactions appeared unfeasible. The Windchime project is the first attempt to use the new technologies and experimental practices pioneered by LIGO and others to ultimately achieve a level of sensitivity that could observe such gravitational interactions. The Windchime detector will use a 3-dimensional array of highly sensitive optomechanical force sensors that could in principle detect a passing DM particle and provide full directional event reconstruction. This detector would also be capable of probing largely unexplored mass ranges. Here, we discuss the status of protochime, a prototype of the Windchime detector intended to develop and evaluate data acquisition and analysis techniques. We interface with a small array of 16 commercial accelerometers mounted via an FPGA that controls data sampling and manipulation. Our current analysis efforts focus on probing the ultralight DM range of 10^{-21} – 10^{-1} eV. In the near future, we intend to fully implement the analysis techniques described here, and develop similar analysis techniques for probing Planck-scale masses.
This work was supported by NSF REU grant PHY-1852501 and the ALPHA
collaboration.

2021-132	Oral Presentation	Physical Sciences and Astronomy

Student Presenter: **Keaveney, Aidan; *Appalachian State University***
Mentor: **Gabriela Gonzalez; *Louisiana State University***

The Effect of Ground Motion on the Sensitivity of LIGO-Livingston

Following the first detection of gravitational waves in 2015, the Laser Interferometer Gravitational-wave Observatory (LIGO) has made dozens of detections and provided insight to many areas of physics and astronomy. An ongoing goal of LIGO is to improve the sensitivity of the interferometer detectors, in order to detect new astrophysical phenomena that produce weaker gravitational waves at a greater distance. Noise caused by ground motion is among the nonfundamental noise sources that limit the sensitivity of the LIGO Livingston Observatory (LLO). To aid in the LLO's ongoing efforts to limit the impact of seismic noise, we propose a new method of identifying the locations and frequencies of motion that are most impactful on the sensitivity of the LLO. We began our study with nine representative ground motion channels of study. We then assign each channel a threshold based on the median absolute deviation of each channel's data. We search for events where only one ground motion channel exceeds its assigned threshold. We then observe coincident changes in the sensitivity of the LLO to determine the effect of that ground motion in that channel on sensitivity. We plot the change in sensitivity from the average sensitivity during quiet periods for each event versus the ground motion velocity during the event. In order to more directly observe general trends, we apply a mean filter and Gaussian convolution to the data. Preliminary results indicate that this method is comparable to the present technique: Physical and Environmental Monitoring (PEM) Injections, which is more labor-intensive.

2021-133	Oral Presentation	Physical Sciences and Astronomy

Student Presenter: **Sharma, Pranet; *North Carolina School of Science and Math***
Mentor: **Bennett, Jonathan; *North Carolina School of Science and Math***

Preliminary Evidence for WHIM in Abell 1795 Using X-ray Absorption Spectroscopy

Warm-hot intergalactic medium (WHIM) is a filamentary ionized plasma distributed between galaxies and throughout galaxy clusters. The most abundant heavy element in WHIM is oxygen in the O VII ionization state, with the most prominent x-ray absorption line being the Kα line. WHIM is essential in astrophysics as it is the solution to the missing baryon problem and the location of 30-40% of the cosmic baryonic matter; studying WHIM can further help validate the current cosmological model. In this study, we report a 1.7σ detection of the redshifted Kα line in the galaxy cluster Abell 1795 (z = 0.06247) along the sightline of the quasar QSO 1348+263. We used data from the Advanced CCD Imaging Spectrometer (ACIS) instrument on the Chandra X-Ray Observatory (CXO) to measure soft x-rays from 0.4-0.8 keV. We combined spectra from several observations using the CXO tools CIAO and Sherpa and fitted the resulting spectrum using a power law with a spectral index Γ of 0.39. Assuming homogeneous distribution of WHIM in the cluster along the sightline, we find an equivalent width of 150±50 mÅ and an upper limit on the column density of O VII of < 4.6e16 cm^−2. For future studies of this system to achieve a significance of at least 3σ, longer exposure times, as well as spectrometers with higher spectral resolutions, would be required. This could allow WHIM to be discovered along the sightline of even dimmer quasars and in smaller galaxy structures, providing further evidence for the solution to the missing baryon problem and validating our model of the cosmos.

2021-134	Oral Presentation	Physical Sciences and Astronomy

Student Presenter: **Sriram, Raghav; *North Carolina School of Science and Math***
Mentor: **Bennett, Jonathan; *North Carolina School of Science and Math***

Effects of Decreased Gravity on the Growth of Brassica rapa Fast Plants

With interplanetary travel efforts being revamped in the twenty-first century, experiments manipulating gravity can provide useful data. If interplanetary colonization attempts occur, data for plant growth under different gravity conditions can provide an expectation for what is to be seen on another planet. For this experiment, we utilized a clinostat (a disc that rotates slowly at a specified angle, 22 degrees for our purposes,, resulting in plants inside the clinostat growing opposite to the diagonal component of gravity at this angle) to simulate the gravity of Mars which is 37% of Earth's gravity. After performing 5-day trials, where the experimental group was placed in the tilted clinostat after germination (time started after the experimental group went into the clinostat), our statistically significant results indicated that our Brassica rapa plants in the clinostat grew 60% faster as a result of the reduced gravity setting.

2021-135	Oral Presentation	Social and Behavioral Sciences

Student Presenter: **Armstrong, Molly; *Elon University***
Mentor: **Ghandour, Bilal; *Elon University***

Body Image and Perfectionism

The study draws attention to meaningful connections between body image disorders and individuals with an obsessive-compulsive personality type, a trait often referred to as perfectionism. Past literature has highlighted the comorbidity between a negative view of physical self and perfectionism but most have focused on its self-critical, rigid and ruminating aspects. Our study adds on to the literature by incorporating the narcissistic element of perfectionism, a component we believe is essential for the full understanding of this construct. In our study, we use Q methodology, a method that mixes quantitative and qualitative elements of analysis and is particularly well-designed for the study of personality patterns and extracting subjective viewpoints. Our preliminary results indicate that we already detect a pattern of perfectionist responses in participants with low Body Appreciation Scale scores. The current study confirms the findings of previous studies while adding value to the added construct of narcissism as well.

2021-136	Oral Presentation	Social and Behavioral Sciences

Student Presenter: **Boone, Hannah; *Elon University***
Mentor: **Savloff, Leyla; *Elon University***

Fear for the Future: Youth Climate Change Activism

Climate change is an issue that disproportionately affects younger generations and has motivated many to participate in climate change activism. Previous research on political activism and social movements has focused on material resources as a motivation for action, leaving the importance of imagination and emotion as inspirations to act undertheorized. Chakrabarty provides a theoretical framework for understanding the emotional motivation to social action in his discussion of climate-change-affected futures that young people struggle to visualize and the anxiety this produces. Considering climate change activism through Chakrabarty's framework allows for the incorporation of imagination and emotion into classical social mobilization theories. The primary question pursued by the current study is how young people's imaginations of a climate-change-affected future shape their activism today. The methodological approach of this study includes semi-structured interviews with young adults ages 18-25 to address what factors have motivated them to join the climate change movement and how they are responding to those factors, as well as art activities to access emotions less easily expressed through words. Preliminary findings show that young people experience contrasting emotions simultaneously when thinking about the climate change-impacted future: they feel afraid and optimistic. They know the situation is dire, but they anticipate great progress by their generation. Learning about young people's perspectives on climate change is important because research has not yet been done on the topic, and the climate crisis will affect them the most directly. Their participation in the movement will likely be a very important factor in its success.

2021-137	Oral Presentation	Social and Behavioral Sciences

Student Presenter: **Cooley, Abigail; *Campbell University***
Mentor: **Parker, Paula; *Campbell University***

Psychological Hardiness: Differences Among Classification and Position in Division I Women's Lacrosse

Psychological hardiness encompasses three components: commitment, control, and challenge. Research has shown athletes possess more hardiness than non-athletes. Prior studies show various lacrosse positions take on different physical workloads, which may also affect hardiness. The purpose of this study was to determine the differences in psychological hardiness in female collegiate lacrosse players among year classification and position. The Dispositional Resilience Scale-15 was used to measure psychological hardiness at the beginning of a training year in 25 female Division I lacrosse athletes. Kruskal-Wallis tests were used to evaluate differences in hardiness and the three subscales by position (attacker, midfielder, and defender) and year classification (freshman, sophomore). By position, there was no difference in the hardiness subscales for commitment ($p = .062$), control ($p = .182$), or challenge ($p = .674$). There was a positional difference for total hardiness ($p = .037$), with midfielders (23.3 ± 2.4) exhibiting lower rates than attackers (28.6 ± 3.2, $p = .039$), but not defenders (26.6 ± 7.5, $p = .162$). For year classification, there were no differences found among total hardiness or the three subscales. The analyses show that players do not demonstrate a difference in hardiness subscales, by either position or classification, but midfielders showed lower hardiness than attackers. This information assists coaches to evaluate tolerance to training load, formulate more effective practices, maximize performance, and demonstrates how different positions respond to stressors. Based on this analysis, midfielders are more adaptable, resilient, and have better stress-coping mechanisms, than attackers or defenders.

2021-138	Oral Presentation	Social and Behavioral Sciences

Student Presenter: **Dixon, Jamaica; *North Carolina Central University***
Mentor: **Dr. Robinson, William; *North Carolina Central University***

Instagram Is Harming Women Self-Esteem

Over the last eleven years, Instagram has been an integral part of allowing people to post their entire life for the whole world to see. Instagram allows people to stay connected by commenting and liking photos. Unfortunately, this has led to people judging, competing, and altering their natural appearance. The act of constantly comparing oneself to others can worsen mental health issues such as depression, low self-esteem, and anxiety. This stirs up the question: Are women experiencing lower self-esteem due to Instagram? The contemporary research done on this matter shows how filters, likes, and celebrities are affecting women's self-esteem. This project, qualitative in nature will explore textually analyze research done on the relationship between Women and Instagram. To do so, this research will attempt to create a measurement scale ranging from non-threatening to reason for concern as it relates to Instagram posts, influencers, selfies, filters, and themes generated from the influencer's verbal text which accompany the photo. Using Albert Bandura self-efficacy theory to explore strain of media comments to address the research problem.

2021-139	Oral Presentation	Social and Behavioral Sciences

Student Presenter: **Jordan-Hernandez, Elisa; *Greensboro College***
Mentor: **Eilbaum, Nicolas; *Greensboro College***

Local Police Departments in North Carolina and their Impact on the Lives of Salvadoran Immigrants

Police departments from around the country are collaborating with the federal government to enforce immigration laws through the Warrant Service Officer Program, part of the 287(g) Program. Immigrants affected by these programs have accused the police departments of racial profiling, arguing that police officers have incentives in their local jails to make arrests solely based on race or ethnicity, or to run them through the immigration databases once apprehended. This research tries to understand the mentalities of both the local police departments working with the programs and of Salvadoran immigrants living in counties where the program is implemented. This study will examine the original 287(g) program in North Carolina and the impact it had in the immigrant community. By considering the impact it has had in the Salvadoran Community and the damage it has done to families of this nationality, this analysis examines the socio-economic and psychological impact these programs have had in the Salvadoran community and how the newly implemented Warrant Service Officer Program can have the same impact. This research will be based on the most recent statistics and policies constructed between local police departments and ICE. Consideration specifically of Salvadoran immigrants in each of these programs, shows the impact on this community and draws conclusions regarding how it has affected them differently from other immigrant communities.

2021-140	Oral Presentation	Social and Behavioral Sciences

Student Presenter: **Montgomery, Tatyanna D; *Fayetteville State University***
Mentor: **Clark, Jelisa; *Fayetteville State University***

The Balancing Act: Black women, Feminity , and Controlling images

This research seeks to understand how the narratives created for black women affects social and mental well-being. Specifically, this research will ask how narratives and misrepresentation in society affects black women in America. Research on the social and mental well-being of black women remains understudied. Further, society has set social standards regarding the expectations for appropriate gender-specific behavior. Stereotypes of Black women as mammy, sapphire, and jezebel are pervasive and shape Black women's understanding of femininity. Black women in this study Black women discussed the pressure to be strong and the dilemma between being fast or feminine.

2021-141	Oral Presentation	Social and Behavioral Sciences

Student Presenter: **Mullennix, Amanda; *UNC Asheville***
Mentor: **Kelley, Heidi; *UNC Asheville***

An Ethnographic Study of the Influence of White Supremacy Culture in a Presbyterian Church (U.S.A.)

This study focused on the language and symbolism used in this context within worship services, devotionals, and interviews concerning white supremacy within a white-dominant congregation in North Carolina. Based on Pierre Bourdieu's idea of embodiment as well as Bronwyn Davies's theory on subject positioning, the race, gender, and religion of those being observed played a part in their response to white supremacy culture. Working with Grace Covenant Presbyterian Church, located in Asheville, North Carolina, this study looked at how symbols and language are used to embody white supremacy and anti-racism. The church was put in the context of its denomination, PC(U.S.A.), and how that played a role in their actions surrounding white supremacy culture. Due to COVID-19, the majority of this project occurred online through Zoom and worship services uploaded to YouTube. This church addressed white supremacy in worship services, devotions, and church-sponsored events; the staff worked to emphasize how they and the congregation cannot ignore white supremacy. I found the repetition of phrases such as "siblings in Christ," "racism is in our bodies," and "take action" when discussing white supremacy culture contributed to the internalization of deconstructing white supremacy as individuals and as a congregation. The worship services followed a specific order that created flexibility for church leaders to emphasize their own beliefs surrounding how and why white supremacy is still prevalent. Throughout services, multiple images of Jesus as a man of color were used to redefine the prototypical image of Jesus within the congregation.

2021-142	Oral Presentation	Social and Behavioral Sciences

Student Presenter: **Parker, Toni; *Elon University***
Mentor: **Fair, Cynthia; *Elon University***

Patient-Provider Decision Making and Risk Perception of Antidepressants in Pregnancy

Depression in pregnancy affects approximately 10-23% of women in the United States. Still less than 20% of pregnant women with depressive symptoms seek treatment during the prenatal period. This may have negative consequences to both the mother and fetus. Those who are already on antidepressants before pregnancy are faced with the difficult decision of whether to continue or discontinue their treatment in the prenatal period. This decision is often made in partnership with the pregnant woman's healthcare provider. While some research has examined the impact of risk perception on patients and providers separately, no study has combined this aspect with patient-provider decision making. The main goal of this research is to gain a better understanding of the ways in which the risk perception of antidepressant use in pregnancy interacts with patient-provider decision making. This will be accomplished through interviews conducted with postpartum women (n=15) and their healthcare providers (n=10). Data collection will be completed by November 2021, after which qualitative analysis will begin. Current emerging themes in interviews include determining need, balancing risks and benefits, and support from providers.

2021-143	Oral Presentation	Social and Behavioral Sciences

Student Presenter: **Tumilty, Victoria; *High Point University***
Mentor: **Kozma, Cara; *High Point University***

What Should be Valued in College Admissions: How Political Identity Influences Views Within the Affirmative Action Debate

The debate of Affirmative Action tends to be discussed around the conflicting perspectives of those who support the policy citing that it is designed to "level the playing field" by providing equal opportunity creating a more diverse setting, and those who oppose the policy claiming it creates "reverse" discrimination by prioritizing identity over merit-based qualifications. Previous research suggests that people's political ideology tends to influence their views on social policies like Affirmative Action. Over the years, the debate surrounding the policy has been a piece in a much bigger, complex political debate, as the U.S. grows more polarized as exemplified in the 2020 Presidential election. To investigate further, an IRB approved survey was administered. It was hypothesized that participants who self-identified as Republican would not agree with the policy believing in a more merit-based admissions process, while participants who self-identified as Democrat would agree in the policy's use supporting a more diverse admission process. For the most part, the results supported this idea; however, there were more participants who self-identified as Independents than expected. As the nation becomes more polarized, people appear to just be picking a side. Typically, the one similar to their political beliefs. Affirmative Action will continue to be a factor in a bigger political debate until the polarity of the nation reduces. This presentation stems from a paper currently in-press for publication in an undergraduate research journal.

2021-144	Oral Presentation	Social and Behavioral Sciences

Student Presenter: **Wilson, Kyle; *Campbell University***
Raynor, Skylar
Divoky, Brenna
Cuddington, Anna
Mentor: **Rushing, Nicole C; *Campbell University***

Perceived Control as a Mediator Between Emotion Regulation Strategies and Satisfaction With Life

Previous research has revealed significant relationships between emotion regulation and satisfaction with life, however the mechanisms behind the relationship remain unclear. Because particular ER strategies are also connected to one's perceived control over their life circumstances (Dijkstra & Homan 2016), this study sought to elucidate whether perceived control mediated the relationship between ER and satisfaction with life. Data from a 2015 online survey study (N=197) were used. Two groups of participants were recruited; one consisting of students from a midsize public university in South Carolina participating for course credit and another comprised of community-dwelling older adults volunteering for the study. Each group completed the Emotion Regulation Strategy Scale (ERSS), Satisfaction With Life Scale (SWLS) and the Pearlin Mastery Scale (PMS) as a measure of perceived control. Linear regression analyses demonstrated that the ER strategy situation modification (ERSS-SM) and cognitive change (ERSS-C) subscales were positively and significantly related to both life satisfaction and perceived control. When controlling for perceived control, the magnitude of the positive relationship between ERSS-C and PMS and between ERSS-SM and PMS were still significant but reduced. Results from the study suggest that perceived control over one's emotions and situation modification may be partially responsible for the relationship between specific emotion regulation strategies and satisfaction with life. While the effect does not reveal a full mediation, interventions promoting situation modification and cognitive change could affect perceived control, thus increasing satisfaction with life.

2021-145	Performance	Arts, Design, and Performing Arts

Student Presenter: **Hedgepeth, River; *UNC Greensboro***
Mentor: **Sowell, Natalie; *UNC Greensboro***

The Gender Gallery: An Expansive Look at Gender Through the Lens of Interdisciplinary Documentary Theatre

The Gender Gallery is an interdisciplinary documentary theatre project that aims to uplift the various experiences of gender. The project's guiding question is, "How do you feel gender?" While focus on transgender, nonbinary, gender non-conforming, and gender-expansive voices are primary, the project is open to everyone. The complexities of gender lie within all of us. Inspired by the findings from interviews, creative submissions, a Story Circle Workshop, Gender Embodiment Workshop, and a Zine Workshop, an ensemble-based devised experience emerges. This interactive interdisciplinary gallery experience takes place in February at the Greensboro Project Space. The Gender Gallery not only pushes the boundaries of gender but also theatre, performance, and the use of space. This project critiques the oversimplification of gender and uplifts the untold trans narratives by asking questions about joy, expression, love, and future in relation to gender. The question, "How would you describe your gender without using a gender identifier?" encourages exploration of abstract gender. With these questions, interviews, creative submissions, and workshops, The Gender Gallery strives to showcase a mosaic of lived experiences highlighting the expansiveness of gender. The project in its early stages has already surfaced themes of found family, the intersectionality of identity, societal pressures to suppress fluidity, hopes and dreams, expansive language, and euphoria. Discoveries uncovering the untold narratives of the complexities of gender experiences and trans lives are emerging daily. The hope is to continue to stimulate this necessary conversation and to continue engaging.

2021-146	Performance	Communication and Journalism

Student Presenter: **Jr Manning, Chukwuemeka A.; *North Carolina Central University***
Mentor: **Robinson, William R.; *North Carolina Central University***

Cancel Culture: Social Justice or Social Threat?

Cancel culture is “a highly punitive approach to disagreement or perceived transgressions, based on strict fidelity to ideology (usually progressive) that elevates performative outrage over dialogue, factual inquiry, or respect for values such as free speech or fair process” (Gerstmann, 2021). This controversial phenomena has been present throughout human history but, in today's world, has extended to a contemporary evolution of a much bolder set of social processes that we can see in the form of banishment (McCorkel, 2021) via social media. For example, a representation of that banishment has been going on for the past week with Dave Chappelle, regarding his new Netlix special titled The Closer and the conversation he sparked with his remarks about the LGBTQ+/Transgender community. The special instantly drew criticism as it caused transgender employees at Netflix to protest the special by walking out and the National Black Justice Coalition asking Netflix to pull the special over its comments deemed “transphobic.” This example serves as a catalyst for the purpose of this research.
This study aims to examine the different aspects of the cancel culture through the lens of the framing theory to illustrate whether it sides with being a social threat or justice. This examination includes detailing the concept's meaning, the context of its historical background, social media's influence, and breaking down real-life examples of recent cancellations. With this information, the study will also serve to give the reader familiarity and clarity on the issue, while taking away a self-interpretation of whether they feel this concept is a tool used for justification, threat, or both.

2021-147	Poster	Arts, Design, and Performing Arts

Student Presenter: **Gold, Josie; *Greensboro College***
Mentor: **Taylor, Sarah; *Greensboro College***

"Sing Out, Louise!": The Correlation Between the Female Singing Voice and Characterization in American Musical Theatre

In American musical theatre, composers and lyricists create their music to develop characters and present them to the audience. When creating music for the female voice, composers have explored the timbral contrast between chest voice and head voice to differentiate between characters and to demonstrate who a character is through the style of sounds that she is making. In this project, I study "Oklahoma!," "Guys and Dolls," "Gypsy," "Into the Woods," and "Wicked": five Broadway musicals that include two female leads who are contrasting both in their vocal styles and characterization. Each show includes a head-voice-dominant or “legit” role and a chest-voice-dominant or “belting” role; each of these pairs of women is developed in a musically contrasting manner. Through surveying the written musical score to understand the composer and lyricist’s choices, analyzing the script to see character development, and listening to actresses perform the music to hear their choices and interpret character implications, I have discovered a more complete understanding of these characters and found new connections between the five shows and their music. My research shows that composers and lyricists construct their music in such a way that each woman’s unique voice is exemplified through her songs. Each choice that creators make is purposeful and gives the audience a more complete picture of who each character is and why her story is important.

2021-148	Poster	Arts, Design, and Performing Arts

Student Presenter: **Hopkins, Vanessa; *Appalachian State University***
Mentor: **Davies, Brian; *Appalachian State University***

Social, Economic, Environmental, and Technological Factors Affecting Interior Design

Academia, government, and industry have increased efforts to anticipate social, economic, environmental, and technological [SEET] Factors to accommodate future disruptions across many disciplines. This creative investigation seeks to increase the incorporation of SEET Factors in the study of interior design. Specifically, SEET Factors tangent to wellness, health, and managed contact as we seek to emerge from the COVID-19 pandemic.

Anticipating SEET Factors to accommodate future disruptions is ever more critical in all disciplines but especially in interior environments where Americans spend 93% of their lives. This study utilized the following methods: (1) review and assessment of existing curricula at the researcher's institution; (2) explore and experiment with existing models of SEET Factors being applied in the professional practice of interior design; (3) review of literature relevant for trend forecasting; and (4) curricular review of 52 of the total 160 interior design programs accredited by Council of Interior Design Accreditation [CIDA] for courses incorporating SEET Factors.

While the interior design industry is undeniably impacted by short-cycle trends, the industry is more significantly impacted by long-term SEET Factors. Post COVID-19, interior places of work, worship, recreation, leisure, hospitality, and retail will all be influenced by SEET Factors tangent to wellness, health, and managed contact. This creative investigation indicates there is opportunity in a majority of CIDA accredited interior design curricula across the United States to incorporate or increase the study of SEET Factors to anticipate and accommodate future disruptions in the discipline.

2021-149	Poster	Biological and Life Sciences

Student Presenter: **Agner, Kevin; *UNC Chapel Hill***
Mentor: **Larkins, Michael; *UNC-CH, NCSU, and AMU***

Impact of nitriloacetic acid (NTA) and EDTA on Zn uptake and pea plant growth in Pisum sativum var Bohun

Heavy metal contamination in soil and water, often as a by-product of agricultural and industrial processes, is a major motivator for research into phytoremediation. Chelating agents (CA) bind to heavy metals, and EDTA has been shown to improve the uptake of Cd, Pb, and Zn by plants; this research investigates the use of another CA, nitrilotriacetic acid (NTA), in phytoremediation experiments. Pea seedlings (Pisum sativum var Bohun) were grown hydroponically for one week and treated in the following combinations: Group 1 - control plants, Group 2 - variant with 40 µM ZnSO4 solution, Group 3 - variant with 40 µm ZnSO4 + 40 µM EDTA, and Group 4 - variant with 40 µM ZnSO4 + 40 µM NTA. The sample collection included measurements of weight, root and stem length, and chlorophyll and relative water content. The average stem and root length provided mixed results associated with the effectiveness of NTA vs EDTA; the percent germination testing (indicative of treatment toxicity) showed EDTA performed better than NTA while the control performed the worst. The results imply that EDTA is a stronger CA than NTA, and the concentrations of the CA in this experiment were likely not high enough to elicit a strong effect to produce clear and noticeable trends. The authors recommend further research be done concerning the effect of EDTA and NTA concentration on plant growth and that an elemental analysis of further specimens be performed via inductively coupled plasma-mass spectrometry (ICP-MS), to determine the true Zn uptake by tested plants.

2021-150	Poster	Biological and Life Sciences

Student Presenter: **Balu, Avanthika Priya; *North Carolina State University***
Mentor: **Dr. Kathryn Meurs; *North Carolina State University***

Searching for a Causative Mutation for Hypertrophic Cardiomyopathy in Persian Cats using Whole Genome Sequencing

Feline Hypertrophic cardiomyopathy (HCM) is the most common form of heart disease in cats. It is an inherited disease in breeds like the Maine Coon and Ragdoll, and its causative mutation has been determined using whole genome sequencing. Whole genome sequencing is a genetic tool that assesses the impact of genetic variations and identifies causation of diseases. However, we still do not understand the genetic basis of the disease in many other breeds, such as Persians. We hypothesized that whole genome sequencing would identify at least one causative mutation (missense or frameshift) for HCM in Persian cats. We performed whole genome sequencing on the DNA of an affected Persian cat, identified causative variants and performed polymerase chain reaction-based sequencing (PCR) in 10 cats with HCM and in 10 without HCM (controls), to test whether the variants were associated with the symptoms and development of the disease.We found variants in some controls and not in all affected cats. Therefore we could not isolate a causative variant for HCM in Persians. However, whole genome sequencing is an emerging method in veterinary medicine and further studies will identify causative mutations for genetic diseases in cats. Using a larger sample size and experimenting on other breeds may provide clues about treatment methods for feline HCM. If a mutation is identified, it could/may lead to advancements in and provide potential treatment options in the future.

2021-151	Poster	Biological and Life Sciences

Student Presenter: **Cochran, Katie; *Lees-McRae College***
Mentor: **Gardner, Susan; *Lees-McRae College***

Effects of Antibiotic Treatment on the Eastern Gray Squirrel (Sciurus carolinensis) Gut Microbiota

Little is known about the gut microbiota of wildlife species. This study has sought to examine the relationship between the gut microbiota composition of eastern gray squirrels (Sciurus carolinensis) and the broad-spectrum antibiotic Amoxi-Clav©. Antibiotics are commonly used in wildlife rehabilitation medicine for treatment of infections. Antibiotic use affects not only pathogenic microorganisms but also causes perturbation of the normal gut microbiota. All the patients followed in this study were admitted due to injuries sustained from cat attacks. Due to the prevalence of Pasteurella multocida in cat saliva, patients that were injured by cat bites were treated with the antibiotic Amoxi-Clav©. Samples from patients that were treated with Amoxi-Clav© were collected at consistent time points during treatment. It was expected that over the course of antibiotic treatment changes would be induced in the composition of the squirrel gut microbiota. Bacteria were isolated from fecal samples through serial dilutions and T-streak plating. Once a bacterium had been confirmed isolated through Gram staining, a colony PCR was performed and purified amplicons were sent to Eton Bioscience, Inc. for sequencing. In a patient not treated with any antibiotics, there was a wide range of confirmed bacterial isolates, ranging from Escherichia coli to Salmonella spp. to Kluyvera spp. In a patient treated with Amoxi-Clav©, the antibiotic did not appear to affect the prevalence of Klebsiella pneumoniae, which is known to be resistant to Amoxi-Clav©, and in fact, K. pneumoniae was the only bacterial species isolated from the treated squirrel.

2021-152	Poster	Biological and Life Sciences

Student Presenter: **Coleman, Padraig; *Appalachian State University***
Mentor: **Geib, Jennifer; *Appalachian State University***

Surveying Syrphid Fly Diversity Along the Blue Ridge Parkway

Flies of the family Syrphidae are a widespread and diverse group of dipterans consisting of over 6000 species worldwide. Although most of the buzz surrounds bees, syrphid flies are thought to be equally important pollinators of native plants. Additionally, the larval stages of many species are predatory towards common plant pests such as aphids, making them promising biological control agents in both natural and agricultural settings. Despite the dual ecosystem services offered by their holometabolous lifestyle, few studies exploring syrphid distribution and diversity have been conducted within the United States, particularly throughout the southern Appalachians. In order to gain a better understanding of the species present in this region, syrphids were surveyed through active netting efforts at 64 sites alongside the Blue Ridge Parkway in North Carolina and Virginia. Field sites were generally characterized by meadows with abundant floral resources ranging from high points to wetlands. Samples (N = 1000) were euthanized on site and frozen before being pinned and identified. Collections yielded over fifty syrphid species total with a range of 3 - 12 species per site. As many native pollinators begin to experience declines in abundance, a heightened focus on the conservation of syrphid flies may prove beneficial in managing natural, recreational, and agricultural assets. The data collected by this project serves as a valuable baseline for future monitoring and studies of an extremely undervalued species.

2021-153	Poster	Biological and Life Sciences

Student Presenter: **David, Rochelle; *North Carolina School of Science and Math***
Mentor: **Goforth, Kayla; *University of North Carolina, Chapel Hill***

A Noisy Sense: Magnetoreception and how it's processed

Sea turtles can detect information from Earth's magnetic field and use it for navigation. For instance, turtles can use magnetic field information to return to the same foraging area. However, little is known about the mechanism of the magnetic sense, or how magnetic field information is interpreted or processed. One hypothesis is that sea turtles average magnetic field information. Averaging magnetic information may help sea turtles detect very small changes in magnetic fields. To investigate this hypothesis, we used a well-developed assay that relies on the ability of sea turtles to distinguish between two magnetic fields. This assay involves conditioning turtles to a specific magnetic field: Every day turtles are exposed to either a specific magnetic field in which they are fed or to a secondary magnetic field in which they do not receive food. In the conditioned magnetic field, turtles display more instances of food-seeking behavior. Using this assay we will expose the turtles to fluctuating magnetic fields to determine if they respond to the fluctuating fields in a manner similar to the conditioned field response. If turtles do respond the same way, then they may be averaging the magnetic field before accurately responding. Understanding how turtles respond to magnetic fields can provide insight into the mechanism behind the magnetic sense and future research.

2021-154	Poster	Biological and Life Sciences

Student Presenter: **Davis, Genesis S.; *Central Piedmont Community College***
Aguilera-Gomez, Krista
Mentor: **Yu, Shuangying; *Central Piedmont Community College***

Organochlorine Pesticide Poisoning in Raptors Found in the Southeast

Organochlorine (OCs) pesticides historically caused harm to wild raptor populations, including eagles, hawks, vultures, and owls. Organochlorine pesticides often cause chronic symptoms but high concentrations can lead to severe neurologic symptoms such as torticollis. Since OC pesticides were banned in the U.S., environmental concentrations of OCs have been declining. However, the Carolina Raptor Center (CRC) has confirmed neurologic symptoms in some admitted birds due to OC poisoning. This study aimed to determine the scale of OC poisoning in raptors admitted to the CRC. We examined 18000 birds in the CRC database, covering 1975 through 2020, and compiled an initial list to include birds with any signs of neurologic symptoms. We then conducted a second review resulting in a list of 86 birds that matched the symptoms of the birds with verified OC poisoning. These birds were categorized according to species, sex, age, and collection location to identify any patterns between neurologic symptoms and those variables. Of the 86 birds, 37% of the birds were Barred Owls, 26% were Red-Shouldered Hawks, and 19% were Great Horned Owls. Most of the 86 birds were found in Charlotte, NC (52 or 60%), and the most common age class was “after hatch-year” with 21 individuals (24%). Only 86 of 18000 birds showed symptoms of OC poisoning, indicating that poisoning is not a major cause of admission into the CRC. Because owls are not migratory, the high prevalence of OC poisoning in owls suggests OC sources are likely local.

2021-155	Poster	Biological and Life Sciences

Student Presenter: **Davis, Julia O.; *Duke University***
Mentor: **Rendina, Danielle N.; *Duke University***

How does prenatal exposure to air pollution and maternal stress influence the expression of gut macrophages in the embryonic gut?

Autism is a male-biased neurodevelopmental condition associated with early life immune challenges and is often accompanied by gastrointestinal symptoms. The Bilbo Lab developed a double-hit stressor paradigm exposing pregnant mice to an environmental toxin (DEP) and a psychological maternal stressor (MS) to investigate the relationship between environmental factors and autism. The lab has shown that only the male pups of the DEP/MS moms have a differing composition of their gut microbiome, as well as decreased sociability, consistent with mouse models of autism. However, it is unclear if there are shifts in gut structure occuring prenatally in response to environmental risk factors, such as DEP/MS. We hypothesize that following DEP/MS exposure, the embryonic guts of wild type offspring will have decreased macrophage expression. We extracted gut tissue from embryonic pups of DEP/MS dams on embryonic day 17. Next, we synthesized complementary DNA from the RNA in the sample to use for a qPCR reaction. We found that there is decreased expression of tissue resident macrophage marker CX3CR1 in male embryonic wild type guts. We additionally explored the impact of knocking out the TLR4 inflammatory pathway in the dams and found that there was no longer decreased expression of macrophages in the gut, suggesting that the TLR4 pathway is involved in shaping the structure of the embryonic gut. This is significant because alterations to the gut environment can have consequences for how the gut is colonized by microbes and the gut microbiome is known to be essential for normative neurodevelopment and sociability.

2021-156	Poster	Biological and Life Sciences

Student Presenter: **Faith Ashley; *Elizabeth City State University***
Aubre Joyner
Mentor: **Margaret Young; *Elizabeth City State University***

Introduction of gus and nptII genes into tomato (Solanum lycopersicum) cv. Florida Lanai using Agrobacterium

Tomato (Solanum Lycopersicum) is used widely in laboratory experiments, as it is a model system for fruit development. Many protocols for the transfer of genes into tomato explants are time-consuming and tedious. This experiment followed a protocol that had high levels of success and was easy to replicate. Seeds of tomato cv. Florida Lanai (a potential model system for studying geminiviruses) were sterilized and grown in vitro. Sterile leaf explants were cut and inoculated with Agrobacterium tumefaciens, containing gus and nptll genes . Two different Agrobacterium concentrations (OD600) were used: 0.5 and 0.8. Explants were then placed on media containing kanamycin. Randomly selected leaf explants were tested for GUS transient expression. The mean percentage of GUS blue spots that covered the area of the leaf explants was calculated. For explants exposed to 0.5 and 0.8 Agrobacterial concentration, a mean of 70% and 68% area coverage was found, respectively. No GUS expression was observed for the control explants. All explants have survived after 3 weeks. Leaf explants on selection media, exposed to the 0.5 concentration of Agrobacterium are green with a slight yellow color visible. Explants exposed to the 0.8 concentration are partially green and yellow. The control explants are all green. The explants will continue to be grown in vitro, and their survival rate will be monitored for approximately 4 months.

2021-157	Poster	Biological and Life Sciences

Student Presenter: **Fisher, Rachael; *UNC Chapel Hill***
Mentor: **Vetreno, Ryan; *UNC Chapel Hill***

Adolescent Binge Ethanol Exposure Accelerates Female Basal Forebrain Cholinergic Neuron Degeneration and AD-associated Pathology in a Mouse Model of AD

Cholinergic degeneration and neuroimmune system activation are hallmark features of many disease states, including alcohol use disorder (AUD) and Alzheimer's disease (AD). Heavy alcohol use is an etiological factor associated with AD, but little is known about the interaction between adolescent alcohol exposure and AD pathology. Preclinical studies using the adolescent intermittent ethanol (AIE) paradigm find basal forebrain cholinergic neuron degeneration and increased neuroimmune activation in brain, similar to observed pathology in AD. Using the 5xFAD mouse model of human AD, we tested the hypothesis that AIE treatment (5.0g/kg EtOH, i.g., 2 days on/2 days off; postnatal day [P]30 to P55) would accelerate onset of AD pathology. In the 5xFAD model, AIE accelerated the loss of ChAT+IR basal forebrain cholinergic neurons, relative to age-matched 5xFAD CONs. This was accompanied by accelerated accumulation of AD-like plaques containing β amyloid (Aβ) and ChAT, as well as upregulation of AD-related genes. In addition, AIE upregulated activated glial-related genes as well as innate immune signaling and proinflammatory cytokine genes in the basal forebrain, relative to age-matched 5xFAD CONs. In post-mortem human basal forebrain samples of individuals with an adolescent age of drinking onset, we found AUD increased Aβ1-42+IR as well as increase pTau181 protein that was negatively correlated with loss of cholinergic protein markers. These data reveal that adolescent binge ethanol exposure accelerates AD-like neuropathology in the adult basal forebrain, suggesting that an early age of drinking onset may be an etiological factor contributing to the onset of AD in the aging brain.

2021-158	Poster	Biological and Life Sciences

Student Presenter: **Garcia, Bartola; *Meredith College***
Mentor: **Powell, Walda; *Meredith College***

Identification of extracted prodigiosin from Serratia marcescens and application of synthetic sulfanilamide as antibiotic

Serratia marcescens is a gram-negative, opportunistic pathogen that can cause fatal nosocomial infections in humans due to its antibiotic resistance. During its growth, this bacterium produces prodigiosin, a red-pigmented alkaloid, as a metabolic by-product. Studies have indicated that prodigiosin has antibacterial, antifungal, and antimalarial properties that could potentially induce apoptosis in cancer cells. The unique tripyrrole structure that the pigment has contributes to the biological role that it plays in several physiological processes. The aim of this study was to employ both bacteriological and synthetic chemistry techniques to an integrated laboratory module that investigated the chemical isolation, purification, and identification of prodigiosin from lab grown S. marcescens, while concurrently synthetically developing a potent sulfanilamide antibiotic that could be used on the bacterium. Prodigiosin was extracted from S. marcescens and purified through thin layer chromatography. Sulfanilamide was made from acetanilide through reflux, simple distillation, and suction filtration. The results showed that the sulfanilamide antibiotic did not inhibit any bacterial growth, however, the synthetic process used was improved to increase the product yield of sulfanilamide from 6.70% to 10.04%. The extracted prodigiosin was relatively pure and identified through H-NMR and infrared spectrometry. Since there are few integrative educational modules that incorporate interdisciplinary skills between organic chemistry and microbiology, establishing effective and interactive modules that cross-interdisciplinary skills like this one can further enhance students' understanding and application of conceptual modules.

2021-159	Poster	Biological and Life Sciences

Student Presenter: **Garrison, Sy'Keria; *Fayetteville State University***
Mentor: **Graham, Danielle; *Fayetteville State University***

Combating ESKAPE Pathogens Through Discovery of Novel Antimicrobial and Antibiofilm Molecules

Currently, antibiotic-resistant bacteria are a public health issue primarily due to their ability to evolve, reduce the effectiveness of antibiotics, and develop protective mechanisms such as biofilm formation. The CDC classifies a group of bacteria known as ESKAPE pathogens as six emerging antibiotic-resistant pathogens that are difficult to eradicate with current antibiotics. Our study aims to investigate microorganisms that have the potential to produce antimicrobial and antibiofilm molecules to combat the spread of ESKAPE pathogens. First, soil samples were collected from the Fayetteville State University campus and serially diluted on various agar plates, including tryptic soy agar, potato dextrose agar, and Luria-Bertani agar. Next, 63 unique colonies were obtained from the plates and screened against non-pathogenic ESKAPE safe relatives. Isolates that could inhibit the growth of the safe relatives were further investigated to determine their motility abilities and gram differentiation. Of the 63 isolates, six inhibited ESKAPE safe relatives Pseudomonas putida and Acinetobacter baylyi. From these, two isolates were identified as gram-negative, and four were gram-positive. Additionally, four were motile and two were non-motile. Our future studies involve characterizing the isolates using biochemical tests and antibiofilm assays and determining the genetic profile of these isolates through DNA purification and sequencing methods. Furthermore, we intend to continue collecting soil samples in other locations on the Fayetteville State University campus for investigation. In conclusion, we hope that these studies will lead to the identification of novel antimicrobial producing microorganisms that can inhibit the spread and biofilm formation of antibiotic-resistant ESKAPE bacteria.

2021-160	Poster	Biological and Life Sciences

Student Presenter: **Giordano, Hayley; *North Carolina State University***
Mentor: **Hess, Paul R.; *College of Veterinary Medicine, North Carolina State University***

Discovery of three promising cancer-testis antigens in canine T-cell lymphoma by RNA-seq

Hayley R. Giordano[2], Holly D. Amato[2], Jenny C. Holmes[1], Paul R. Hess[1]
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ABSTRACT
Canine Non-Hodgkin's lymphoma of T-cell origin is inherently resistant to chemotherapy, and typical survival times with standard-of-care chemotherapy is just 7 months. Tiny burdens of drug-resistant cancer cells called minimal residual disease, or MRD, eventually multiply, leading to relapse, and eventually, death. Eradication of MRD must be achieved by some other means of treatment in order to improve the survival time. T-cell-based immunotherapies that utilize tumor-specific antigens to allow T-cells to eliminate cancer cells and spare normal cells could be highly effective. One valuable category of tumor-specific antigens are the cancer-testis antigens (CTAs). These proteins are made in germ cells, silenced in normal cells, and sometimes re-expressed in tumors. We hypothesized that an RNAseq-based comparison of a representative canine T-cell lymphoma (TCL), and normal and positive control tissues (brain; testis) could identify CTA candidates for additional screening. In total, 8 X-linked and 6 autosomal candidates were identified via a pilot-scale RNA-seq analysis; we surveyed the expression of one X-linked CTA and two autosomal CTAs via reverse transcription polymerase chain reaction (RT-PCR). Two of the three evaluated CTAs look especially promising as immunotherapeutic targets as they are present at subjectively intense signals in about 60% of TCL samples and in no normal tissues.

2021-161	Poster	Biological and Life Sciences

Student Presenter: **Haley, Kim; *North Carolina State University***
Mentor: **Marsden Kurt; *North Carolina State University***

Optimizing larval zebrafish genotyping protocols by using the Zebrafish Embryonic Genotyper (ZEG)

Zebrafish are a valuable model organism in research that allow us to take advantage of genetic similarities to humans to study diseases. Effective use of the zebrafish model for large scale studies has been limited by the manual genotyping process. Fin clipping is a tedious and time consuming process that can only be performed after two to three months, once the zebrafish have reached adulthood. This late-stage genotyping requires more adult fish to be raised than may be ultimately required. The Zebrafish Embryonic Genotyper (ZEG) allows for the simultaneous collection of genetic material from 24 zebrafish larvae early in development. The collected genetic material can then be run through typical genotyping protocols. However, recent efforts to use the ZEG in our lab have been unsuccessful. Attempted use of the ZEG yielded inaccurate and insufficient DNA concentration for genotyping. In an attempt to maximize the effectiveness of the ZEG, I conducted several tests where various settings were adjusted, including voltage, run time, and the volume of liquid loaded onto the ZEG. Each test was followed by PCRs of the collected DNA, as well as PCRs of the original zebrafish larvae in order to confirm the results. I hypothesized that a lower volume of liquid loaded onto the ZEG tray would increase the sensitivity of subsequent PCRs. The optimization of the ZEG as a genotyping protocol would be an invaluable tool to maximize productivity in our lab and eliminate our need to raise extra fish to adulthood.

2021-162	Poster	Biological and Life Sciences

Student Presenter: **Hall, Kagan; *Catawba College***
Mentor: **Witalison, Erin; *Catawba College***

The Microbial Odyssey: Investigating the viability of commercial probiotics under physiological conditions

The human gut microbiome is a complex and incredibly important part of human anatomy. The human microbiome plays a crucial role in maintaining the body's immune system, preventing gut permeability, and the metabolism of nutrients. As important as these are, it is equally important to maintain these bacterial populations. Our body has several non-specific defenses such as digestive enzymes and stomach acid that help protect against pathogens. Our goal is to test the viability of several commercial probiotic supplements. Our initial results suggest that probiotic growth may be significantly inhibited by the conditions found in the human body, as demonstrated by our experiments using simulated gastric juice. Going forward, we would like to repeat these experiments using selective media for lactobacilli and bifidobacterium. This media is optimized to support the growth of the probiotic bacteria we expect to find in probiotic sources, such as supplements and fermented foods. So, we expect that the probiotic strains found in these sources may be able to grow on the selective media even under acidic conditions. Overall, we expect there to be a decline in probiotic viability in response to gastric exposure.

2021-163	Poster	Biological and Life Sciences

Student Presenter: **Hemingway, Nathalie; *East Carolina University***
Pajski, Megan L.
Kerr, Patrick
Mentor: **Graber Ted G.; *East Carolina University***

Age related changes in calcium handing gene expression

Intracellular release and reuptake of calcium ions from the sarcoplasmic reticulum affect the strength and speed of muscle fiber contractions. Changes in calcium cycling may have a role in changes to muscular function as we age. Sarcolipin and myoregulin are calcium regulating proteins that block SERCA from pumping calcium in the muscle fibers. Next Generation Sequencing, RNAseq previously performed in our lab discovered SLN expression was significantly upregulated (log2 fold change=4.33, q-val< with age (6-month, m, compared to 28m mouse tibialis anterior muscle). Using a mouse model of aging and exercise we compare transcription levels of these two genes to detect a correlation with their functional abilities, which are quantified using a composite scoring system comprised of numerous well validated tests (rotarod, inverted cling, grip strength, treadmill max speed, and voluntary wheel running), and contractile physiology measurements. RT-qPCR was performed using the housekeeping genes, β2-microgobulin (B2M) and glyceraldehyde 3-phosphate dehydrogenase (GAPDH) which work as references to test the extent of which transcription of sarcolipin and myoregulin is present. The relative expression of sarcolipin is higher in older mice (28m) compared to young adults (6m). Subsequent analysis will determine if exercise affects these trends.

2021-164	Poster	Biological and Life Sciences

Student Presenter: **Hiatt, Jacob; *Catawba College***
Sjobom, Hunter
Roque, Will
Mentor: **Rushing, Amanda W.; *Catawba College***

Soil Sleuths: Characterization of Antimicrobial Compounds from Soil-Dwelling Bacteria

In the microscopic world, bacteria have long been in fierce competition for resources. As a result, many bacterial species have evolved the ability to produce molecular "weapons" that negatively impact the physiological processes of their competitors. Some of these compounds have since been successfully adapted for use as antimicrobial therapies, and are commonly known as antibiotics. Unfortunately, pathogenic bacteria are continually evolving resistance to one or more of these therapeutics, resulting in increased incidences of antibiotic-resistant, or multi-drug resistant, infection. Alarmingly, the research and development of novel antimicrobial therapeutics has slowed significantly, due largely to the idea that antimicrobial development is not a financially lucrative pursuit. As the antibiotic resistance crisis continues to grow, it is imperative that new and effective antimicrobial metabolites are identified. Bacteria from locally-collected soil samples will be cultured on a selection of general media to encourage the growth of soil bacteria. Individual bacterial colonies will be isolated and screened for antimicrobial activity against ESKAPE-safe relatives, bacterial strains that share significant similarities with antibiotic resistant strains. Metabolites will be extracted from bacterial isolates found to exert a microbiostatic effect in these screens. Extracts will be fractionated using TLC, and each fraction will be screened to confirm microbiostatic activity. Lead fractions will be submitted for untargeted LC-MS metabolomics analysis to identify presumed antimicrobial compounds based on structural similarities to known antimicrobial compounds. Further, DNA extraction and 16s rRNA gene sequencing will be used to identify antibiotic-producing isolates to the genus level.

2021-165	Poster	Biological and Life Sciences

Student Presenter: **Hill, Karl; *North Carolina State University***
Mentor: **Planchart, Antonio; *North Carolina State University***

Generation of a novel CRISPR-Cas9-mediated pycr1b mutation in zebrafish (Danio rerio) as a model of human microcephaly

Microcephaly is a debilitating developmental condition characterized by an abnormally small head, craniofacial deformities, hypomyelination, and intellectual disability. This disorder affects 1 in 800 to 5000 babies born in the United States each year. Familial studies have implicated homozygosity for mutations in PYCR2, a gene encoding a protein involved in the proline biosynthesis pathway, as a likely candidate for some microcephaly cases. We have leveraged the CRISPR-Cas9 system and zebrafish to generate a loss-of-function mutation in pycr1b, an ortholog of human PYCR2, to study the proposed genetic correlation and to generate a vertebrate model of microcephaly. While still in progress, we report a possible CRISPR-Cas9 mediated allelic series in an F1 population of D. rerio larvae. The next stage of this project will be to breed a homozygous mutant pycr1b line of fish that we predict will present with a high incidence of microcephaly, and to use this model to characterize the molecular mechanism through which PYCR2 mutations cause microcephaly.

2021-166	Poster	Biological and Life Sciences

Student Presenter: **Hysong, Helena; *North Carolina State University***
Mentor: **Joseph Rodriguez; *National Institute of Environmental Health Sciences***

The Role of Cell Communication in Gene Expression Heterogeneity

Recent advents in single-cell sequencing technology have revealed that populations of cells of a single cell type exhibit variable responses to external stimuli. Increased levels of this gene expression heterogeneity have been implicated in disease progression of cancerous cells; therefore, it is important to gain an understanding of the mechanistic principles driving transcriptional variability. Given tissues' use of paracrine signaling to maintain homeostasis, intercellular communication may also play a role in regulating single-cell gene expression profiles. To investigate this relationship, MCF7 cells were treated with Estradiol and single-cell RNA sequencing was used to monitor gene expression 2, 8, and 24 hours after treatment. Dimensional reduction analysis was performed to identify clusters of gene expression profiles, illustrating that the cells clustered by time point after Estradiol treatment. Gene ontology analysis also revealed that cell communication genes were the most variably expressed during the estrogen response. Furthermore, variability in cell communication genes was inversely related to the total number of variably expressed genes at each timepoint. This implies that cell communication may be coordinating gene expression profiles during the cellular response. Further research will need to be conducted to confirm this relationship.

2021-167	Poster	Biological and Life Sciences

Student Presenter: **Johns, Benjamin; *Duke University***
Mentor: **Hoffman, Brenton; *Duke University***

A Novel Suite of Biosensors to Investigate Vinculin Coordination of Collective Cell Migration

Collective cell migration (CCM) features a group or chain of linked cells moving together with the same speed in the same direction. This multicellular process is critical in physiological events such as wound healing and morphogenesis. The coordination of forces crucial to CCM is achieved by connecting the actin cytoskeletons of adjacent cells together at dynamic cadherin cell-cell contacts. However, how this mechanical linking regulates CCM at the molecular level remains poorly understood. We hypothesize that the actin-binding protein vinculin mediates these connections to control the speed and coordination of CCM. To test this, we are fusing vinculin to the fluorescent protein mScarletI and creating versions with point mutations that affect specific vinculin protein-protein interactions. With this suite of biosensors, we can visualize vinculin localization and dynamics through fluorescence microscopy and examine vinculin's effects on CCM speed and coordination through a migration assay. Specifically, we expect that the actin-binding mutant vinculin will alter CCM speed and coordination. Identifying and characterizing these key molecular players of CCM would both greatly advance our understanding of this biological process and possibly provide future targets for therapeutic and tissue engineering purposes.

2021-170	Poster	Biological and Life Sciences

Student Presenter: **Kane, Meara; *North Carolina School of Science and Math***
Mentor: **Goforth, Kayla; *North Carolina School of Science and Math***

Sensitivity to Magnetic Field Readings in Sea Turtles

Magnetoreception, the ability to detect and respond to Earth's magnetic field, has been observed in sea turtles, but little is known about their level of sensitivity to the magnetic field. It has been hypothesized that certain animals may be highly sensitive to magnetic fields because they use them to return to specific feeding and breeding locations annually. In this study, we aimed to determine whether sea turtles were capable of learning to distinguish between two highly similar magnetic fields that were a small geographic distance apart. A previous behavioral assay has shown that turtles can learn to associate a specific magnetic field with food. For this assay, turtles undergo a period of conditioning: They are fed every other day in a specific magnetic field and exposed to a control magnetic field on non-feeding days. Turtles are then tested in both the conditioned and control magnetic fields in the absence of food. If turtles can differentiate between the two fields, they exhibit more food-seeking behavior in the conditioned field. Using this assay, we conditioned one group of turtles to a magnetic field near Turks and Caicos, with a control field near Haiti, and we conditioned a second group to a magnetic field near Haiti, with a control field near Turks and Caicos. We found that the turtles were capable of differentiating between these two magnetic fields, which are only 300 kilometers apart. This demonstrates a high level of sensitivity to magnetic field information that has not been observed in turtles before.

2021-171	Poster	Biological and Life Sciences

Student Presenter: **Khan, Zarin; *UNC Charlotte***
Mentor: **Chakrabarti, Kausik; *UNC Charlotte***

Probing Structure and Function of Telomerase

Telomeres ensure chromosomal replication and protection in eukaryotic organisms. These non-coding repetitive DNA sequences cap the chromosomal ends and are essential for genomic integrity and continuity of cell viability. Telomerase is a cellular ribonucleoprotein enzyme that regulates and maintains telomeres by controlling telomere lengths. Telomerase reverse transcriptase (TERT) and telomerase RNA (TR) are two main components of telomerase. Telomerase RNA (TR) provides the template for DNA repeat synthesis which is essential for genome stability. TERT is a protein-coding gene that provides instructions for making Telomerase Reverse Transcriptase enzymes. The abnormality of telomere lengths correlates to aging and cellular proliferation. The parasitic protist, Trypanosoma brucei, is a microscopic protozoan that causes a disease known as African Sleeping sickness in humans. In parasitic diseases, the increased lengthening of telomeres trend has been linked to the continuous proliferation of the pathogens within their host. Therefore, studying the telomerase function for telomere synthesis is significant for these protozoa to develop therapeutics. Telomeres are generally synthesized during the S-phase of the cell cycle. Two different proliferative stages of T. brucei are Procyclic forms (Insect Stage) and Bloodstream forms (Mammalian stage). However, the relative expression of T. brucei telomerase components and telomerase activity for telomere synthesis in different stages (Procyclic and Bloodstream forms) is unknown. In this study, T. brucei was cultured and chemically treated to arrest the cells at the S-phase of the cell cycle. Western blot was used to measure the abundance of telomerase reverse transcriptase (TERT) protein, and RT-PCR was used to measure T. brucei telomerase RNA from both cytoplasmic and nuclear fractions of T. brucei cell extracts. Ultimately T. brucei telomerase activity was measured with a laboratory-optimized assay. Overall, findings from this project can aid our understanding of the molecular mechanism of telomerase function in human pathogens such as Trypanosoma brucei.

2021-172	Poster	Biological and Life Sciences

Student Presenter: **Lauf, Sarah; *North Carolina State University***
Mentor: **Harris, Gabriel K.; *North Carolina State University***

In Vitro Effects of Regular and Decaffeinated Coffee Against Oral Cancer

Coffee contains bioactive compounds such as antioxidants and phenolics which could play a role in fighting cancer. Some bioactive compounds in coffee may be lost during the decaffeination process. This research project explores the in vitro effects of caffeinated and decaffeinated coffee treatments on the viability of the squamous cell carcinoma line (UPCI:SCC154). This model of oral cancer was used to simulate a scenario of coffee consumption before it is significantly altered or diluted during digestion. Treatments were applied to adherent SCC154 cells in 12-well plates. Relative to the standard concentration of an 8-ounce cup of coffee (0.0135g/ml), regular and decaffeinated instant coffee treatments were performed at the following levels: 0.25, 0.5, 1, 2, and 4-times strength. Additional treatments included pure caffeine at 0.38mg/ml, pure 3-O-caffeoylquinic acid (3-CQA) at 0.42 mg/ml, and 1% sodium azide for isolation of compound effects and comparison for general toxicity. Cell viability was assessed visually based on a loss of cell adherence. HPLC was utilized to determine caffeine and 3-CQA levels. Decaffeinated coffee more effectively inhibited SCC154 cell adherence and putative viability over a 6-hour time period. Individual treatments with pure 3-CQA and caffeine suggest that the greater observed effects of decaffeinated coffee may be mediated by chlorogenic acid-related compounds. This study initiated the exploration of the potential anti-cancer effects of coffee on oral squamous cell carcinoma. Future studies will examine viability via ATP assay, and factors including temperature, multi-treatment trials, and presence of saliva to further expand on this interesting area of research.

2021-173	Poster	Biological and Life Sciences

Student Presenter: **Lee, Grace; *Duke University***
Mentor: **Yin, Henry; *Duke University***

The role of D1 receptor-expressing neurons in the olfactory tubercle in exploratory facial and full body movements

The basal ganglia are essential for action selection and ongoing movement regulation. In the dorsal striatum – the major input structure of the basal ganglia – D1 receptor-expressing medium spiny neurons (D1-MSNs) give rise to the direct pathway, which is thought to be involved in the initiation of movement. However, little is known about the organization and functional role of D1 receptor-expressing neuronal pathways in ventral regions of the basal ganglia, such as the olfactory tubercle (OT), because these neurons do not project to traditional basal ganglia output nuclei. Here, we found that bilateral optogenetic stimulation of D1-MSNs in the OT results in nostril and facial muscle contractions and can evoke large-scale searching behavior, such as sniffing, digging, biting, and licking. Unilateral stimulation caused nostril and facial contractions in addition to ipsiversive turning during open-field stimulation. Interestingly, prolonged stimulation led to a sequence of movements that began with ipsiversive sniffing, then contraversive mouth-opening and licking. Our results suggest that the D1-MSNs in the olfactory tubercle may be involved in initiating and coordinating facial movement and exploratory behavior.

2021-174	Poster	Biological and Life Sciences

Student Presenter: **McLamb, Kasey; *Catawba College***
Walters, Abby
Mentor: **Witalison, Erin; *Catawba College***

Toxicological and reproductive consequences of BPA and BPAF exposure on Daphnia pulex

Bisphenol A (BPA) is an industrial chemical used in the formation of polycarbonate plastics and epoxy resins, which are used in the manufacturing of food packaging and water bottles. BPA has been shown to mimic the hormone estrogen, allowing it to react with estrogen receptors and affect their function. Previous research has shown that exposure to BPA through food and beverage packaging can increase the risk of adverse health effects on the brain, prostate gland, mammary glands, behavior, and reproduction. Thus, BPA was banned from the manufacturing of everyday plastics, but was promptly replaced with BPA derivatives, like BPAF and BPS, which were thought to be more stable than BPA. However, these BPA replacements may have more potent consequences on human health. This research project aims to investigate the reproductive effects of BPA and BPA derivatives on Daphnia pulex. D. pulex are freshwater crustaceans that are used in research for their easy reproducibility and sensitivity to toxins. Previous studies have not examined the reproductive effects of BPA and BPA derivatives in D. pulex. Thus, we will examine the effects of BPA, BPAF, and BPS in varying concentrations on the reproduction rates and age of sexual maturity. Due to the estrogenic effects of BPA and BPA derivatives, we expect that reproduction rates will increase and D. pulex will reach sexual maturity earlier when exposed to BPA and BPA derivatives. The results of our findings could indicate possible impacts on D. pulex populations, freshwater ecosystems, and human health.

2021-175	Poster	Biological and Life Sciences

Student Presenter: **Monkman, Ryan G.; *Elon University***
Mentor: **Overman, Amy A.; *Elon University***

Understanding Associative False Memories

Everyone experiences false memories from time to time. As individuals age, the likelihood of experiencing false memories increases (Devitt & Schacter, 2016). In associative memory, the type of memory in which two or more pieces of information are linked together, recent research has shown that there is a potential benefit in maintaining the way stimuli are presented at encoding and at retrieval, otherwise known as configural congruence (Gerver et al., 2020). The current study aimed to examine whether this benefit of configural congruence is reduced in aging, and whether the neural similarity of memory representations between targets and lures underlies age-related increases in false memories. Both younger (M=20.5 years) and older adult participants (M=71.04 years) experienced behavioral benefits when the configural presentation of the stimuli was matched at encoding and retrieval. While no age difference was observed in hits, an expected age-related increase in false alarms was found. Use of brain state classifier techniques (MVPA) demonstrated that older adults exhibited overall less pattern similarity in brain activity for hits and false alarms and greater pattern similarity in brain activity for hits and correct rejections. Results suggest that while neural processes supporting associative memory retrieval are dependent on configural congruence between encoding and retrieval, the benefit of configural congruence is maintained in aging. Using configural congruence when re-presenting everyday information to older adults (e.g., information about their medication) may be helpful in counteracting age-related memory decline.

2021-176	Poster	Biological and Life Sciences

Student Presenter: **Moody, Sarah E; *UNC Charlotte***
Mentor: **Chi, Richard; *UNC Charlotte***

A Novel Method to Markerlessly Edit the Yeast Genome

Budding yeast, Saccharomyces cerevisiae has long been championed as an excellent model organism to study a multitude of cellular processes. 25 years ago, the complete genome sequence of budding yeast was publicly released, which paved the way for researchers to develop chromosome modification techniques to knockout specific genes using selection marker cassettes flanked by short DNA segments homologous to the target gene. This technique results in highly efficient homologous recombination at the targeted locus in a quick one-step gene disruption event, which has become a standard technique in every yeast research laboratory around the world. While effective, this technique is limited by selection marker availability, and reduced efficiency during sequential gene edits due to redundant homologous sequences available in the targeted yeast strain. Recent variations of this technique have only included more selection markers and more fusion tags; however, none have addressed these major limitations. In this study, we report a novel, cost effective and highly efficient method to genome edit using CRISPR-Cas9 technology that overcomes all previous limitations.

2021-177	Poster	Biological and Life Sciences

Student Presenter: **Ndey-Bongo, Nyssa P.; *North Carolina State University***
Mentor: **Doherty, Colleen; *North Carolina State University***

Investigating the Potential of Mulberry, Morus Alba, as a Rare Earth Element Hyperaccumulator

The term rare earth elements (REEs) refer to a class of metals in the lanthanide group that are lauded for their use in a variety of applications, including, but not limited to: renewable energy, drug development, and micro fertilizer due to their unique physical and chemical properties. These properties make them especially important for modern technologies such as lasers and high-intensity magnets, making them a highly sought-after commodity. Despite their high demand, the term 'rare' points to the lack of REEs being found in concentrated ore deposits, posing a great challenge as it pertains to their mining. The extenuating process it takes to extract usable samples of REEs often results in the deposition of soluble REEs and other contaminants in water sources. As such, it has been a goal for many researchers to investigate methods to uptake REEs whilst maintaining environmental integrity. One method investigated in this project is the use of plants (dubbed "hyperaccumulators") to uptake large quantities of REEs and extract them from their tissues. This project's objective was to investigate the accumulation capacity of Morus alba. A proteomic analysis protocol that consisted of a total peptide extraction, protein quantification via a Bradford assay, and, lastly, a colorimetric assay to locate the presence of metal-binding proteins was followed. It was found that the protein extract from the fruits of Morus alba may exhibit some metal-binding affinity to cerium, yet more research would need to be done to confirm whether this is due to confounding variables or not.

2021-178	Poster	Biological and Life Sciences

Student Presenter: **Noah, Ryan; *Fayetteville State University***
Mentor: **Delaney Nguyen, Kristen; *Fayetteville State University***

Phage recovery

Pseudomonas syringae, is a gram-negative bacterium known to cause bacterial blight in local NC crops. This blight leads to massive losses in annual agricultural revenue. During the fall of 2017 and 2018 Pseudomonas syringae-specific bacteriophages were exposed to sub-optimal storage conditions during weather events. These phages have lost the ability to infect host bacterial cells. Rather than discard the phages, this experiment sought to "resuscitate" phages by combining possibly still intact phage DNA with chemically competent cells. Chemical competence was induced in P. syringae using CaCl2 solutions along with heat shock methods. The newly competent P. syringae were then combined with samples containing phage lysate, yet no transformation occurred. Therefore, these phages cannot be revived, and future efforts will now focus on identifying novel P. syringae phages.

2021-179	Poster	Biological and Life Sciences

Student Presenter: **Powell, Amanda; *East Carolina University***
Mentor: **Elizabeth Ables; *East Carolina University***

An Ecdysone Importer is necessary for germ cell survival in the Drosophila ovary

Oogenesis is the progression of germ cells through mitotic expansion, differentiation into an oocyte, and successful completion of meiosis. Steroid hormones play critical roles in this process in diverse organisms. In Drosophila, the main steroid hormone, ecdysone, facilitates female fertility in part by promoting germline stem cell self-renewal. Foundational studies demonstrated that ecdysone is synthesized primarily in egg chambers during mid-oogenesis; however, more recent data suggests that somatic escort cells, which support germline stem cell differentiation, may also produce ecdysone. Understanding how ecdysone is transported, and received in the ovary would help resolve these disparate results. A study by the Yamanaka lab supports the hypothesis that ecdysone needs Oatp74D, a membrane transport protein, to import ecdysone into cells, disproving the popular assumption that steroids passively transport through membranes. Oatp74D was first characterized in the blood brain barrier of Drosophila, but may have roles in steroid hormone uptake in other cells. To understand the role of Oatp74D in the ovary, we knocked down its function in escort cells using somatic cell-specific RNAi. When Oatp74D is depleted from escort cells, the number of germ cell progenitor cells increases, while the number of viable oocytes decreases. Our preliminary data thus suggest that Oatp74D is necessary in somatic cells to support germ cell differentiation and survival. We are now testing whether the role of Oatp74D in escort cells is independent of neuronal input to the ovary and whether ecdysone uptake alters ecdysone reception in escort cells. Together, our studies will help resolve the molecular mechanisms by which a steroid hormone regulates oogenesis.

2021-180	Poster	Biological and Life Sciences

Student Presenter: **Primus, Clara; *High Point University***
Zimmerman, Alex
Mentor: **Segarra, Veronica; *High Point University***

Scientific societies fostering inclusivity in the life sciences through engagement of undergraduate scientists

Scientific societies serve as communities of practice in which scientists develop many of the skills and connections required for the progression of their careers. For example, scientific societies offer a range of opportunities to attend career development programs, gain experience in communicating science, and receive recognition for achievements within their discipline. Programming for undergraduate student members has recently been increasing, both in prevalence and in its range of offerings. The Alliance to Catalyze Change for Equity in STEM Success, ACCESS, a meta-organization seeking equity and inclusivity in life sciences fields, has examined programs and opportunities focused on undergraduates across its member scientific societies to identify common themes, promising practices, and challenges. In this poster, we share and discuss our findings.

2021-181	Poster	Biological and Life Sciences

Student Presenter: **Russo, Gina; *North Carolina State University***
Mentor: **Simpson, Melanie; *North Carolina State University***

A Study of Human Hyaluronidase 1 and 2 on Prostate Cancer Progression

An essential component of the extracellular matrix of tumor cells is Hyaluronic Acid (HA). HA is a glycosaminoglycan that participates in the processes of cell migration, differentiation, and proliferation which result in tumor growth. Increased levels of HA are frequently an indication of metastasis, or the spread of cancer from its site of origin. Hyaluronidase (HYAL) is a family of enzymes that regulate the degradation of HA into fragments. There are five human HYALs (hHYAL1-4 and hPH-20). Research has been performed on hHYAL1, however, there is little known about the activity and importance of hHYAL2-4. This project focuses specifically on the expression, purification, and catalytic activity of hHYAL1 and hHYAL2. HYAL1 was purified using ammonium fractionation, followed by ion exchange chromatography. The catalytic activity was measured using a colorimetric assay which confirmed, as expected, that hHYAL1 effectively degrades HA and that reaction kinetics were similar to those previously published by our group. The HYAL2 sequence was expressed with a FLAG epitope and purified using ANTI-FLAG affinity chromatography. We then compared the activity of hHYAL1 and hHYAL2 using the colorimetric assay.

2021-182	Poster	Biological and Life Sciences

Student Presenter: **Sariah D'empaire-Salomon; *Livingstone College***
Mentor: **Williams, Emmanuel; *Vanderbilt Medical Center***

mRNA expression of the glaucoma-associated gene Adamts10 with a C495X mutation in zebrafish

Glaucoma is the primary cause of irreversible blindness globally, and it is defined by optic nerve injury and patterns of peripheral visual field loss caused by retinal ganglion cell (RGC) degeneration. A disintegrin and metalloproteinase with thrombospondin motifs (ADAMTS) genes encode for secreted proteins that are essential for many developmental processes. A mutation in ADAMTS10, Gly661Arg, has been shown to cause glaucoma in dogs. Previously in zebrafish embryos, preventing translation of ADAMTS10 mRNA resulted in severely disrupted RGC development. However, zebrafish with a truncation mutation (C495X) of adamts10 had normal retinas. We hypothesize that the lack of effect on retinal development of C495X mutation was due to normal expression levels of the truncated but perhaps still functional form. Here, we used RNAscope in situ hybridization on frozen sections of zebrafish embryos to detect adamts10 mRNA to determine the amount of transcript expressed by fish with the C495X mutation or normal wild type (wt) fish. We found that C495X adamts10 mRNA was expressed at very low levels in most embryos compared to wt, with considerable variation between fish (P-Value= 0.0007).The majority of mRNA expressed was found in the outer layer of the eye, possibly in the RPE for both wt and C495X. Our preliminary findings indicate that reduced expression at 72hour post-fertilization of adamts10 mRNA in zebrafish retinal pigment epithelium does not affect retinal development. We speculate that the lack of an effect of the C495X mutation could be due to other gene(s) that compensate for low expression of adamts10 mRNA. Future experiments will examine localization of mRNA adamts10 at earlier time points.

2021-183	Poster	Biological and Life Sciences

Student Presenter: **Schmitt, Adam T.; *East Carolina University***
Pajski, Megan L.
Fisher-Wellman, Kelsey
Mentor: **Graber, Ted G.; *East Carolina University***

Optimizing Mass Spectrometry Protein Detection in Aging Mouse Muscle

Neuromuscular dysfunction results in a decline in physical function and exercise capacity with aging, leading to reduced quality of life and eventual increased mortality. Changes in muscle protein expression levels through aging play a role in the development of sarcopenia (age-related loss of muscle mass/strength). Tandem mass tag-labeled (tmt) liquid chromatography tandem mass spectrometry (lc-ms/ms) is a well-validated technique used to establish differential protein expression, but the dominance of two proteins necessary for generating force output, myosin heavy chain (MHC, ~42%) and alpha-actin (a-actin, ~18%), limits effective dynamic range and makes it difficult to detect low abundance proteins in muscle fibers. With no further treatment, 493 proteins are detected in our mouse skeletal muscle homogenates. This ongoing project's main goal is to use different strategies to maximize protein detection. We increased detectability 70% to 803 proteins using a high pH reverse phase fractionation kit, and then with size-exclusion chromatography, further increased detection to 1493 proteins in an under 30,000 Dalton fraction alone (note: MHS ~ 200 kDa, a-actin ~ 60 kDa). Our pilot data (n=3 per age group) using reverse phase fractionation demonstrates that we can reliably detect significant ($p<0.10$) protein differences between older adult (28m) and adult (6m) muscle (22 altered proteins). We will also be investigating a myofibrillar separation homogenization where myofibrillar proteins are fractionated biochemically from sarcoplasmic proteins. Overall, we conclude that finding an optimal protein detection protocol will better enable us to tease out potential mechanisms of age-related muscle dysfunction using tandem mass spectrometry.

2021-184	Poster	Biological and Life Sciences

Student Presenter: **Sharma, Swarup; *North Carolina School of Science and Math***
Mentor: **Frost, Ellie; *UNC Chapel Hill***

Engineering a dual reporter plasmid for CRISPR gene editing of the F508del-CFTR mutation in-vitro

Improvements in biomedical science have led to the development of numerous advancements and possibilities for disease therapeutics. One of these advancements, gene therapy, allows for the cellular modification of genetic information. CRISPR-Cas9 is a protein and RNA complex often used in a range of gene therapy applications that can target and edit DNA sequences. CRISPR allows for very specific edits to be made and is a widely popular gene-editing system. The editing of cellular instructions leads to the modification or production of new byproducts of the cell, which have therapeutic applications for the treatment of many genetic diseases, including cystic fibrosis. Cystic fibrosis is an autosomal recessive disease, characterized by sticky, thick, mucus that clogs airways, affecting the respiratory and digestive system, which can significantly reduce life expectancy. The F508del-CFTR mutation is the most common mutation associated with cystic fibrosis, leading to a deletion in an amino acid essential for a chloride ion channel protein. This research project aims to create a CRISPR construct to edit the common F508del-CFTR mutation in mice. A reporter plasmid will be constructed to test the CRISPR constructs with, composed of two fluorescent protein genes, one showing that the plasmid is viable and transduced, and the other that will fluoresce if the CRISPR construct successfully corrects the F508del-CFTR mutation. Upon successful editing of the reporter, the optimal CRISPR construct will be delivered via AAV to mice with the F508del-CFTR mutation, and later used in human clinical applications.

2021-185	Poster	Biological and Life Sciences

Student Presenter: **Silkstone, Dylan; *North Carolina State University***
Mentor: **Cheng, Ke; *North Carolina State University***

miRNA-loaded Exosomes to Enhance Tissue Regeneration in a Rodent Model of Pulmonary Fibrosis

Idiopathic pulmonary fibrosis (IPF) is a form of interstitial lung disease characterized by scarring of lung tissue, which can cause respiratory failure and death. While FDA-approved drugs can slow disease progression, they cannot reverse IPF scarring. This lack of sufficient treatments demonstrates a need for new therapeutics that recover healthy tissue in IPF patients. Lung spheroid cells (LSCs) are derived from a heterogeneous population of human lung cells and have known regenerative properties. LSCs release nanoparticles called exosomes that share their therapeutic properties. Exosomes are 30-100 nm vesicles used in cell communication and marked for selective targeting of cells. LSC-derived exosomes reduce collagen build-up in IPF rodents and restore lung function. This study investigated how loading exosomes with miR-30a, a microRNA that reduces fibronectin and α-smooth muscle actin expression, affects tissue regeneration in the fibrotic murine lung. Lower expression of these proteins would reduce scarring in the lungs, and a combination of miR-30a with the therapeutic LSC-exosomes is expected to enhance tissue regeneration in the lungs of IPF mice. Normal expression levels of miR-30a were determined in both LSCs and mouse lung tissue using qPCR. Loaded and unloaded LSC-exosomes were characterized by nanoparticle tracking, western blotting, and TEM. Loaded exosomes were delivered to cultured LSCs to determine uptake efficiency in-vitro. A preliminary in-vivo experiment measured tissue regeneration in an IPF mouse model after loaded exosome delivery by qPCR, western blot, and histology staining. This study lays the groundwork for the development of a new treatment for patients with IPF.

2021-186	Poster	Biological and Life Sciences

Student Presenter: **Simonton, Kijah; *North Carolina A&T State University***
Mentor: **Maldonado-Devincci, Antoinette; *North Carolina A&T State University***

Effects of early adolescent intermittent alcohol exposure and subsequent voluntary alcohol drinking in C57BL/6J male and female mice.

During adolescence, alcohol consumption at a chronic rate is a prominent issue due to the potential consequences that can occur during this developmental period. These consequences include alcoholism, anxiety, and depressive behaviors. This study was used to determine sex specific effects of binge-like ethanol exposure during adolescence on relapse-like voluntary ethanol drinking in adulthood. Male and female C57BL/6J adolescent mice were exposed to intermittent ethanol vapor exposure (or air;control) between postnatal days (PND) 22-36. Mice underwent abstinence until PND 66 then were tested for voluntary intermittent ethanol drinking using a two-bottle paradigm with 10.5% ethanol in one tube and water in the other every other day. We recorded the initial and twenty-four-hour readings of the tubes each day. The placements of each tube were also switched to prevent the mice from having a bias towards a specific side. For the male and female mice, early ethanol exposure did not alter initial relapse-like ethanol consumption in adulthood. However, after repeated relapse-like ethanol exposure, male ethanol-exposed mice showed a trend for decreased ethanol consumption compared to air-exposed mice. This effect was absent in female mice. Although, on average female mice voluntarily consumed more ethanol than the male mice. These results show that binge-like ethanol exposure during adolescence induced sex specific effects on adultood ethanol drinking. However, these effects were in the opposite direction of our hypotheses. It is likely that unstable social housing altered these drinking patterns differently in males and females which we will explore in future studies.

2021-187	Poster	Biological and Life Sciences

Student Presenter: **Singhvi, Krish; *North Carolina School of Science and Math***
Mentor: **Burch, Christina L.; *University of North Carolina at Chapel Hill***

Horizontal Gene Transformation - Complexity vs. Balance Hypotheses

Horizontal gene transfer (HGT) is a major contributor to bacterial genome evolution, generating phenotypic diversity, driving the expansion of protein families, and facilitating the evolution of new phenotypes, new metabolic pathways, and new species. Comparative studies of gene gain in bacteria suggest that the frequency with which individual genes successfully undergo HGT varies considerably and is inhibited by high gene connectivity (e.g., Jain et al. 1999, Lercher and Pal 2008). Two non-exclusive hypotheses have emerged to explain why transferability should decrease with connectivity: the Complexity Hypothesis (Jain, Rivera, & Lake, 1999) and the Balance Hypothesis (Papp, Pál, & Hurst, 2003). These hypotheses predict that the functional costs of HGT arise from a failure of divergent homologues to make normal protein-protein interactions or from gene mis-regulation, respectively. Here we describe genome-wide experimental tests of these hypotheses by examining the fitness consequences of 1) the gene misregulation that results from the horizontal transfer into E. coli of more than 4,000 plasmids, each expressing a different gene identical to its E. coli homolog, and 2) the protein interaction failure that results from the horizontal transfer into E. coli of plasmids containing divergent copies of the same homologs, obtained from taxonomically diverse bacterial genomes. Our results suggest that the primary barrier to HGT results from gene misexpression rather than from protein interaction failure. Furthermore, the fitness effects of gene misexpression were substantially stronger among physically interacting genes such as those that comprise the ribosome than among genes that interact as components of metabolic pathways.

2021-188	Poster	Biological and Life Sciences

Student Presenter: **Smith, Charity J; *North Carolina Central University***
Swann, Jalynn
Mentor: **Sliver Key, Catherine; *North Carolina Central University***

Genomic Mapping of Drosophila melanogaster and Fab Lab Project to Determine Genes Associated with Alcohol Use Disorders

In the U.S., Alcohol Use Disorder (AUD) has become a prominent disease that affects the lives of patients and their families: About 1 in every 8 people develops AUD and 15.1 million Americans suffer from the disorder. Being able to establish the potential source of the disorder can lead to optimized treatment of AUD, which is greatly significant.

AUD is 50-60% heritable, allowing one to research the potential genetic effects. Due to their similar gene homology and bodily systems, Drosophila melanogaster is used as a model organism. A living library of D. melanogaster 200+ genotypes, the Drosophila Genetics Reference Panel (DGRP), are being used in behavioral assays to screen for SNPs in genes conferring an alcohol resistance phenotype. We report on the DGRP-362 strain. Gender-sorted flies were exposed to ethanol in an Ethanol Mobility Behavioral Assay (EMBA). Assays were conducted with the w1118 strain as the control. Three sets of DGRP-362 gender-sorted flies were assayed with ethanol to test the time for half and all the flies to become sedated, ST50 and ST100 respectively. Overall, there is no statistically significant difference for DGRP-362 sedation times.

In combination with the behavioral research, students are using engineering techniques to design a tool that optimizes the EMBA protocol. Two designs will be presented: 1. A device to improve the transferring of D. melanogaster into vials, and 2. a device to improve the survival rates of the D. melanogaster. The prototypes will undergo future design modifications to help improve the assay.

2021-189	Poster	Biological and Life Sciences

Student Presenter: **Smith, Courtney L.; *North Carolina State University***
Mentor: **Jetton, Robert; *North Carolina State University***

Efficacy of Aphytis melinus as a biological control agent for elongate hemlock scale, Fiorinia externa on Fraser fir, Abies fraseri

We tested the efficacy of the parasitoid Aphytis melinus as a biological control agent for the elongate hemlock scale, Fiorinia externa, on Frasier fir Christmas trees, Abies fraseri, by conducting petri dish assays. Aphytis melinus wasps were purchased from Evergreen Grower's Supply. Thirty petri dishes full of elongate hemlock scale infested Fraser fir needles were tested. Each petri dish contained three infested Fraser fir needles, one cotton ball moistened with distilled water, and two Aphytis melinus wasps. The number and life stages of elongate hemlock scales were recorded. Petri dishes were sealed before being placed in an environmental chamber set to the ideal conditions for development of Aphytis melinus. Petri dishes were left in environmental chambers for at least 48 hours before the two Aphytis wasps were removed. Thereafter, petri dishes were placed back into chambers for at least 16 days before elongate hemlock scale covers were lifted from the needles to check for oviposition and/or the emergence of Aphytis melinus offspring. Ten petri dishes full of pine needle scale, Chionaspis pinifoliae, were tested in the same manner. It appeared that Aphytis melinus did not utilize either scale species as a host. However, we found that many of the scales were already parasitized by Encarsia citrina, which emerged in 14 petri dishes (of both scale species). Moreover, one Aphytis melinus pupa was found beneath a pine needle scale cover. More experiments are needed to confirm the efficacy of A. melinus and the possibility of using E. citrina for augmentation biocontrol.

2021-190	Poster	Biological and Life Sciences

Student Presenter: **Snider, Ali; *Catawba College***
Mentor: **Witalison, Erin; *Catawba College***

Effects of BPA on C. elegans viability

The simplicity of Caenorhabditis elegans allows the nematode to be studied in detail, identifying them as model organisms. C. elegans are easily maintained and bred in a laboratory setting and they possess many commonalities with complex organisms, including molecular signals and genome sequences, making them ideal to research and compare to humans. The goal of this study is to examine the toxicological and molecular effects of bisphenol A, commonly referred to as BPA, and other BPA derivatives on C. elegans. Past studies have shown a positive correlation between BPA exposure and decreased development and functionality during a C. elegans lifespan. During this project, we will test the effects of BPA at various concentrations on the C. elegans measuring viability, molecular variability, and genome disruptions. In our preliminary experiment, we performed a Trypan blue viability assay to test the effects of vehicle treatments (PBS, ethanol, and DMSO) on C. elegans. We further plan to test the effects of BPA and BPA derivatives on the viability of C. elegans. In future experiments, we will test the consequences of BPA exposure on the expression of conserved genes in C. elegans, such as TP53 (cep-1). Based on our data, if we see toxicological and molecular effects, exposure to BPA and its derivatives could have potential implications on human health.

2021-191	Poster	Biological and Life Sciences

Student Presenter: **St. Clair, Juelle; *Elizabeth City State University***
Aniya Martin
Serena Perry
Nicholas Prosper
Mentor: **Dr. Margaret Young; *Elizabeth City State University***

Exploration of Salt-Tolerance Somatic Mutants in Kalanchoe

Plant growth is hindered in high salinity due to rising oceans. Kalanchoe was used because it is a drought tolerant species and could potentially survive in harsh salinity conditions. Sixty grams of soil was added to thirty-six pots. Ten plants were added to 24 pots; this set of Kalanchoe was the treated group. Ten plants were then added to 12 pots (control). The treated group was watered with 100 mM NaCl for two weeks, and the controls were watered with distilled water. Data on the weight of each pot, the number of leaves/plant, and the number of new shoots were taken. In Week 1, the total number of leaves for the control was 4.41 ± 0.85 and the treated was 4.02 ± 0.71. The mean weight of the control pots was 111.95 ± 4.33 and that of the treated was 95.15 ± 3.19 g. By Week 2, the mean number of leaves was 5.64 ± 0.97 and that of the treated was 4.48 ± 1.10. The pots of the control group weighed 164.83 ± 3.30 and that of the treated was 141.39 ± 7.50 g. In week two, new shots were observed on the leaf edges of the control plants and none on the treated plants . Data will be taken for another 6 weeks. New plants from the control will be aseptically cultured. Any plants arising from those treated will be placed into culture to regenerate plants that are tolerant to NaCl.

2021-192	Poster	Biological and Life Sciences

Student Presenter: **Stewart, Cade; *Central Piedmont Community College***
Santiago, Keila
Mentor: **Yu, Shuangying; *Central Piedmont Community College***

Investigating the Presence of Microplastics in Local Aquatic Ecosystems

The National Oceanic and Atmospheric Administration defines microplastic particles (MPPs) as plastic debris smaller than 5 mm long. The growing presence of these small plastics has been associated with the increased consumption of single-use plastic products. In addition to the marine environment, rising levels of MPP and effects have also been reported for various freshwater ecosystems like streams, lakes, and ponds. As part of the Mapping Microplastics Project developed by Miami University, our research seeks to examine the various waterways across the Greater Charlotte Area, NC, to determine the presence of MPPs in local ecosystems. Following the testing protocol provided by the Mapping Microplastics Project, approximately 500 ml of surface water was collected in glass jars, filtered, stained, and particles 1 mm or larger were recorded. A total of 24 samples were collected from natural water bodies, including ponds, lakes, a large river, and several creeks. Microplastics were detected in approximately 42% of the samples. Among samples with detected MPPs, the average number of particles observed was 2.3, with a range of 1-4 particles. Samples from standing water (lakes and ponds) appeared to have more particles (0-4; 1.2 particles/sample) than samples from flowing water sources (0-1; 0.3/particles/sample).

2021-193	Poster	Biological and Life Sciences

Student Presenter: **Suresh, Neha; *North Carolina State University***
Daniel Spang
Linnea Andersen
Mentor: **Dr. Arnab Sengupta; *North Carolina State University***

Adapting Experimental CRISPR CLONInG Protocols for a Biotechnology Teaching Lab at NC State University

CRISPR-Cas9 is an RNA based DNA editing tool reengineered from the bacterial immune system.Our aim is to implement CRISPR-CLONInG (Shola et. al, 2020, CRISPR Journal) into a CRISPR Technology course designed for upper class undergraduates and graduate students. CRISPR-CLONInG is a tool that enables efficient cut-and-paste of multiple complex DNA segments that are constructed to form Adeno Associated Vectors (AAV) by Gibson assembly. CRISPR-CLONInG is able to utilize CRISPR-Cas9 as an excision tool to make use of the entire gRNA vector rather than just the backbone. The use of Gibson assembly allows the flexibility of requiring overhang sites to be present in either one of the DNA components to be assembled. Gibson also allows for the digested vector backbones to construct double stranded DNA and AAV vectors without leaving behind cloning scars. The vector backbone is a small portion of the guide RNA (gRNA) that is used to direct the Cas9 protein to the correct DNA to make a double strand break. CRISPR-CLONInG combines the gRNA and Cas protein complex to form the ctRNP complex that can make use of the entire gRNA vector rather than just the backbone, which allows for larger clusters of edits. Our goal is to design highly customizable donor vectors that are more efficient than traditional CRISPR Cas options. We plan to create and implement a protocol based on Shola et. al's experiment and incorporate it to the teaching lab for Spring 2022.

2021-194	Poster	Biological and Life Sciences

Student Presenter: **Tarkenton, Madison K.;** ***Elon University***
Rogers, Christopher J.
Thompson, Lyric M.
Monkman, Ryan G.
Overman, Amy A.; ***Cross-institutional team: Tarkenton and Monkman are at***
Mentor: ***Elon; Rogers and Thompson are at North Carolina A&T State University***

fMRI of Memory for Old and New Associations

Memory and cognitive abilities naturally decline with age. For older adults, associative memory decline is a common impairment that hinders their ability to learn and remember the relationship between unrelated items. This may result from increased proactive interference, which occurs when old memories interfere with the ability to encode new information. This study investigates the role of proactive interference in associative memory using computational, behavioral, and neuroimaging methods to understand brain functions during encoding and retrieval. Older and younger adult participants will memorize a set of word-picture associations while in an fMRI scanner. Pilot testing has been completed, resulting in structural and functional brain images for several young adult participants. An initial manipulation check was performed on the pilot images to verify data quality. Preprocessing of brain images was conducted using the fMRIprep pipeline, which provides an accessible way to review images using well-known software that allow for minimal manipulation before statistical analysis. Differences in brain activity were analyzed between conditions that presented words and images versus number stimuli. We found activation differences consistent with typical functions of brain regions such as visual cortex. The research is ongoing and future analyses will focus on multivariate pattern classification and graph theory measures of functional connectivity. Our goal is to identify age-related changes in neural processing of old and new associations, to better understand how proactive interference plays a role in associative memory impairment. The results will also inform theories such as the PMAT framework (Reagh & Ranganth, 2018).

2021-195	Poster	Biological and Life Sciences

Student Presenter: **Valines, Amani L.;** ***Fayetteville State University***
Mentor: **Yuan, John;** ***Fayetteville State University***

Analysis of Seed Germination in Cultivated Soybean and Wild Soybean

Seed germination is the initial step of plant developmental process. The wild accession (Glycine soja) of soybean is the progenitor of the cultivated soybean varieties [Glycine max (L.) Merr.], which was selected by peasants several thousand years ago. Seed germination is the process by which a seed begins to sprout and grow into a seedling under the right growing conditions. This experiment examined and analyzed seed germination between cultivated soybean (G. max) and wild soybean (G. soja). Ten different lines of the cultivated soybean and wild soybean were used in this experiment, and they were tested five at a time with 10 seeds from each line, which were soaked in distilled water for one day and then, placed on the surface of wet filter paper in a sealed petri dish for five days before assessed. WinRhizo software (Regent, Canada) was used to measure the root volume, root length, and length of hypocotyl between cultivated soybean varieties and wild soybean. The results from this experiment showed the average hypocotyl length for G. max was 2.69 cM and 2.65 cM for G. soja, respectively while the average root length for G. max was 1.27 cM and 2.51 cM for G, soja, which was significantly different between two species for root length ($P<0.05$) but no difference was observed for hypocotyl length. The significant differences between two species for hypocotyl and root volumes were also identified ($P<0.05$). Moreover, the various agronomic traits for seed germination were also analyzed in these two species. The results derived from this project will be useful information to further investigate the genetic bases of these differences between two species.

2021-196	Poster	Biological and Life Sciences

Student Presenter: **Walker, Allison; *North Carolina State University***
Mentor: **Peralta, Ariane; *East Carolina University***

Nutrient Enrichment Modifies Soil Bacterial Composition and Plant Productivity to Disrupt Wetland Carbon Storage

Nutrient addition from human activities affects carbon storage by changing the balance of fixed and respired carbon. For example, wetland ecosystems are known for slow decomposition rates and high carbon fixation rates. However, atmospheric deposition of nutrients could be changing wetland plant-microbe interactions in ways that tip the balance from carbon storage to loss. We hypothesized that fertilization increased plant carbon inputs to soils which can enhance microbial diversity and lead to negative effects on soil carbon storage potential. To test this hypothesis, we used data from the long-term ecology experiment at East Carolina University's West Research Campus. We compared coastal plain wetland soil microbial communities and plant growth in fertilized and unfertilized plots. We conducted 16S rRNA targeted amplicon sequencing to determine soil bacterial community composition. Results showed an increase in aboveground plant biomass, soil carbon, and bacterial diversity. In contrast, belowground plant biomass and microbial biomass were similar in fertilized and unfertilized plots. To further examine bacterial community changes to nutrient enrichment, we looked at changes to the relative abundance of fast growing copiotrophic and slow growing oligotrophic bacteria. Results revealed a decrease in oligotroph relative abundance and little to no change in copiotroph relative abundance. These results suggest a possible negative impact on organic carbon storage since oligotrophic bacteria respire less carbon than copiotrophic bacteria over the same amount of time. This study provided evidence that long-term nutrient enrichment influences wetland soils in ways that decrease their carbon storage potential, which may inhibit climate change mitigation.

2021-197	Poster	Biological and Life Sciences

Student Presenter: **Williams, Anna; *East Carolina University***
Mentor: **Elizabeth, Ables; *East Carolina University***

Tnpo-SR is required for GSC fusome dynamics in Drosophila

The maintenance of species is dependent on parental genetic information being passed onto the next generation. Germ cells are crucial for this transfer and therefore drive evolution. Evolutionarily conserved across phyla, germ cells in many systems are supported by a germline stem cell (GSC) population. These tissue-resident stem cells divide to form daughter cells that will mitotically divide and differentiate to form oocytes and nurse cells, which supply the oocyte with maternal factors necessary for embryogenesis. Tnpo-SR, an ecdysone-responsive gene, was identified in a genetic screen for its putative role in stem cell self-renewal. Tnpo-SR shares amino acid similarity to mammalian β-importin proteins; however, its specific roles in stem cells has not been characterized. Here, we demonstrate that Tnpo-SR is necessary in GSCs for their self-renewal. Loss of Tnpo-SR in GSCs using germline enhanced RNAi and genetic mosaics showed decreased GSC formation, impacted maintenance, and decreased fusome size. This provided a basis for investigating whether Tnpo-SR controls fusome dynamics necessary for GSC self-renewal. The location of Tnpo-SR is still unknown, so I aim to uncover its location by characterizing CRISPR mCherry-tagged Tnpo-SR lines and building HA-tagged lines. Development of these tools will not only help us elucidate the location of Tnpo-SR but give us the necessary tools to perform genetic screens and pull-down assays to investigate genetic interactions and potential mechanisms.

2021-198	Poster	Biological and Life Sciences

Student Presenter: **Williams, Sebastian; *North Carolina State University***
Mentor: **Colleen, Doherty; *North Carolina State University***

Eco-Friendly Extraction of Rare Earth Elements Using Phytolacca americana

The production of many electronic devices today requires the use of Rare Earth Elements (REEs) which explains why they are in such heavy demand as the world functions on technology. These REEs are typically mined from bedrock however, these elements are not found in large deposits making the means to getting these elements both financially costly and detrimental to the environment. Therefore, a possible solution to mining these REEs is through coopting biochemical pathways found in plants. In this study, we determined the basal intake levels of REEs in a known heavy metal hyperaccumulator called Phytolacca americana (P. americana) and began strategies to engineer plants to increase REE uptake. The ability of P. americana, also known as pokeweed, to grow in acid mine drainage was examined. Acid mine drainage is a residue of coal mining that is enriched in REEs. The results of the acid mine drainage experiment prove the capability for P. americana to grow in REE rich soil. This work also tested transformation protocols using agrobacterium on P. americana with the goal of generating plants expressing high levels of REE binding proteins. The transformation experiment utilized a screening selection using regenerated callus and selection media with antibiotics. GFP fluorescence microscopy and PCR gel electrophoresis resulted in Sample 1 of P. americana having potentially been transformed by agro-transformation. Further tests are being done to find the most effective way to transform P. americana to continue improving the plant's ability to absorb REEs from the earth.

2021-199	Poster	Biological and Life Sciences

Student Presenter: **Zia, Raazia; *East Carolina University***
Mentor: **Spuches, Anne M.; *East Carolina University***

Structural and Thermodynamic Investigation of Pb2+ Binding to Human Cardiac Troponin C

Toxic metal exposure is linked to a variety of health issues including cardiovascular disease and diabetes. It is known that toxic metals are capable of mimicking essential metals for binding sites in proteins. It is also known that both divalent cadmium (Cd2+) and lead (Pb2+) can disrupt Ca2+ signaling pathways. However, little else is known about how this happens at the molecular level. Research in the Spuches Lab is geared towards understanding metal toxicity from a structural and thermodynamic perspective. In this project, I will investigate Pb2+ binding to human cardiac troponin C(hcTnC), a Ca2+ binding protein that is responsible for heart muscle contraction. Isothermal titration calorimetry (ITC)studies of Pb2+ binding to wild-type and C35A/C84A N-domain hcTnC will be conducted to determine the stoichiometry of metal binding as well as ΔG, ΔH, and TΔS of the reaction. Circular dichroism (CD) experiments will also be used to probe the structural changes that occur upon Pb2+ binding to wild-type and C35A/C84A N-domain of hcTnC. My results will be compared to data obtained for Cd2+ in the Spuches lab in an effort to understand lead toxicity at the molecular level.

2021-200	Poster	Biological and Life Sciences

Student Presenter: **Alabi, Mora; *UNC Charlotte***
Mentor: **Adam Reitzel; *UNC Charlotte***

Detection and quantification of stratified bacterial colonization in the starlet sea anemone, Nematostella vectensis.

The microbial community associated with multicellular eukaryotic organisms ('microbiome') is essential to the development, physiology, and health of the host species. Studies have shown the vast diversity of the microbiome and the variability between individual organisms. The sea anemone Nematostella vectensis possesses unique morphology, phylogenetics and physiological tolerance for environmental variation. I used Nematostella vectensis as an experimental model for studying microbial communities of hosts in marine habitats. In this study, we are introducing a common environmental bacteria (Vibrio alginolyticus) conjugated with fluorescent plasmids (Schlechter et al., 2018) into N. vectensis to understand colonization dynamics of temporal stratification and if there is an advantage conferred to primary colonizer introduced into the host. I predict that priority effects would favor the initial colonization of V. alginolyticus and a second colonization would be less successful due to limited available surfaces of the mesentery. Additionally, I hypothesize that the longer the time interval between the first and subsequent colonization, the more successful the latter colonization. Ongoing studies are quantifying these aspects of symbiotic interactions at various stages of cnidarian development and collection of comparative data in other species. [1] Schlechter RO, Jun H, Bernach M, Oso S, Boyd E, Muñoz-Lintz DA, Dobson RCJ, Remus DM and Remus-Emsermann MNP (2018) Chromatic Bacteria – A Broad Host-Range Plasmid and Chromosomal Insertion Toolbox for Fluorescent Protein Expression in Bacteria. Front. Microbiol. 9:3052. doi: https://doi.org/10.3389/fmicb.2018.03052

2021-201	Poster	Biological and Life Sciences

Student Presenter: **Alston, Kayla; *North Carolina A&T State University***
Mentor: **Mulumebet Worku; *North Carolina A&T State University***

Evaluation of Secretion of Calprotectin in Cow Milk and Blood

Calprotectin is a protein released by a type of white blood cell called a neutrophil. When there is inflammation neutrophils move to the area and release calprotectin, resulting in an increased level. Neutrophils are the reason for increased somatic cell count (SCC) in cows. High SCC indicates an infection from bacteria. This project will determine if calprotectin secretion is related to somatic cell count levels in cows. BCA protein assay is used to determine the total amount of protein in a sample. An ELISA test determines the level of a specific protein or antibody. Detection of specific proteins or antibodies can help to diagnose infections that are related to the specific protein or antibody. We will choose 6 cows (3 with high SCC, 3 with low SCC) to take blood samples from and run both BCA and calprotectin ELISA on the samples. We will also collect milk samples from all 6 cows and perform a microscopic somatic cell count.

2021-202	Poster	Biological and Life Sciences

Student Presenter: **Dediavoukana, Rodney; *East Carolina University***
Mentor: **Hoben, John; *East Carolina University***

Investigating metal contents in environmental samples

Falls of Neuse Lake, the drinking water source for Raleigh North Carolina is listed as impaired due to its high level of chlorophyll A derived from excess nutrients. In previous years, there has been an increased field of research to improve nutrient loading in an effort to protect the lake and its watershed. These bodies of research have mainly focused on three things: the reduction of nitrogen and phosphorus overload in sewer vs septic ponds, the impact of heavy metals, and identifying points and nonpoint pollution. However, little is known about the pollution of nonheavy metals such as copper on these very sites. In this research, it was hypothesized that sewer ponds had a much higher metal concentration than septic ponds. Using the Inductive coupled Plasma mass spectrometry (ICP-MS), falls water samples were thoroughly analyzed. It was concluded that no significant dangerous copper levels were present in the ponds; however, septic ponds had a much higher copper concentration than sewer ponds. Moreover, it was shown that some ponds with higher levels of phosphorous and nitrogen also had a much higher level of copper concentration. These results could help the state of North Carolina focus more on certain areas and watersheds more than others.

2021-203	Poster	Biological and Life Sciences

Student Presenter: **Kerr, Patrick; *East Carolina University***
Pajski, Megan
Hemingway, Nathalie
Maroto, Rosario
Mentor: **Graber, Ted; *East Carolina University***

Muscle calcium handling changes in aging mice

Sarcopenia (age-related loss of muscle mass and strength) leads to decreased physical function, loss of independence, onset of frailty, and increased mortality. Previously, using NGS RNAseq, gene ontology analysis (GOrilla and GSEA) revealed a high enrichment of calcium handling genes in older adult mouse muscle versus younger adult mice. Furthermore, age-associated functional decline, measured with our validated composite scoring system (CFAB), was associated (R=0.55) with increased sarcolipin (SLN) gene expression (log2 fold change 4.33, q-val=1.08x10-6). SLN protein expression in gastrocnemius was also 835% higher ($p<0.05$). SLN blocks SERCA (sarcoplasmic endoplasmic reticulum ATPase) from pumping Ca2+ (calcium ions) back into the sarcoplasmic reticulum following contraction, yet still uses energy and produces heat. The main purpose of this research is to determine Ca2+ flux in isolated soleus (SOL) and extensor digitorum longus (EDL) during maximum isometric twitch and tetanic contractions. The treatment groups include control mice at 6m, 24m and 28m (equivalent to mid-20's, mid-60's and mid-late 70's in humans), and 6m mice that were transfected with an adeno-associated virus serum 6 (AAV6) vector to upregulate SLN expression in muscle cells. We hypothesize that increasing SLN will cause transfected 6m to function similar to 24m or 28m. Work is ongoing on this project, but we note that SOL maximum specific tetanic force was down in the older mice (24m - 10%, $p=0.025$; 28m - 26%, $p<0.001$), and expect to find increased relaxation times in the older mice that strongly correlate with SLN expression and CFAB.

2021-204	Poster	Biological and Life Sciences

Student Presenter: **Bunch, Zachary; *UNC Greensboro***
Mentor: **Dr. Sally Koerner; *UNC Greensboro***

Impacts of invasion on the insect communities of Montanan rangelands

Invasive species threaten nearly every ecosystem on the planet, negatively affecting resident populations via competitive marginalization leading to a reduction of native biodiversity. In this project, we are investigating the multi-trophic consequences of invasion by B. arvensis in Montanan rangelands, including the plant, insect, and soil microbial communities. This study is a multi-year experimental field study at Fort Keogh Livestock and Range Research Laboratory in Miles City, Montana. Insects were transported from our field site in Montana to our lab where I am in process of sorting, weighting and identifying them. We will use this data to assess the impacts of B. arvensis on insect biodiversity in Montanan rangelands.

2021-205	Poster	Business and Economics

Student Presenter: **Bland, Austin; *East Carolina University***
Mentor: **Quick Linda; *East Carolina University***

Factors influencing decisions to invest in cryptocurrency

Cryptocurrency is one of the newer options when it comes to the world of investing. According to a survey done by Bakkt, a digital asset marketplace, 48 percent of American investors invested in cryptocurrency during the first half of 2021, and 32 percent of respondents who did not currently hold cryptocurrency planned to within the next 6 months. This relatively new investment method has gained a lot of interest from investors. For all the excitement around cryptocurrencies, we know very little about this investment method. There has not been much research done on the issue of how risky investors perceive cryptocurrency to be, or what drives risk tolerance when dealing with cryptocurrency investments. This study investigates whether the source and amount of investment capital will influence the desire to invest in cryptocurrency and the perceived risk of investing in cryptocurrency. I hypothesize that participants with self-generated capital will choose to invest less in cryptocurrency and perceive the investment as riskier than participants with gifted capital.

2021-206	Poster	Business and Economics

Student Presenter: **Correia, Carolina; *Catawba College***
Mentor: **Yurchisin, Jennifer; *Catawba College***

Defining the Characteristics of Online Vintage Apparel Consumers

The market for vintage apparel, or clothing that is at least 25 years old, has grown along with consumers' concern about the environmental impact of the contemporary apparel industry. Online apparel retailing has also seen tremendous growth recently. However, growth of online shopping for vintage apparel has been slower and taken longer than for other types of apparel. To remain competitive with other types of apparel retailers, vintage apparel retailers need an understanding of the drivers of vintage apparel consumers' behavior so that they can better design their websites and promotions to appeal to this market. The purpose of this research is to investigate the demographic and psychographic characteristics of online vintage apparel consumers. The study is framed by the Theory of Reasoned Action. Background factors (i.e., past behavior, personality characteristics, demographic factors) are hypothesized to influence consumers' attitude toward shopping online for vintage apparel. Subsequently, that attitude is predicted to influence consumers' intention to shop online for vintage apparel. A questionnaire featuring existing Likert-type scale items will be used to collect data. Regression and ANOVA will be used to analyze the data and test the hypotheses.

2021-207	Poster	Business and Economics

Student Presenter: **Cross, Emily G.; *East Carolina University***
Mentor: **Kowalczyk, Christine; *East Carolina University***

Impulse Buying: How Digital Marketing is Influencing the Millennial Generation's Impulsive Spending

Impulse buying, in its most simplest form, is the process of making a purchase one had not intended to make (Cruze, 2020). Impulse buys can be small, they can also include larger items such as cars and computers. Millennials, currently aged between 26 and 41 and a population of 72.1 million, make up the largest segment of the American workforce (Pastore, 2020). Not only does this population make up a majority of the American workforce, they are also the highest spending generation and the generation that the media is most easily able to influence (Mullen, 2020). Among millennials, 82 percent buy a product they like the first time they see it, 70 percent admitted to often regretting purchases they made, and 64 percent reported they often make impulse buys (Mullen, 2020).

The purpose of this research is to analyze what forms of digital marketing are able to influence the millennial population the most. This research will also attempt to examine what demographics influence consumers to purchase an expensive or luxury product that they had not intended to buy. The demographics that will be included are age, race, gender, general income, and household type.

Information will be contributed to this research through surveys submitted anonymously from participants aged 25 to 40 years old. By analyzing the results from the surveys, there will be more insight on what forms of digital marketing are most successful in achieving an impulse purchase by millennials.

2021-208	Poster	Business and Economics

Student Presenter: **Etin, Ari; *North Carolina School of Science and Math***
Mentor: **Chen, Elizabeth; *University of North Carolina at Chapel Hill***

Data Processing Needs at Small Nonprofit Organizations

Effective data collection and analysis are beneficial to organizations for internal development, funding procurement, and external engagement. However, small nonprofit organizations with limited resources to divert into professional data analyses may rely on alternative, less efficient systems. Limited literature exists regarding the exact extent of the problems small nonprofits face as well as the types of solutions which may be most beneficial. In this case study, we addressed these questions through conversations with staff at the Rural Opportunity Institute (ROI) — a nonprofit addressing cycles of trauma in Edgecombe, North Carolina. We identified inconsistent, decentralized data collection; human input error; and a lack of experience, time, and resources for data processing as the primary challenges small organizations face. ROI has shown interest in standardization of data inputs, automated low-level data-analysis done quarterly, generally accessible simplified data representations generated automatically, and value standardization through weight assignment as potential future courses of action.

2021-209	Poster	Chemical Sciences

Student Presenter: **Akinola, Adunoluwa Z; *UNC Chapel Hill***
Mentor: **Chekan, Jonathan R; *The University of North Carolina at Greensboro***

Discovering New Chemistry in Streptococci

Natural products—small molecules produced by living organisms—are and have been key contributors to pharmaceutical and biological developments for the past century. These products were grouped into many classes during the 20th century, and research in the 21st century has revealed the prevalence of another class: ribosomally synthesized post-translationally modified peptides (RiPPs). These differ from the rest because after ribosomal translation they go through a process called post translational modification in which they undergo chemical modifications that provide them with antibiotic, cytotoxic, or signaling qualities, among others yet to be discovered. In this project, we used genome mining and found a biosynthetic cluster associated with certain strains of Streptococcus bacteria including S. pneumoniae (a human pathogen that attacks the lungs). Our goal was to express and purify protein from this cluster as well as test it to determine if it is involved in catalyzing new reactions. This information is significant for understanding whether a new type of reaction will take place resulting in new compounds that could potentially provide us with information about some properties of this bacteria, such as its pathogenicity.

2021-210	Poster	Chemical Sciences

Student Presenter: **Brotherton, Andrew; *UNC Charlotte***
Mentor: **Walter, Michael; *UNC Charlotte***

Voltage-Sensitive Asymmetric Thiazolothiazole Dye for Molecular Probe Sensing Applications

The development of highly fluorescent molecular probes has continued to increase as researchers focus on less invasive and more sensitive methods of probing biological and cellular environments. One example is the use of organic dyes capable of two-photon (2PA) excitation to conduct bioimaging studies in deep tissues. We have recently developed thiazolothiazole-based, high-performance probes that utilize a donor-acceptor molecular architecture to greatly enhance fluorescence efficiency and environmental sensitivity. These dyes show strong solvatofluorochromism, good cell membrane localization, and promising voltage sensitivity. New dyes have now been prepared incorporating dibutylaminophenyl and nitrophenyl push-pull functional groups. These asymmetric dyes also demonstrate impressive solvatofluorochromism with Stoke's shifts ranging from 0.29 eV in non-polar solvents to 0.64 eV in polar solvents. The absorbance and fluorescence are red-shifted relative to previous asymmetric dyes due to the strong intramolecular charge-transfer (ICT) character these functional groups confer to the rigid thiazolothiazole-bridged system. Interestingly, the fluorescence is effectively quenched in select, highly polar solvents with a large decrease in fluorescence quantum efficiencies. These observations may prove useful attributes for high signal to background ratio cellular membrane fluorescence imaging. In addition, molecular asymmetry is closely linked to the magnitude of nonlinear optical phenomena such as 2PA. Therefore, we expect that stronger electron withdrawing groups (e.g. nitrophenyl) will increase the 2PA coefficient, thus improving bioimaging utility.

2021-211	Poster	Chemical Sciences

Student Presenter: **Emehel, Chloe; *North Carolina A&T State University***
Mentor: **Alston, Jeffrey R.; *The Joint School of Nanoscience and Nanoengineering***

Observing the Effects of Ionic Liquids on the Conductivity of Regenerating Solvents

Regenerated natural polymers are known for their biomedical applications in tissue engineering and drug delivery; however, the effects of solvent selection on polymer regeneration mechanisms and their resulting properties are currently not well understood. The diffusion rate of ionic liquids (IL) in regenerating solvents could influence the regeneration rate of the polymer and could be an important control factor for ionic liquid regenerated natural polymers.

The current study aims to determine how fast and how much the IL 1-Butyl-3-methylimidazolium (BmimCl) spreads throughout different regenerating solvents. By creating calibration curves to show the diffusion rates of BmimCl we can analyze regenerated polymer properties and total IL content, which both affect biological and material properties.

The results we obtained show that the respective conductivities of DI Water and Methanol increased linearly with the addition of IL. The conductivities of the other three solvents – Ethanol, Butanol, and 2-Propanol – also displayed linearly increasing conductivities, but were less pronounced.

Based on these results, we have a better understanding of how ionic liquids diffuse in select regenerating solvents. This will inform us of how fast the regeneration of polymers occur in each regenerating fluid and how the properties of the regenerated polymers are affected. Furthermore, our improved understanding of this subject matter will allow for the creation of more efficient protocols along with advances in bioengineering.

2021-212	Poster	Chemical Sciences

Student Presenter: **Gross, Elizabeth; *North Carolina State University***
Mentor: **Ohata, Jun; *North Carolina State University***

Chemical protein modification in ionic liquid

Biomolecule conjugates, such as antibody-drug conjugates (ADCs), have become an important research topic in both the chemical and biological sciences. Interest in these molecules stems from the ability of such conjugates to participate in targeted therapy. However, creating new bioconjugation methods is limited since many organic reactions are incompatible in aqueous media; therefore, it has been difficult to achieve selective biomolecule labelling methods associated with these biomolecule conjugates. Here, we demonstrate that an organic medium ionic liquid, a salt which is a liquid with a boiling point <100 °C, allowed for the formation of a tetrazene linkage on biomolecules via an amine-azide coupling reaction mediated by triarylphosphines. Not only did the polar, aprotic solvent facilitate an organic reaction, the reaction was rapid and showed great specificity towards alkylamine groups. Additionally, the linkage was stable in multiple media that mimic biological environments (e.g. extracellular matrices and pH ranges) alluding to its in cellulo capabilities. Already, a preliminary fluorescence microscope-based experiment with the cancer biomarker Her2 showed the successful synthesis of a biomolecule conjugate with no observable impact on the native function of the Her2 receptor due to the ionic liquid. By employing a novel, non-traditional media, the tetrazene linkage could become an alternative strategy for the creation of novel biomolecule conjugates.

2021-213	Poster	Chemical Sciences

Student Presenter: **Laforet Jr., Joseph R; *Duke University***
Mentor: **Reker, Daniel; *Duke University***

A Molecular Dynamics/Machine Learning Hybrid Model for Predicting Formation of Self-Aggregating Nanoparticles

Co-aggregating nanoparticles can stabilize drugs with more than 90% drug loading capacity. While machine learning can be productively employed to identify nanoparticles, this approach requires large datasets. Simulations provide an opportunity to design nanoparticles without prior data generation, but this method has not yet shown sufficient accuracy. Here, I will develop a novel simulation-based approach that achieves productive accuracy of nanoparticle predictions. By pairing a predictive machine learning model with molecular dynamics simulation, we analyzed hydrogen bond formation and potential energy in silico and used our findings to identify pairs of interest. We validated our predictions against experimental data and found that the presence of hydrogen bonding correctly predicts nanoparticle formation in more than 75% of the analyzed pairs. The use of the simulation-derived potential energy as an input feature to a K-Nearest Neighbors machine learning classifier can predict nanoparticle formation with 89.5% accuracy. This machine learning/molecular dynamics hybrid pipeline is poised to enable the large-scale design of nanoparticles as innovative drug delivery solutions for approved and investigational drugs. Using this analysis protocol, we plan to design nanoparticle formulations aimed at encapsulating drugs to treat viral diseases such as COVID-19.

2021-214	Poster	Chemical Sciences

Student Presenter: **Waafa, Maisha; *UNC Greensboro***
Mentor: **Chekan, Jonathan R.; *UNC Greensboro***

Discovery of a Conserved Protease Across Diverse Natural Product Biosynthetic Pathways.

Natural products play a tremendous role in our life. These compounds are produced by all domains of life and have a wide range of activities including anticancer and antibacterial. Reflecting this, nearly half of all FDA approved drugs are derived from natural products in some way. While there are many different classes of natural products, our research mainly focuses on ribosomally synthesized and post-translationally modified peptides (RiPPs). RiPPs are a rapidly growing class of natural products. They are first produced as peptides by the ribosome and are then modified by biosynthetic enzymes, turning them into complex natural products. Over 40 classes of RiPPs are known, but there are likely many waiting to be discovered. Using bioinformatic techniques, we sought to identify gene clusters that could lead to new classes of RiPP natural products with new enzymatic modifications. This approach lead to the identification of a conserved proteases found across new RiPP gene clusters. To confirm our bioinformatic predictions, we used binding assays to demonstrate that the predicted peptide substrate tightly binds to the target biosynthetic enzyme. Our initial results indicate that we have identified a valuable new approach for identifying undiscovered RiPP natural products.

2021-215	Poster	Chemical Sciences

Student Presenter: **Wang, Winnie; *North Carolina School of Science and Math***
Mentor: **Anglin, Time; *North Carolina School of Science and Math***

Rational Design and Evaluation of a Novel Class of Boronic-Acid Containing Tubulin Inhibitors as Tumor Vascular Disrupting and Antiproliferative Agents

Due to its vital role in tumor vasculature structure and endothelial cell proliferation, the tubulin colchicine complex is a key target in the development of antitumor drugs. Once tubulin polymerization is inhibited, the vascular system within tumoral masses can be made to collapse, leading to necrosis in the tumor's core. Though there are a number of existing vascular disrupting agents, such as Combretastatin A-4, the limitation of these drugs is their low Oral Non CNS Scores and associated pharmaceutical profiles, rendering them poor candidates for cancer therapies. However, research has proposed structure-activity relationships for CA-4 that point to the possible success of analogs. Hence, this study proposes a novel class of small molecule vascular disrupting and antiproliferative agents that have the potential to improve the inhibition and oral administration efficacy of CA-4. Inhibitors were designed using a 4-phase drug design framework in Schrodinger Maestro. The docking scores of the compounds were predicted in Schrodinger Maestro and the compounds were further assessed for pharmaceutical efficacy through StarDrop scoring profiles. Analysis of docking scores and scoring profiles identified a class of novel compounds as the most optimal candidates for tubulin depolymerization and vascular disruption. In fact, this particular candidate demonstrates better predicted binding and oral administration capabilities over multiple clinically relevant tubulin inhibitors. This study intends to synthesize the top compound through a 3-step pathway featuring three reactions, and evaluate it for tubulin polymerization inhibition.

2021-216	Poster	Chemical Sciences

Student Presenter: **Anthony, Amaiya K.; *High Point University***
Mentor: **Heather Miller; *High Point University***

Using CRISPR-Cas9 to Delete stk1 in MRSA

Methicillin-resistant Staphylococcus aureus (MRSA) has been difficult to treat because of its resistance to multiple antibiotics. One way this is being combated is through the development of antibiotic adjuvants. These adjuvants have no activity on their own, but when combined with an antibiotic, the cotreatment results in bacteria becoming sensitive to the antibiotic again. Our lab has identified small molecule adjuvants that potentiate beta-lactam antibiotics in MRSA. We are now exploring how these adjuvants work at the molecular level. Based on previous results, we are first focusing on a master-regulator called eukaryotic-like serine-threonine kinase 1 (Stk1). This protein contributes to many of MRSA's virulent characteristics such as biofilm formation and antibiotic resistance. The CRISPR-Cas9 system has recently been used for efficient genome editing in this organism that historically has been difficult to genetically manipulate. The research that will be presented uses CRISPR-Cas9 to create novel knockout mutants of the stk1 gene in MRSA strains that are clinically relevant. These mutants will then be used in our efforts to find out more about the strain-specific functions of Stk1.

2021-217	Poster	Chemical Sciences

Student Presenter: **Viering, Brianna; *High Point University***
Mentor: **Miller, Heather; *High Point University***

Suppression of Key Antibiotic Resistance Genes in MRSA with Small Molecule Adjuvants

Methicillin-resistant Staphylococcus aureus (MRSA) is responsible for infections that occur both in and out of healthcare settings. As new antibiotics are deployed, these bacteria have unfortunately quickly developed resistance, making MRSA challenging to treat. Instead of the timely and costly effort to create new antibiotics, we can develop antibiotic adjuvants. These adjuvants are expected to minimize resistance mechanisms and allow the antibiotics to once again kill bacteria. We have evaluated several small molecule adjuvants that had strong potentiation with β-lactam antibiotics and decided to look at the molecular level to learn how these adjuvants exert their effects. Our hypothesis was that the expression levels of key resistance genes would decrease once cotreated with the antibiotic oxacillin and the adjuvant compared to treatment with only oxacillin. In order to measure gene expression levels, RT-qPCR was conducted and the results of four treatment types were compared. The resistance genes we measured included blaZ and blaI from the bla operon, as well as mecA and mecI from the mec operon. We also analyzed the transcript levels of the gene pbp2. We discovered that the genes blaZ and mecA were both upregulated upon oxacillin treatment and down regulated upon the inclusion of our adjuvant and those changes in regulation were statistically significant. We also observed that blaI and mecI followed similar trends while pbp2 did not. Together, these results support our hypothesis that these small molecule antibiotic adjuvants are downregulating key resistance genes in a specific manner.

2021-218	Poster	Computational Sciences

Student Presenter: **Benjamin, Sophia; *North Carolina School of Science and Math***
Mentor: **Abdi-Oskouei, Maryam; *North Carolina School of Science and Math***

Meteorological Sensitivity to WRF-Chem Planetary Boundary Layer Parameterization and its Impact on Ozone Prediction During the Lake Michigan Ozone Study

In the areas near Lake Michigan, near-surface ozone concentrations often exceed air quality standards, and this has many adverse effects on public health and the environment. It is thus important to have models that can accurately predict near-surface ozone concentrations. Complex meteorological processes such as lake breeze affect ozone formation and transport near Lake Michigan. Hence, changing meteorological parameters in air quality models can affect accuracy of their ozone predictions. In this study we run Weather Research and Forecasting with Chemistry (WRF-Chem) simulations with 4km horizontal resolution over Lake Michigan on June 2, 2017, a high-ozone lake breeze day. We vary the simulations by Planetary Boundary Layer (PBL) scheme, using PBL schemes MYNN (Mellor-Yamada-Nakanishi-Niino), a local PBL scheme, and YSU (Yonsei University), a nonlocal PBL scheme. We then compare these two models' predictions of meteorological variables and ozone concentrations to observations taken during the Lake Michigan Ozone Study 2017. We find discrepancies in meteorological variables between the two simulations, with neither simulation having an obvious accuracy advantage. YSU generally predicted lake breeze arriving earlier, penetrating further, and having stronger winds. The two models also differed in ozone predictions, with YSU sometimes performing more poorly and sometimes performing comparably to MYNN at sites near the lake. We investigate how these meteorological differences caused these ozone differences, and find that varying the PBL scheme can impact meteorology, especially lake breeze and temperature, in a way that impacts ozone concentrations on high ozone lake breeze days.

2021-219	Poster	Computational Sciences

Student Presenter: **Bhattacharya, Sourodeep; *North Carolina School of Science and Math***
Mentor: **Gotwals, Robert; *North Carolina School of Science and Math***

Computational Drug Optimization of FA Pathway Inhibitors to Prevent Chemotherapy Resistance

Traditional chemotherapy methods have utilized platinum-based compounds in order to kill tumors. These molecules inhibit DNA synthesis in tumor cells by creating interstrand cross links (ICLs) that covalently bind two DNA strands together. As a result, enzymes such as helicase cannot separate the strands, preventing replication, and leading to cell death. However, many tumor types such as lung and bladder tumors have utilized a DNA repair pathway called the Fanconi Anemia (FA) pathway to recover from this mechanism. Thus, compounds that can inhibit this pathway are of great demand to the medical and scientific communities. Recent studies have even found a series of hits using High-Throughput Screening of existing small molecule databases. However, none of these compounds have been optimized specifically for FA pathway inhibition. As in silico methods can greatly reduce the cost and time required for drug development, this study seeks to computationally optimize the hits found by a series of earlier studies. The project utilizes Quantitative Structure-Activity Relationship (QSAR) algorithms through the Auto-Modeller software on StarDrop to develop a mathematical model that correlates the chemical structure of each compound to its experimentally derived IC50 value (the concentration required to inhibit the FA pathway by 50% in a tumor cell line). Then, chemical transformations were conducted through StarDrop's Nova platform on the hits to develop a larger dataset of similar compounds. These were sorted using predicted IC50 values from the QSAR model to predict a set of viable compounds that can potentially be tested experimentally for chemotherapy development.

2021-220	Poster	Computational Sciences

Student Presenter: **Budzichowski, Amy K.;** ***North Carolina School of Science and Math***
Mentor: **Gotwals, Robert R.;** ***North Carolina School of Science and Math***

Control of Upper Limb Prostheses

Upper limb loss is a medical condition accompanied by many significant challenges, often arising from the loss of use of one or more hands. The use of a prosthesis to augment a user's residual limb has been common practice for millenia, through use of either artificial limbs meant to replicate either the appearance or function of the missing limb. In recent years, significant research has been devoted to a new direction in the world of prostheses: myoelectric control. Myoelectric prostheses take in electromyographic (EMG) signals from the user's skin, process these signals, and use them to determine the user's desired motion. The greatest challenge in myoelectric research has been processing EMG input. Myoelectric prostheses, despite their promise of intuitive control, face high rejection rates. This comes as a result of several challenges such as: non-intuitive muscle contractions to activate prosthesis; difficulty switching between motions; poor performance of classification algorithms in real-world settings; inability to perform simultaneous motions; and other challenges. This project aims to make myoelectric prostheses more usable by creating a computational control method for simultaneous and independent control of multiple degrees of freedom (DoF). Using Rami Khushaba's publicly available dataset Identifying Individual and Combined Fingers Pressure On a Steering Wheel, a convolutional neural network architecture was constructed which independently and simultaneously classified pressure on up to two different fingers. The network achieved a mean accuracy of 77.92%, with subject 1 achieving a high of 84.84% accuracy, and subject 8 achieving a low of 69.15% accuracy.

2021-221	Poster	Computational Sciences

Student Presenter: **Dejournett, Rodney;** ***North Carolina A&T State University***
Mentor: **Yuan, Dorothy;** ***North Carolina A&T State University***

Periocular Facial Recognition

The goal of this research is to determine whether a person can be authenticated by their feature rich region around the eye which is called the periocular region. This region is rich in features because of the eyelids, eyelashes, eyebrows, eye shape, skin tone and more. We want to explore this possibility due the current pandemic and the new normal of wearing masks. It is hard to recognize a person wearing a mask and this is also problematic with crimes happening with face mask being a common thing. Masked faces are also not accurately detectable by all the AI devices in use. A masked face covers the face and leaves the periocular legion open for recognition. We will use the open region and extract it from a current masked dataset and create a new periocular region dataset. The new dataset will then be used on a CNN deep learning model to test the ability to authenticate a person with only that feature rich region. After testing the model we calculated the false positive rate (FPR), true positive rate (TPR), receiver operating characteristic (ROC) curve, accuracy, precision, and recall along with a confusion matrix and classification report.

2021-222	Poster	Computational Sciences

Student Presenter: **Elayaperumal, Sreenidhi; *North Carolina School of Science and Math***
Mentor: **Gotwals, Robert; *North Carolina School of Science and Math***

Using Machine Learning to Classify Chest X-Rays in Mathematica

Chest X-Rays are the most commonly performed diagnostic X-Ray procedure, known for their low cost and speed. However, they can be difficult to read, and it is especially difficult for developing areas to reach conclusions from chest X-Rays because of a lack of educated professionals who can interpret the scans. My goal is to create a machine learning model in Mathematica that can classify chest X-Rays to diagnose a wide variety of conditions and assist healthcare professionals. So far, I have used Random Forest, Nearest Neighbors, Logistic Regression, and Neural Network algorithms to create models that differentiate between Chest X-Rays where patients have COVID-19, pneumonia, or no disease, using a dataset of 125 images. As I continue this project, I hope to improve accuracy by using image processing tools that are available in Mathematica, such as filters and segmentation tools, which will make the very standardized and grayscale appearance of X-Rays easier to interpret. I also hope to use a much larger dataset of 112,000 images, created by the NIH, to further improve accuracy and diagnose a wider variety of conditions. This will require an external hard drive to store the data, but will create a much more useful model.

2021-223	Poster	Computational Sciences

Student Presenter: **Gall, Leah; *North Carolina State University***
Mentor: **Inman, Elliot; *SAS Institute***

Validation of Automated Text Analytics Modeling: Ruling Out Simple Keyword Scoring

This project implemented four keyword scoring methods for interrogating the results of a previously developed text analytics model that used FDA medical device defect narrative reports to generate text topics. Those text topics were used to predict the severity of the incident (malfunction, serious injury, death, or other) using a variety of machine learning models: neural network, gradient boosting, random forest, decision tree. The champion model was a gradient boosting model which had an accuracy of 94%.

To explore the possibility that a much simpler scoring system could have similar accuracy, simple tests were conducted using keywords instead of the more complex text topics. These keywords were the target variable names, their synonyms and related words, and terms from the text topic analysis – all of which were evaluated using Chi-Square to see if any of the terms was a good predictor of report type. Additionally, terms related to a specific report type were grouped to determine if a combination of terms would be a good predictor. Then, the terms were used to create a decision tree to predict incident severity. All of these keyword methods were much less accurate than the text mining and gradient boosting model. While science dictates that, all other things being equal, the best model is the most parsimonious model, this supports the power of the text topic analysis as better than simple keyword checks as a meaningful predictor.

2021-224	Poster	Computational Sciences

Student Presenter: **Joshi, Jayvik; *North Carolina School of Science and Math***
Mentor: **Gotwals, Robert; *North Carolina School of Science and Math***

An Analysis of Computational Models of Action Potentials using STELLA Architect

The human brain is one of the most complex structures in the universe. Neurons are responsible for communicating information through electrical currents. To carry out biological functions and generate complex thoughts, trillions of action potentials are fired every second. Being able to understand and model action potentials is essential to understanding the macroscopic structure and function of the brain. Many computational models already exist to represent the process, each with its strengths and weaknesses. We examined the leaky integrate and fire, Hodgkin-Huxley, Fitzhugh-Nagumo, and adaptive exponential integrate and fire models. This study aims to analyze the models and determine when particular models should be utilized or avoided. We used STELLA Architect, which makes solving differential equations and manipulating variables simple. The main observations involved understanding the shape and intensity of the action potential as the applied current, and other constants were varied. These observations gave an understanding of the limitations and inaccuracies. Although these models are simple and can be used on most laptops, a study with 10, 100, or 1000s of neurons would be computationally expensive. Finding the optimal model that is accurate and requires minimal computational resources is crucial.

2021-225	Poster	Computational Sciences

Student Presenter: **Liu, Sherry; *North Carolina School of Science and Math***
Mentor: **Heber, Steffen; *NC State University***

A citation based approach to identify software with homonym names used in bioinformatics literature

Software tools are critical to the field of bioinformatics, and trends in software usage can provide valuable insights for researchers. One way to uncover these trends is to analyze published literature in the field and automatically extract what tools are used in papers over time. However, current keyword based approaches fail to identify tool names which are homonyms (e.g. “Star”). This project improves the keyword-only approach by incorporating citation information to automate the identification of software tools in bioinformatics literature. The basis of our approach is the publication paper, which is a paper published when the tool was created and is often cited by papers using the tool. We queried the PubMed Central database for papers related to the sequencing task “RNA-Seq” from 2011-20 to obtain our corpus. We then manually labeled the publication paper for a predefined list of tools. For any given paper, we identify it as using a tool if it cites the publication paper for that tool. We used our approach to analyze trends in the usage of “RNA-Seq” tools for the last 10 years. We also compared the properties of homonym tools and non homonym tools when analyzed using keyword search and the citation-based methods. Our results demonstrate that our citation based approach is a more robust form of tool extraction than keyword search, especially when the tool is a homonym. This highlights the value of citation information in analyzing scientific literature to draw insights from textual data.

2021-226	Poster	Computational Sciences

Student Presenter: **Marsh, Kennedy; *North Carolina A&T State University***
Mentor: **Yuan, Xiaohong (Dorothy); *North Carolina A&T State University***

Facial Recognition Based on Periocular Biometrics and Skin Tone

Despite the decreasing rate of infections, it is clear that the coronavirus pandemic has effectively changed life as we know it. Restrictions due to the virus are constantly changing, as leaders across the world attempt to find a balance between health safety and normality. Regardless, the CDC continues to recommend that certain individuals wear masks in indoor public spaces, and mask-wearing continues to be required on planes, buses, trains, and other forms of public transportation traveling into, or out of the United States. With a large portion of the population still wearing masks, difficulties in facial recognition from conventional surveillance technology are becoming increasingly apparent. To address this rising issue, we will develop and apply an accurate machine learning approach to accurately authenticate real and fake facial images. We will combine elements of periocular biometric information, and most importantly, skin tone information as well.

2021-227	Poster	Computational Sciences

Student Presenter: **Moore, Uriah; *North Carolina A&T State University***
Mentor: **Yuan, Xiaohong; *North Carolina A&T State University***

Recommending Attack Patterns for SRS Documents

One thing software developers must keep in mind when they are developing a project is the different ways this project can be exploited. Keeping that in mind would lead to minimal security issues when it comes to releasing the final product. Through using Common Attack Patten Enumeration and Classification (CAPEC) software developers can see different attack patterns that can be used to exploit their projects. The purpose of this project is to be able to recommend different CAPEC attack patterns that can be used to exploit software using topic modeling on Software Requirement Specification or SRS documents. Topic modeling is being used to extract topics from the attack patterns and extract topics from the system description, use cases, user classes, functional requirements that can be found in the SRS documents. The distance measure of each attack pattern topic distribution and each SRS topic distribution is then calculated by using cosine similarity. Then by using the calculations the program would recommend attack patterns that are most relevant to the software.

2021-228	Poster	Computational Sciences

Student Presenter: **Nguyen, Loc; *North Carolina State University***
Mentor: **Lanzas, Cristina; *North Carolina State University***

Differences in the Resistance Profile and Virulence Factors in Healthcare- and Community-Associated MRSA USA300 Strains

Methicillin-resistant Staphylococcus aureus (MRSA) USA300, initially a community strain, has recently emerged in healthcare settings. In this study, we looked at the prevalence of resistance genes that confer resistance to clinically important antibiotics commonly used in MRSA treatment and virulence genes that encode for PVL toxin between healthcare- (n=80) and community-associated (n=99) USA300 strains. Our preliminary results show little difference in the prevalence of clinically important antibiotic resistance genes between healthcare- and community-associated USA300 isolates. There was a higher prevalence of PVL toxin genes (lukF-PV and lukS-PV) in community-associated USA300 isolates.

2021-229	Poster	Computational Sciences

Student Presenter: **Shirolkar, Elina; *UNC Chapel Hill***
Mentor: **Bhamidi, Shankar; *UNC Chapel Hill***

Modeling Epidemiological Spread on Contact Networks

The rapid diffusion of a contagion amongst a population has detrimental impacts on both public health and economic stability. As individuals of a population come into contact, they can spread tangible materials, such as bacteria and viruses, through probabilistic diffusion of the resulting contact network. The probabilistic branching process of disease relies on the basic reproductive number, or the average contagiousness of the pathogen - a crude measure of the true impact of the virus. Multiple precautionary measures can be taken to reduce the reproductive number in the case of an epidemic. Stochastic agent-based modeling was used in this study to emulate and analyze the impacts of various public health measures on the coronavirus epidemic. These ABM simulations are carried out using the EpiModel package within R, implemented by the ERGM (Exponential Random Graph Model) package. This algorithm allows the network model to vary stochastically (randomly) over time. The following protocols implemented during the coronavirus epidemic were assessed: the mask mandate, the social distancing protocol, the reduction of initial infected population size (ex. travel restrictions), and national vaccination. The simulated examples within this study followed the susceptible-infectious-recovered/immune (SIR) compartmental model type. These simulations serve to model the spread of the coronavirus contagion through a connected network of 1,000 nodes and 4,000 edges over a span of 100 days. The findings of this study could point towards a tool for future researchers tasked with the difficult job of updating national safety standards and precautionary health measures to inhibit contagion spread.

2021-230	Poster	Cultural and Language Studies

Student Presenter: **Asghar, Aqsa; *UNC Greensboro***
Horstman, Cecily
Herrera-Leal, Abigail
Mentor: **Vargas, Elisa A.M.; *UNC Greensboro***

Brazilian American Children's Experience of Gratitude

Gratitude involves receiving a freely given benefit from a benefactor, recognizing the benefactor's intentionality, feeling positive, and freely reciprocating or wishing to reciprocate to the benefactor. Based on this definition, this study investigated Brazilian American children's experiences of gratitude. Accordingly, 23 Brazilian American children (aged 7 to 14) were interviewed; children were recruited in Georgia, North Carolina, and Massachusetts via Brazilian community groups (churches, after-school programs, Brazilian centers, etc.). After listening to two gratitude vignettes in which a character received help (once from an adult and once from a peer), children were asked to recall whether something similar had happened to them, how they felt about it, whether they had the chance to do something for the person and what they had done, how they felt about the person, and if their feelings had changed after receiving the benefit/help. Data from the interviews were content analyzed by four different coders. Children identified gratitude-related situations in different contexts such as school and home and indicated positive feelings; friends mostly served as benefactors. Older children showed the ability to take others' perspective when reciprocating the help or benefit received. Younger children tended to reciprocate by responding in similar ways to benefactors. Older children showed understanding that the benefactor provided the benefit freely and intentionally. Children recognized that gratitude responses either strengthened or helped maintain relationships. By understanding children's gratitude experiences, we can promote ways to develop gratitude in children in a culturally sensitive manner.

2021-231	Poster	Education

Student Presenter: **McDonald, Autumn; *UNC Charlotte***
Mentor: **Byker, Erik; *UNC Charlotte***

Empowering Teachers with Culturally Responsive and Equitable Quantitative Data Analysis

Our Executive Summary presentation's purpose is to examine how to empower teachers with culturally responsive and equitable quantitative data analysis tools. As future teachers, quantitative data analysis is important because over a specific time span data can show consistency or inconsistency in a specific area. Data can also show a starting point, growth, and progress. We examined North Carolina data from the U.S. Department of Education's Civil Rights Data Collection (https://ocrdata.ed.gov/). We had two research questions: (1) What do the quantitative data from the Civil Rights Data Collection descriptive statistics reveal about schools and learners in NC? (2) What are culturally responsive and equitable ways to be responsive to this data? We found that African American students were in the majority of students that were below proficiency on their reading levels. We also found that Hispanic and Latino students were consistently low. American Indian students had the highest percentile for low reading proficiency, but no data was recorded for the year 2017. We recommend the following to be responsive to these data findings: one-on-one sessions with students, having culturally relevant texts for students to read including picture books to support reading development with visuals, and working closely with families to provide support for reading practice at home. This study was influential to my development as a future teacher by allowing me to analyze and identify data based strategies to improve student performance, as well as think deeply about the cultural relevance I incorporate into my classroom.

2021-232	Poster	Education

Student Presenter: **Park, Goeun; *UNC Charlotte***
Mentor: **Byker, Erik; *UNC Charlotte***

Practices in Elementary Schools to Reduce Racial Stereotypes That Impact Students' Academic Performance

Racial stereotypes in schools negatively influence students' academic success. There are a variety of methods that can reduce racial stereotypes that influence students' academic performance and help students who are in groups that face racial stereotypes. Students from a young age face heavy racism in their lives by the way they talk, interact, play, and live with other people (Kromidas, 2016). The purpose of this study is to examine the perceptions of stereotype threats among elementary school educators from across the United States (n=18). The study is primarily based on a survey research design (Hines, 1993). The survey includes Likert scale questions and open-ended responses to help answer the following research questions: (1) How does racial stereotypes impact students' academic performance? (2) In what ways, if any, do elementary school educators try to address racial stereotype threats? (3) What are the elementary school educators' perceptions of the different methods to address stereotype threats? To analyze the data from my study, I used descriptive statistics and Miles and Huberman's (1994) three-step data analysis method. The preliminary findings from my study include that all participants think it is best to address racial stereotypes in the classroom since it is critically important to prevent the long term effects racial stereotypes on students. Another finding from my survey was the impact of racial stereotypes on students and the implications of this impact in relation to the students' academic performance in school.

2021-233	Poster	Education

Student Presenter: **Reid, Ashley; *East Carolina University***
Mentor: **Hand, Mark; *East Carolina University***

Men in Nursing Academia: Factors Associated with Recruitment and Retention

Currently there is a shortage of males holding faculty positions in schools of nursing. Minimal research has been conducted to address the shortage of male faculty. The purpose of this study was to identify factors related to recruitment and retention of men in the faculty role. In this multisite descriptive design, 242 male faculty completed the electronic Nurse Educator Recruitment and Retention Survey. Top strategies reported regarding attraction to the role were opportunity to work with students , help shape the nursing profession, and nurse faculty role modeling. Top recruitment strategies were increased salaries , employee benefits , having discussions with students, and flexibility in working hours. Retention strategies reported were positive work environment and support from administration.The factors identified from this study are essential for the recruitment and retention of men in faculty roles.

2021-234	Poster	Education

Student Presenter: **Stimson, Isabelle J.; *Elon University***
Mentor: **Trocki, Aaron; *Elon University***

Addressing Access and Equity in Mathematics Education: The Role of Technology in the Twenty-First Century Classroom

Technology has become common practice in secondary classrooms, with teachers using it as a tool for instruction and assessment; enabling students to learn in any environment. With the remote learning that many schools experienced during the last two years, technology has become imperative within classes. In this context, the study addressed the general research question of how teachers in International Baccalaureate (IB) schools use technology to teach secondary mathematics in in-person and virtual classrooms to create a student focused classroom that is beneficial for all learning types. Qualitative research is currently being conducted with IB secondary mathematics classes in the United States, United Kingdom and Australia, and consists of three phases: questionnaires, interviews, and field observations. The questionnaire asked current IB mathematics teachers to consider the technology they use in both their in-person and online classrooms, and how they believe their pedagogical approaches have changed in these environments. Questionnaire results provide data on IB mathematics teachers' use of technology in in-person and virtual classrooms, and how they believe instruction and learning have changed in these settings. Much of the questionnaire uses an equity lens to focus on student learning experiences. Current results will be shared along with emerging key findings such as the ability for students to engage in meaningful discourse being different from in-person to virtual classrooms. Results of this research may help better inform the field of mathematics education in supporting teachers and students with technology use in secondary mathematics classrooms.

2021-235	Poster	Education

Student Presenter: **Stoddard, Charlotte; *Elon University***
Mentor: **Buchanan, Lisa; *Elon University***

What factors affect teachers choosing diverse literature for their classrooms?

The focus of my research is teacher decision-making in terms of diversity in children's literature. The first step in my research process was completing a literature review to identify what research has been done before on the topic and work from there. After the literature review, I created a mixed methods survey that asked teachers about their own backgrounds, including their race, gender identity, education, and teaching experience and about their classroom libraries. Questions included their level of autonomy, their class demographics, and the demographics of the literature in their classroom. This initial survey was a convenience sampling advertised on Twitter. I found that a lot of teachers who have diverse literature in their classrooms purchased that literature with their own money. I also found that teachers who come from diverse backgrounds are more likely to choose books for their classrooms that have characters from those same backgrounds. After analyzing the responses I received on this survey I will send out a purposeful sampling survey to those teachers whose responses showed that they are already dedicated to choosing diverse literature for their classrooms.

2021-236	Poster	Education

Student Presenter: **Sydney Melvin; *North Carolina A&T State University***
Mentor: **Ofori-Boadu, Andrea; *North Carolina A&T State University***

Investigating Mental Health Experiences and Adaptation Decisions of STEM Students During the COVID-19 Pandemic

The COVID-19 pandemic affected learning across the nation. Institutions evacuated campuses and students were forced to transition to online education. E-learning was challenging for STEM students and many struggled to maintain good STEM performance. Consequently, mental health remained a concern. As part of a larger nationwide research project investigating decision making processes in undergraduate STEM students, the purpose of this research is to investigate the mental health experiences of STEM students during COVID-19. Adopting purposive sampling and the constructivist Charmaz Grounded Theory method, one-hour interviews were used to obtain narrations of COVID-related lived experiences from 63 students in six U.S. institutions. MS Excel was utilized for coding, categorization, and constant comparative analysis. Preliminary results from eight interviews indicated that students experienced stresses that impacted their mental health. Mental health triggers were coded as burnout, isolation, physical illness, mental illness, heavy workload, family, hard on self, and lack of resources. These triggers caused declining mental health, learning challenges, stresses, and weak STEM performance.Adaptation decisions included exercising, healthy diets, family time, self-leniency, self-reward, environment redecoration, sleep, break, friend time, journaling, and meditation. These decisions were effective in improving mental health and reducing learning challenges and stresses. In conclusion, effective adaptation decisions are likely to improve mental health, learning and performance. Early identification of mental health triggers can accelerate the implementation of effective interventions to maintain mental health and STEM performance during future pandemics. Future research will focus on quantifying effect of mental health triggers on STEM performance.

2021-237	Poster	Education

Student Presenter: **Eltinay, Minnatallah; *North Carolina State University***
Mentor: **Leggett, Zakiya and Spence, Porche; *North Carolina State University***

STEM Confidence within Gender Groups

STEM confidence refers to an assurance of one's skills and capabilities in their own endeavors within the fields of science, technology, engineering, and/or mathematics (STEM). One's identity is informed by their gender, personal experiences, upbringing, and even society as a whole. While these identities can shift over a period of time by deliberate effort or unconsciously, our research aims to examine the effects of gender on the level of confidence and family and professional support that STEM majors receive as undergraduate students. Using a quantitative questionnaire-based research design approach, this study analyzes the experiences of undergraduate students currently pursuing and enrolled in STEM disciplines at a four-year land-grant university. With family members, friends, peers, classmates, and professors playing a role in supporting undergraduate STEM students, our study signifies a trend of males demonstrating more confidence than females. The results of the study are useful for understanding the barriers, which affect the transition of women through the STEM pathway in Western societies and have important implications for research on gender issues in STEM education in larger contexts.

2021-238	Poster	Engineering

Student Presenter: **Ayers, Abigail; *North Carolina State University***
Mentor: **Sano, Mike; *North Carolina State University***

Evaluating Novel Electroporation Protocols for Transgenesis in Drosophila

In the past few decades, extensive research has been conducted utilizing Drosophila as a model organism in order to study patterns in population genetics, gene expression systems and cell signaling complexes due to both the availability and reproductive efficiency of the organism. These studies require specific insertions of foreign DNA into the Drosophila genome; however, the standard method for delivering foreign DNA, microinjection of Drosophila embryos, requires special equipment and is quite time consuming. To overcome disadvantages with embryonic microinjections, we are investigating alternative approaches in which transgenesis is done on a larger scale while also being more practical.

During our current project we will be evaluating novel electroporation protocols as a method of introducing DNA into fly embryos with the goal of genetic transgenesis. During the experiments, large quantities of embryos are put in a DNA plasmid solution and exposed to intense ultrashort electrical pulses. The electroporation pulses create microscopic perforations, or holes, in the fly embryos that allow the DNA to be transported across the embryo's outer cell wall. After successful DNA integrates into the genome, a phenotypic response will be seen in the F2 , or offspring of embryos. If accomplished, we will be able to produce industrial quantities of specialized fly lines which will contribute to Drosophila research, enhancing our understanding of genome interactions by less labor intensive and time consuming means.

2021-239	Poster	Engineering

Student Presenter: **Baker, Ronald; *North Carolina A&T State University***
Roy, Manosi
Mentor: **Akangah, Paul M.; *North Carolina A&T State University***

Midsole Design for Running Shoe Using Polyurethane

Health-conscious people are always walking, jogging, or doing some strenuous physical exercise. Long-term impact on hard surfaces can damage feet, ankles, and knees. Therefore, there is a need for energy-absorbing shoes that can reduce the strain on body. The goal of this research is to design an energy-absorbing shoe material to dissipate the massive amount of kinetic energy that enters the body during physical activities. Material is produced using additive manufacturing process. The midsole is focus of this research as it plays an important role in designing. Material of the midsole is important for energy absorption. Thermoplastic polyurethane was used to design midsole because it is utilized in a new footwear production called photopolymerization. Photopolymerization includes the Carbon lattice theory and extruding polymers through Digital light processing (DLP). DLP technology is used for mold-making that is very durable and prints in a fast amount of time. It uses layers and different cross-sectional thicknesses to support the load of running. Solid works were used to design a shoe midsole that ensures stability and shock absorption in the lateral side of the foot. The sole was modeled after a Semi-Curved Hybrid to incorporate speed and control for the user. Modeled midsole was printed using a 3D printer and characterized by a compression test. Results showed that 3D printed thermoplastic polyurethane midsole can absorb energy and reduce impact on the body by 25%. This midsole design can be used to prevent injuries and can improve running mechanics in running shoes.

2021-240	Poster	Engineering

Student Presenter: **Beavans, Rachel; *East Carolina University***
Walker, Erica
Cole, Emma
Wilson, Nia
Mentor: **Ryan, Teresa; *East Carolina University***

Moisture and Grain Size Variation with Depth and Distance from Sandy Seashore

The research conducted in this study is focused on analyzing the variation of grain size and moisture content in sand at various depths and incremental distances from the shoreline. The results will determine what if any relationship exists between the grain size or moisture content and distance from the shoreline as well as depth of sample. This research is part of a larger project that seeks to understand how several different factors, such as wind speed, humidity, temperature, surface characteristics, etc. influence long distance sound propagation. Data was collected at Jennette's Pier in Nags Head, North Carolina. Moisture measurements and core samples were made at 5cm, 10cm, and 20cm depths at incremental distances along three transects from the shoreline to the dunes. Analyzing the grain size distribution from the sand samples demonstrated that grain size is uniform and is not affected by sample depth or distance from the shoreline. This work-in-progress research will also report on the moisture variation by examining the results according to both sample depth and distance from shoreline.

2021-241	Poster	Engineering

Student Presenter: **Blaylock, Troy; *North Carolina A&T State University***
Mentor: **Dawkin, Kendall; *Joint School of Nanoscience & Nanoengineering***

A Simulation Study of Optimal Light Absorption in GaAsSb Nanowires for Multispectral Devices.

Lumerical Finite-Difference Time-Domain modeling has been used to simulate the absorption characteristics gallium arsenide antimonide (GaAsSb) nanowires. The optimal absorbance spectra for GaAsSb nanowires for arrays was determined by varying nanowire diameter, pitch length, and array configuration. Results show that nanowires that have a diameter that range from 100 nm -150 nm with a pitch length of 400 nm provide the optimal absorbance spectra according to simulations. Multispectral absorption spectrums were demonstrated by simulating nanowires with different diameters to achieve broadband absorption characteristics in the infrared region. This result opens the door design and application for multispectral devices based upon the nanowire configuration. Results show that Lumerical FDTD can be used as a powerful simulation tool for optical simulation of nanowire arrays for device application while reducing experimental iterations. National Science Foundation Award #ECCS-1832117, LSAMP fellowship and Title III HBGI PhD Fellowship are acknowledged.

2021-242	Poster	Engineering

Student Presenter: **Cobb, Faith A.; *East Carolina University***
Mentor: **Ryan, Teresa; *East Carolina University***

Development of an Averaging Method for Acoustic Surface Impedance Measurements

The American National Standards Institute in collaboration with the Acoustical Society of America developed a standard (ANSI/ASA s1.18) by which to measure the acoustic surface impedance of outdoor ground surfaces. This project seeks to obtain in situ acoustic surface impedance measurements of sandy shores and supports a larger effort to model acoustic transmission loss over coastal areas. Long-range sound propagation is affected by several factors including local meteorological conditions, sea state, and shore topography. Data obtained from this project supports the modeling effort by providing insight on the effects of acoustic surface impedance on transmission loss. The surface impedance measurement process involves an omnidirectional source producing a tone which is recorded by two microphone receivers. The process requires multiple individual placements of the measurement gear and subsequent averaging of groups of data. The overall measurement process can be simplified with the creation of a user-friendly interface to accomplish the averaging. A LABVIEW virtual instrument was developed to specify and produce the desired tone and record the signal with both microphones. The software performs calculations to determine the acoustic level difference between the two microphones and the resulting average surface impedance. This measurement interface will be used to obtain surface impedance measurements along a beach transect near Jennette's Pier in Nags Head, North Carolina.

2021-243	Poster	Engineering

Student Presenter: **Driver, John; *UNC Charlotte***
Mentor: **Dahlberg, Jerry; *UNC Charlotte***

Development of Heater for Hypersonic Wind Tunnel

Hypersonic wind tunnels are research machines designed to simulate the forces that objects undergo as they flow through the air at high speeds. A modular, compact blow-down hypersonic wind tunnel at the University of North Carolina at Charlotte (UNCC) was built by a senior engineering design team in 2019 with the theoretical capability to reach Mach 7. The tunnel was designed with a heater, but due to lack of time, it was not built and installed. The lack of heater limits the tunnel's maximum Mach to Mach 5. The wind tunnel utilizes twelve compression tanks that release the compressed air through a fast-actuating valve to initiate low velocity/high-pressure flow through a plenum and release a high velocity/low-pressure flow through a specific CD nozzle for the desired Mach number for testing. In this research, we aim to conduct a literature review of past heaters utilized in wind tunnels above Mach 5 to support the development of a heater for the UNCC Wind Tunnel. The literature review will review the technical components of other wind tunnels to make recommendations for the UNCC wind tunnel heater design and implementation. Data and information from recent wind tunnel testing will be included to show the current capabilities of the wind tunnel. Through the literature review and initial designs, a heater will be able to be installed into the UNCC wind tunnel in the near future, which will allow for speeds of over Mach 5 in the hypersonic wind tunnel.

2021-244	Poster	Engineering

Student Presenter: **Ferris, Alan; *North Carolina State University***
Mentor: **Vallem, Veenasri; *North Carolina State University***

Development of Liquid Metal Kinetic Energy Harvesting Devices

The kinetic energy present in tidal motion is a renewable opportunity that has seen little practical advancement in recent years despite the clear potential to assist in the transition to green energy. Utilizing the promising properties of a liquid metal, eutectic Gallium-Indium alloy (EGaIn), a device has been created that can produce a flow of electrons when exposed to oscillating motion. The cylindrical devices consist of different sized electrodes and electrolytes with varying composition. We characterized the performance of these devices as a function of the material properties, the device architecture, and the kinetic input on the device. The device output followed expected trends as the voltage saw an increase with increasing electrode area. In ideal conditions, maximum voltage outputs were approximately 300mV at 0.25 Hz. Tests with regard to longevity and repeatability are ongoing to assure the long term viability of these devices.

2021-245	Poster	Engineering

Student Presenter: **George, Madison; *Elon University***
Mentor: **Christopher, Shefali; *Elon University***

Putting the Right Foot Forward: The First Pole Vault Spikes for Women

Despite evidence that women's feet are proportioned differently than men's and react differently to load, shoes are still designed without attention to women's specific biomechanics. There exists research examining differences between men and women's biomechanical differences of the foot and ankle during simple loading tasks as well as limited kinematic differences during a pole vault approach. However, no current literature has analyzed kinetic variables of men and women's feet during a pole vaulting task. This proposed study attempts to compare men and women's foot load distribution during a pole vault approach to provide information relevant to the design and development of women's pole vault spikes. Participants will be adult athletes grouped into experienced pole vaulters and non experienced pole vaulters, and further divided by gender. Subjects will perform a pole vault approach characterized by a run forward into a single leg vertical jump while wearing LoadSol (novel, Demark) inserts in their shoes. Load data at the heel, midfoot, forefoot, lateral forefoot, and medial forefoot will be collected during the time of maximum total force at the takeoff step, penultimate step, left mid-run step, and right mid-run step. Average force values of men vs. women at these points will be compared to find significant differences. Women's specific force tendencies will be used in the material and density determination of women's pole vault spikes, to be designed and developed by May of 2023.

2021-246	Poster	Engineering

Student Presenter: **Hinton, Michael L.;** ***Elizabeth City State University***
Mentor: **Adedeji, Adetayo V.;** ***Elizabeth City State University***

Optical Characteristics of Sn-doped Gallium Oxide Deposited by Magnetron Sputtering

Gallium oxide is an ultra-wide bandgap semiconductor with many potential applications. Transparent layers of pure Ga2O3 and Sn-doped Ga2O3 were grown on single crystalline quartz, silicon, and silicon carbide substrate by magnetron sputtering method. The transmittance and reflectance spectra of the layer were measured simultaneously. The absorption coefficient and the energy bandgap of the layers were determined. The surface morphology and amount of Sn dopant were quantified with Scanning Electron Microscope - Energy Dispersive Spectroscopy (SEM-EDS) and Atomic Force Microscope (AFM).

2021-247	Poster	Engineering

Student Presenter: **Houk, Matthew;** ***North Carolina State University***
Mentor: **Nam, Chang S.;** ***North Carolina State University***

EEG Signal Classification: Validation of a 3D Multi-Branch CNN Approach in EEGNet

This project sought to verify the advantages of 3D multi-branched convolution neural networks (CNNs) in electroencephalography (EEG) classification, specifically in the motor imagery and emotion classification tasks. The 3D multi-branched modifications reportedly offer superior temporal and spatial feature sensitivity to the model. Using a transformed 3D data layout to imply spatial relationships between channels allows the model to better grasp how signal channels relate to each other, while a multi-branched model structure with varying temporal receptive field sizes allows for improved sensitivity to different sized temporal features. In this work, the EEGNet architecture was modified to allow for both 3D and multi-branched styles. EEGNet is a well-known, open-source deep learning (DL) model developed by the US Army Research laboratory that is effective in classifying multiple EEG paradigms; however, model performance falls behind state-of-the-art research. By implementing the 3D multi-branched modifications to EEGNet, we seek to bring the model performance up to par with current research. This work is being made open-source for other researchers to refer to and make use of in their own studies. From our research, it appears that while a multi-branched model offers improvements to model performance, the advantages of a 3D data format over a 2D format require further investigation.

2021-248	Poster	Engineering

Student Presenter: **McKee, Richard; *North Carolina A&T State University***
Mentor: **Yi, Sun (Dr.); *North Carolina A&T State University***

Human Robot Interface Using Microsoft Kinect and Denso VP6242-G

The interaction between humans and robots provides substantial benefits, for example, in manufacturing, medical and defense applications. It also requires a unique challenge to create a simple but usable interface. One approach that has gained particular interest is controlling the robotic arm by communicating through motion sensors. A 3D sensor, Microsoft Kinect, uses infrared and depth data to locate objects. The Kinect also can track the movement of the collaborator. This work aimed at creating an interface through the Kinect to control a robotic arm simply by detecting the positions and motions of the user's arm to create an interface between the user and robotic arm. The equipment used includes the Kinect infrared motion sensor along with the Denso VP6242-G six degrees of freedom robotic arm. The Kinect SDK software helps one assign numbered points to the shape of the individual and tracks specific movements. MATLAB/Simulink software is used to build a signal path for the interface. The research is presented with illustrations.

2021-249	Poster	Engineering

Student Presenter: **Neill, Bevin; *North Carolina State University***
Mentor: **Brudno, Yevgeny; *North Carolina State University***

Computational Modeling and Testing of Drug Targeting in the Body

Delivering therapeutic molecules locally to diseased tissue remains a challenge in drug delivery. Although many devices can release drugs over time, they cannot be modified after implantation and deplete their drug stores quickly. To overcome these limitations, our lab has developed refillable drug-eluting depots. Refillable drug depots have click molecules at the disease site that capture systemically administered protodrugs from the blood. The protodrugs are inactive in the blood and only release drug at the disease site, allowing for repeated, sustained, and targeted delivery. Herein, we report a physiologically based pharmacokinetic (PBPK) model of the refillable depot system that can predict the concentration of drug at the disease site and in the organs. Using published physiological parameters, the PBPK model predicts the behavior of a common chemotherapeutic doxorubicin protodrug after systemic administration. This model recapitulates published values for doxorubicin concentration over time. After this, the click-mediated capture and subsequent drug release was modeled through the addition of a tumor compartment containing a depot that captures circulating prodrug to release active drug. Currently, we are validating this model by studying the in vivo behavior of click-conjugated fluorophores to offer real-time monitoring of the click reaction. This data will offer insight into the click reaction kinetics, allowing the PBPK model to be modified accordingly to improve its predictive ability.

2021-250	Poster	Engineering

Student Presenter: **Paul, Elliot; *East Carolina University***
Mentor: **Vahdati, Ali; *East Carolina University***

Implementation of an in silico modeling pipeline for bone remodeling in microgravity

As space exploration become more prevalent, bone health in microgravity remains a major concern. Microgravity puts astronauts at risk of losing 1% - 1.5% of bone mass per month in space [1]. This study aims to implement a mechanistic in silico approach to simulate mechanically-induced bone remodeling in microgravity. A finite element model was developed in the open-source software FEBio [2], which was run using a MATLAB script and the open-source toolbox GIBBON. The output of this finite element analysis became the input to an existing NASA toolchain for bone remodeling in microgravity [3], which couples differential equations for temporal evolution of biological and chemical factors. Preliminary results show that factors, such as TGF-β1, osteoblasts, and osteoclasts population dynamics play an important role in the computational remodeling simulations. For example, when the mechanical loading was increased, the population of active osteoblasts and bone density slightly increased, while the number of active osteoclasts slightly decreased. This in silico model is currently being further developed, verified, and validated against NASA's existing modeling toolchain [3]. The fully verified and validated model can eventually aid in designing exercise protocols that minimize astronaut bone loss and maximize the potential for safe space exploration.

[1] J. K. Smith, Applied Sciences, vol. 10, no. 13, 2020. [2] J. A. Pennline and L. Mulugeta, Jul. 2014. [3] S. A. Maas, B. J. Ellis, G. A. Ateshian, and J. A. Weiss, J. Biomech. Eng., vol. 134, no. 1, 2012.

2021-251	Poster	Engineering

Student Presenter: **Rice, Diarra; *North Carolina A&T State University***
Roy, Manosi
Mentor: **Akangah, Paul; *North Carolina A&T State University***

Energy Absorbing Running Shoe Using 3D Printing Technology

Additive manufacturing is a synonymous term for three-dimensional printing. The 3D printing process focuses on a 3D design being made into a prototype through CAD (computer-aided design) and printed using specified materials. For the purpose of this research, the focus is on incorporating energy absorbent materials in regard to the actual designing process of running shoes and turning the designs into tangible products with 3D printing technology. The sole purpose of this project is to use engineering principles and properties to restructure the shoe manufacturing process while maintaining quality as well as durable functionality. The objective of the product that is to be created from this research is to design running shoes that use heat-resistant materials that absorb, as well as convert energy while providing comfort simultaneously. Shoe soles are an important component, as sole foundations provide reinforcement especially against impact on the foot when running. Sorbothane was used to design the midsole of the shoe using CAD. Sorbothane is a polyether-based material and has a very high damping coefficient. Using Sorbothane in the midsole increases shock absorption, is waterproof, and most importantly non-toxic, which creates an environmentally friendly material.

CAD designed midsoles were printed using a 3D printer and characterized by a shift from dexterous to computerized manufacturing. This Sorbothane midsole using 3D printing can be beneficial to prevent injuries of the runners as the Sorbothane shock absorption coefficient is very high and can reduce many health-related problems.

2021-252	Poster	Engineering

Student Presenter: **Seibert, Paige; *North Carolina State University***
Mentor: **Sagues, Joe; *North Carolina State University***

Lactic Acid Production Through Saccharification and Simultaneous Fermentation

The development of a new bioprocess for the enzymatic hydrolysis and fermentation of textile residues is beneficial for waste reduction as well as lactic acid production. According to the American Association of Textile Chemists and Colorists, 11.6 million metric tons of cotton waste are produced every year (Johnson et al. 2020). This new bioprocess will both utilize this abundance of cotton waste in a meaningful way and produce lactic acid, a valuable and versatile organic compound. To begin the bioprocess, the cotton residues receive a simple one-step alkaline pretreatment ranging from 0 to 120 mg/g potassium hydroxide in biomass at 50 degrees celsius for twelve hours. The pretreatment level of 60 mg potassium hydroxide with 5% solid load resulted in spontaneous fermentation that produced an average of 16g/L of lactic acid. Lactic acid titer was further improved to an average of 22g/L through the addition of mineral AM1 media. The lactic acid is produced by a wild microbial consortia in the cotton. Notably, this microbial community appears to be resilient to harsh conditions, as it produced these yields despite enduring a sterilization temperature of 121°C and pH up to 12. The resulting lactic acid can be utilized for a variety of promising bioapplications including the production of bioplastics.

2021-253	Poster	Engineering

Student Presenter: **Shikarkhane, Pracheeti; *North Carolina School of Science and Math***
Mentor: **King, Mariah; *North Carolina School of Science and Math***

Ziegler-Nichols Tuning Implementation on Arduino-Based PID Controller for DC Motor Rotation

Control systems are the core regulatory mechanisms in many engineered devices. One of the widely implemented industrial control systems is the Proportional-Integral-Derivative (PID) controller, known for its efficient tuning outputs, situational versatility, and relative ease in logic. Yet despite its prevalence, the PID framework remains largely inaccessible to secondary school students and early undergraduates. Aimed at expanding the educational reach of control systems, this research study presents a control experiment implementing the PID algorithm on a DC motor for fine-tuned speed regulation. The system is designed using the Arduino microcontroller with the intention of lowering cost-barriers for replication. Upon specifying the target speed, a photoelectric sensor is used to enable closed-loop feedback control, in which the system receives and adjusts the rate of motor rotation based on calculated steady-state error. The algorithm is developed with goals of reducing sinusoidal oscillation at the setpoint and minimizing overshoot. The Ziegler-Nichols (ZN) tuning experiment is implemented on the algorithm to predict gain parameters, after which it is observed that the motor self-corrects with reduced settling-time and thus increased efficiency. The derived gain parameters lead to minimized overshoots and desirable, logarithmic settling trajectories as the setpoint is reached. The success of this two-part implementation demonstrates feasibility for classroom applications.

2021-254	Poster	Engineering

Student Presenter: **Stanfield, Ashley; *North Carolina State University***
Mentor: **Brandon McConnell; *North Carolina State University***

Investigation of Spare Parts Demand Models with Additive Manufacturing

Additive Manufacturing (AM) is an emerging technology that is evolving quickly and has the potential to disrupt many industrial sectors. Researchers are investigating how AM can transform these industries. Recent research explores the potential application of AM technology in spare parts supply chains. There is a consensus in forecasting literature that spare part demand is often intermittent; this property thwarts traditional supply chain production and inventory models. Early research in AM for spare part supply chains seeks AM integration strategies to reduce costs or lead time. However, these models oversimplify demand distribution properties and do not reflect the intermittent demand complications found in industrial data sets. This research seeks to identify some of these demand modeling gaps and provide initial experimentation to assess which gaps should be prioritized in future research.

2021-255	Poster	Engineering

Student Presenter: **Vagt, Bruce; *Elon University***
Mentor: **Dr. Blackmon, Richard; *Elon University***

Development of ultra-fast deep-imaging optical coherence tomography for assessing diseases on the nanoscale

Optical Coherence Tomography (OCT) is a non-invasive laser-based imaging technique that has found applications in a wide range of fields from medicine, to art, to biometric-based security. OCT is capable of taking subsurface cross-sectional images using the time-delay of photons scattered from microscopic features within the sample being imaged, in much the same way ultrasound works on the centimeter scale. Laser light is incident upon the sample, scattered back by microscopic features (such as cells and collagen), then passed through an interferometer and recorded using a spectrometer. This yields a profile of features under the surface of the sample at the location of the incident laser beam.

OCT records subsurface features using an interferometer that compares the phase of light being sent to and from a reference mirror of known distance to that of light being reflected from the sample of unknown distance. Investigators in our lab have used this to monitor nanoparticle movement in biological tissue with a wide range of applications from cardiology to pulmonology and to monitor the movement of cell organelles with applications in oncology.

Here, we have developed a deep-imaging OCT system (DIOCT) theoretically capable of imaging 5-10x deeper into tissue than conventional high-resolution systems. We present details for the construction of the DIOCT system, steps taken to write the code for the system user-interface, and discuss how we have integrated the more advanced imaging and data processing capability into the system. Additionally, we discuss the unique challenges encountered while developing ultrafast scanning capability (>140kHz).

2021-256	Poster	Engineering

Student Presenter: **Wilson, Nia; *East Carolina University***
Terry, Austin
Mentor: **Ryan, Teresa; *East Carolina University***

Experimental infrastructure to assess temporal variability of atmospheric temperature gradient

This work is part of a larger effort that focuses on how various factors, such as land topography and atmospheric conditions, affect sound propagation. The overall focus of this subordinate project is to understand how experimental temperature data compares to existing temperature models. Recent findings indicate that existing temperature profile models are insufficient at capturing the near surface complexities below about 5 meters above ground level. However, these findings also brought up a few more questions that will be explored by this work. The first question asks what is a better way to capture the temperature data to show the very near surface complexities (up to ~5m) than using an unmanned aerial vehicle (UAV)? The UAV does an adequate job at capturing temperature data with existing data-logging sensors. Even so, it does not do a great job of surface avoidance or measuring in or near tall vegetation because of the uncertainty and drift in the UAV's own positioning system. Therefore, there is a need to develop a measurement system that can characterize the very low atmospheric boundary layer temperature profiles. The other research question addressed in this work is how does the slope of the vertical temperature profile change over time? Understanding this question will help answer the broader question of how accurate near-surface temperature information improves acoustic propagation modeling efforts when compared to the use of simplified temperature gradient assumptions.

2021-257	Poster	Environmental Sciences

Student Presenter: **Angulo, Cameron; *North Carolina State University***
Mentor: **Walsh, Cathy; *Mote Marine Laboratory and Aquarium***

Innate Immune Parameters of the Atlantic Stingray and Bonnethead Shark

The Atlantic stingray, Hypanus sabinus, and Bonnethead shark, Sphyrna tiburo, are potentially exposed to environmental stressors, such as toxic algal blooms and contaminants, that may impact immune function. Lysozyme and superoxide dismutase (SOD) are innate immune function enzymes in epidermal mucus, plasma, and leukocytes of elasmobranchs that can be used as anti-bacterial and oxidative stress biomarkers. This project's aim is to compare lysozyme and SOD activities in plasma, leukocytes, and mucus as potential biomarkers in H. sabinus in wild (n=1) versus captive individuals (n=3) and in S. tiburo wild individuals (n=3), using lysozyme assays, protein and plasma gels. Average lysozyme level in captive stingray mucus was lower compared to wild but higher in the plasma compared to wild. SOD plasma levels were higher in mucus and plasma in wild compared to captive. Bonnethead lysozyme and SOD levels in plasma were higher than those of both wild and captive stingrays. Environmental differences may contribute to potential variation in innate immune function in captive and wild stingrays. Findings of this project could be used in future studies to determine health impacts of potential exposure to environmental stressors in the Atlantic stingray and
Bonnethead Sharks.

2021-258	Poster	Environmental Sciences

Student Presenter: **Brookhart, Alyssa; *North Carolina Wesleyan College***
Mentor: **Elias, Daniel; *North Carolina Wesleyan College***

Effects of salinity and acetaminophen on egestion rate and movement of Poecilia reticulata

Freshwater organisms currently face increasing salinity in their ecosystems, which is driven by agricultural activities, runoff of road salts, and global climate change. Changes in water salinity can influence the toxicity of pollutants in marine ecosystems; however, little is known about the combined effects of elevated salinity and pharmaceuticals in freshwater biota. This study assessed the combined effects of acetaminophen (350 µg/L) and salinity (680 mg/L) on Poecilia reticulata. After a 96-hour exposure period, egestion rate (mg/cm/hr) and movement variables (e.g., absolute turn angle: the absolute change in direction of the animal) were measured. Elevated salinity levels increased egestion rates and erratic movement (absolute turn angles and movement between designated zones), while higher acetaminophen levels decreased absolute turn angles. There was no observed interaction between salinity and acetaminophen, suggesting saltwater intrusion does not affect the toxicity of this pollutant.

2021-259	Poster	Environmental Sciences

Student Presenter: **Lynch, Arilyn; *Catawba College***
Halstead, Kate
Mentor: **Bolin, Jay; *Catawba College***

Measuring Shifting Forest Dynamics as a Result of the Emerald Ash Borer

The Emerald Ash Borer (EAB) is a relatively new invasive species to the central piedmont of North Carolina. Our goal is to measure the decline and patterns of change in a Green Ash dominated swamp forest in the Catawba College Fred Stanback Jr. Ecological Preserve (FSJEP). In fall 2019 we established six, 200 m2 plots using a nested plot design to measure changes in the canopy, sapling, and herbaceous vegetation. We resampled the plots in fall 2020. Our canopy data indicated a relatively low diversity in the tree canopy, trees importance values in descending order (of the top 6), green ash (Fraxinus pennsylvanica), sweetgum (Liquidambar styraciflua), red maple (Acer rubrum), black willow (Salix nigra), American elm (Ulmus americana), and the American Sycamore (Platanus occidentalis). The canopy was dominated by green ash, accounting for 68% of trees greater than 10 cm dbh. In fall 2019 and fall 2020, 20% and 54%, respectively, of green ash trees were visibly infected with signs of EAB infection (“D” shaped EAB exit holes in the bark, larval galleries under the bark, and/or copious adventitious bark sprouts). 12% of the green ash trees in the fall of 2020 were dead. The importance value of the green ash declined from 1.6 in 2019 to 1.5 in 2020.

2021-260	Poster	Environmental Sciences

Student Presenter: **Verbrugge, Isobel; *Catawba College***
Mentor: **Poston, Joe; *Catawba College***

Environmental Mercury in High Rock Lake

Environmental mercury can come from anthropogenic sources such as mining operations and coal burning plants, or mercury can come from natural sources such as volcanic eruptions. High Rock Lake in central North Carolina has elevated mercury due to two anthropogenic point sources: a former battery factory and ash ponds from a former coal power plant. In previous work, sediment sampled from six locations downstream of the point sources had almost twice as much mercury as sediment from six locations upstream of point sources, but this difference was not statistically significant. Further analysis of High Rock Lake is needed as previously only 12 locations were looked at. I will gather sediment samples from twenty locations upstream of point sources for mercury, and twenty locations downstream of point sources. My project will determine if the point sources are still a source of mercury in High Rock Lake.

2021-261	Poster	Humanities

Student Presenter: **Barber, Gray; *Belmont Abbey College***
Mentor: **Jensen, Erin; *Belmont Abbey College***

The Problem of Individuation

Scholastic Philosophers have debated for centuries over the Problem of Individuation, which asks: why are two things of the same kind different things? This is related to the problem of identity and the ship of Theseus, which asks us: how can the me of the present and the me of the past and future be the same person, if there are differences between us? These questions will be discussed by my presentation on the Problem of Individuation.

2021-262	Poster	Humanities

Student Presenter: **Parrilla, Eloy; *North Carolina State University***
Johnson, Emma
Burg, Austin
Mentor: **Nam, Chang; *North Carolina State University***

Ethics in Artificial Intelligence and Autonomous Systems

Every day, artificial intelligence (AI) and autonomous systems (AS) are becoming more relevant, as new technologies are presented to the public with the intent of integrating them into society. However, these systems are not perfect and have been known to cause accidents that impacted a multitude of people. The purpose of this study is to ensure that ethical guidelines are followed by AI and AS when being designed and implemented into society. We investigated three ethical theories, nine ethical principles regarding AI, and the ADC model to analyze accidents involving AI and AS to determine the ethical principles the systems failed to follow. By analyzing the accidents, we hope to gain an understanding of how similar incidents may be prevented in the future. Additionally, we demonstrate the importance of ethics being a part of AS programming and give recommendations for future incorporation of ethics into AS.

2021-263	Poster	Humanities

Student Presenter: **Schultz, Alexandria; *UNC Charlotte***
Mentor: **Malin Pereira; *UNC Charlotte***

Racial Consciousness, Uplift, and Justice in Harlem Renaissance Poetry

Were you surprised or confused by the recent Black Lives Matter protests? Were the arguments for or against the movement hard for you to understand? This essay will help the reader see, through the lens of poetry, how the Black experience in America came to be, and what Blacks have been saying and doing about their unequal circumstances for the past 100 years. Throughout the history of civil movements pursuing liberty for marginalized peoples, poetry stands out as an effective vehicle of advocacy. The Harlem Renaissance of the early 1920s to the late 1930s demonstrated an exceptional assemblage of activists and artists. Tracing threads of racial consciousness, uplift, and justice through the poetry of Langston Hughes, Countee Cullen, James Weldon Johnson, and Carrie Williams Clifford, uncovers a Black aesthetic and nationalism expressing double consciousness and intersectionality, that advances recurrent themes such as reclaiming of Black history, promoting education, and advocating for civil rights. Harlem Renaissance poetry builds the infrastructure of mid-to-late 20th century outpourings of work like the Black Arts Movement and into the first two decades of the twenty-first century, the third “Renaissance” of poetry and art. The implications of the aforementioned tenets in modern American society and in Black poetry since the Harlem Renaissance serves as a secondary goal. Enduring ripples of racism towards African Americans in the United States remain to be extinguished through contemporary creativity and advocacy, therefore investigating past themes of revolution and restoration will inform new paths to achieve authentic and lasting justice.

2021-264	Poster	Humanities

Student Presenter: **Williams, Josiah; *High Point University***
Mentor: **Anexander, Laura; *High Point University***

Melancholy and Gender in Shakespeare's Twelfth Night

Freud's confluence of mourning and melancholia describes "loss" as a central to the melancholic affect. The "what" that is lost can range from an object, person, to an abstract ideal, the latter being the most common in presentations of mourning or melancholy. This project will use Freud's vocabulary to describe melancholy and consider the idea of loss as it pertains to gender ideals in Shakespeare's, "Twelfth Night." The character of Viola is central to this analysis as she is a woman who is forced to portray a male character that takes on the external characteristics, the societal expectations, and the internal understanding of this role. The resulting dissonance of her biological sex assigned at birth, and her external gender presentation creates a melancholic disposition but for the loss of her previous self-conception. This project will look specifically at Viola's asides while acting within the traditional duties of a man, her soliloquies, and the resolve of her dissonance in act 5 will be described using Freud's framework of melancholia as a product of loss. The Tim Nunn (1990) and John Sichel (1970) productions of Twelfth Night will be juxtaposed to delineate the inherent melancholic affects, these being the performances' commonalities. The purpose of this project is to better understand melancholia as it results from the forced loss of a self-conception of gender by giving Freud a new case.

2021-265	Poster	Mathematics and Quantitative Studies

Student Presenter: **Gawron, Nicholas C.; *North Carolina State University***
Mentor: **Wang, Fangfang; *Worcester Polytechnic Institute***

Decorrelation Detection in Financial Time Series Data

For this NSF funded REU project, we partnered with Wellington Management Company and researched how dimension estimation can determine whether seemingly diversified index fund portfolios in fact have latent commonalities that increase risk for investors. Principal Component Analysis (PCA) is a widely used tool for dimension estimation, but during periods of financial crisis, PCA is unable to adequately perform dimension estimation, because it relies on linear relationships and is sensitive to outliers. We investigate robust and nonlinear techniques including Robust PCA and autoencoders, assessing their usefulness for three tasks: dimension estimation, data reconstruction, and correlation visualization. We find several methods that are resistant to market shocks and develop a novel method to estimate dimension using autoencoders. We additionally provide insight into future time series modeling.

2021-266	Poster	Mathematics and Quantitative Studies

Student Presenter: **Majumdar, Manav; *UNC Charlotte***
Mentor: **Dr. Doug Hague; *UNC Charlotte***

Cross Country Runner Modeling and Team Scoring Prediction

High school cross-country running is a team sport that hosts 5k distance events on a multitude of courses. Research shows that 5k times for athletes improve over a season with training while variables such as lower temperature and difficulty of the course impact the performance of athletes. Our goal is to reduce the uncertainty in the predictive forecast of high schoolers in the upcoming season within individual and team ranking results. We will adopt a multivariate model approach to predict performance within individualized cross-country running times. For team scoring, our method will incorporate a Monte Carlo simulation within our cross-country team scoring algorithm. Environmental and individual performance variables will be included in the model to predict athlete performance and progression through a season. The utilized dataset includes performance and individual data from nc.milesplit.com, environmental information from NOAA, and other sources. Moreover, initial descriptive analysis shows that an individual's performance depends on skill, temperature, and course. This work will develop methods to combine these factors into a predictive model for individual performance throughout a season at specific events, different courses, and variable stipulations to simulate the end of year state meet rankings.

2021-267	Poster	Medical and Health Sciences

Student Presenter: **Alberto, Katey; *Elon University***
Mentor: **Vallabhajosula, Srikant; *Elon University***

Analyzing differences in force, power, and time during the five time sit-to-stand while dual-tasking in older and younger adults

The sit-to-stand (STS) movement is an important, routine task that may become more difficult with age. Understanding the role of fatigue on this movement can provide information on whether there are certain compensations or shifts in strategies that occur during repeated movements. The purpose of our study was to examine the effect of aging on force characteristics during repeated STS while dual tasking. 12 healthy young (age: 24.3[3.8] years) and 8 healthy older adults (age: 69.5[3.89] years) performed the STS movement five times as fast as they could while simultaneously counting backwards by threes with their feet placed on force platforms. Time to complete the task, power to stand, and concentric (standing) and eccentric (sitting) impulse were computed. After normalizing the data with bodyweight (BW), independent samples t-tests were run. Older adults took significantly longer time to complete (11.56[1.82]s vs. 8.37[1.75]s for younger adults; $p<0.001$), showed similar concentric impulse (.82[.14]BWs vs. .69[.27]BWs for younger adults; $p=.243$), similar eccentric impulse (.76[.19]BWs vs. .59[.22]BWs for younger adults; $p=.076$), and a significantly lower power (.71[.15]BWm/s vs. .92[.15]BWm/s for younger adults; p=.008) . These results tell us that there was no significant difference in the force dissipation over time between the groups during standing or sitting, however, younger adults were able to perform the movement more quickly and efficiently while performing a cognitive task. Understanding this difference and its relationship with the cognitive function may be important in knowing how aging affects the mind and body functioning simultaneously.

2021-268	Poster	Medical and Health Sciences

Student Presenter: **Carter, Jenna L; *Campbell University***
Mentor: **Bunn, Jennifer; *Campbell University College of Pharmacy and Health Sciences***

Salivary Cortisol Analysis in Collegiate Female Lacrosse Athletes

BACKGROUND: Cortisol is a hormone that corresponds to athlete readiness and recovery. These hormone levels fluctuate throughout the competitive season, correlating with performance and athlete load. The purpose of this study was to 1) classify the changes in cortisol in female Division I collegiate lacrosse players (n=15) and 2) evaluate the liaison between cortisol and athlete wellness and load. METHODS: Salivary cortisol samples were collected weekly on Friday mornings throughout the entirety of the 2021 competitive season (12 weeks). Subjective athlete total wellness scores and subscores (muscle soreness, sleep quality, fatigue, and stress) were taken on the same days. Objective total weekly training load for distance, high-intensity distance (HID), sprints, accelerations, and decelerations were tabulated from the previous training week. RESULTS: Time elapsed in the lacrosse season and academic semester had various effects on cortisol, wellness, and athlete load over the twelve weeks ($p<.001$, partial eta squared = .202). Univariate tests were performed to show that wellness ($p<.001$, partial eta squared = .244) and athlete load ($p=.019$, partial eta squared = .258) were different over time. Univariate tests showed that cortisol differences were not significant over time (differences over time ($p=.058$, partial eta squared = .132).

2021-269	Poster	Medical and Health Sciences

Student Presenter: **Catherine Luba; *UNC Charlotte***
Sadula, Mahita
Sawhney, Monika
Mentor: **Sawhney, Monika; *UNC Charlotte***

Assessing the Impact of COVID-19 on the Health and Well-Being of Healthcare Professionals in North Carolina, United States

The Coronavirus Disease of 2019 (COVID-19) disrupted everyone's life, but it arguably affected healthcare professionals the most. The impact of COVID-19 is great, but few studies have been done on healthcare professionals, and even fewer have been done on the gender dynamics in healthcare. The purpose of this study is to find out how substantially it directly affected healthcare professionals in regards to mental health and well-being, with a focus on gender. We will be able to look at North Carolina, U.S., along with the medical sites being private facilities and cross-sectors, which shows a different perspective. This cross-sectional study will focus on demographics (gender, race, job characteristics), burnout, stress, and how COVID-19 as an event affected healthcare professionals. This study will be conducted by distributing a completely anonymous survey (Qualtrics®) through an anonymous link by a blind copy email to 1000 probable participants, which will be sent through the three medical organizations in North Carolina's respective databases. Three analytical instruments are used in the survey: Perceived Stress Scale (PSS), Oldenburg Burnout Inventory (OBI), and the Impact of Events Scale (IES-R), which look at their respective areas of burnout, stress, and COVID-19. Preliminary analysis shows that there is an increase in stress, burnout, PTSD, due to COVID-19. especially in women when comparing gender. The results of this study will address the gender gap and reassess the needs of healthcare providers in the future to create appropriate intervention and coping strategies.

2021-270	Poster	Medical and Health Sciences

Student Presenter: **Chu, Wei Shen "Serena"; *East Carolina University***
Mentor: **Reis, Pamela; *East Carolina University***

Analyzing Elements of Postpartum Confinement and the Effect on Women's Health: An Integrative Review

Postpartum confinement is a traditional postpartum custom in Chinese culture based on the theory of Yin-Yang (hot and cold). The purpose is to balance yin and yang energies after pregnancy, labor, and birth which is said to result in major loss of yang/heat. Postpartum confinement facilitates physiological and psychological postpartum healing through a combination of behavioral and dietary restrictions. The aim of this integrative literature review was to analyze elements of postpartum confinement and discuss the outcomes of the practice on women's health. PubMed and PsychINFO electronic databases were used to search for publications between 2016 and 2021. Search terms included postpartum and confinement. Whittemore and Knafl's integrative review guidelines were utilized to conduct the methodological review. Each article was assessed for level of research evidence. A total of 16 articles were included in this review. Five themes were discovered from the literature analysis: (1) effect of postpartum confinement on postpartum depression (PPD) and postpartum anxiety (PPA); role of family, friends, and professional support; impact of nutrition; relevance of breastmilk and infant gut microbiota; and taking warm showers to alleviate discomfort. Different aspects of postpartum confinement were found to affect PPD/PPA in different ways, and adequate support is crucial in postpartum recovery. Postpartum confinement can be nutritionally beneficial to maternal and infant health. Measures such as warm showers should be encouraged to reduce postpartum fatigue. Based on these conclusions, health care providers should allow flexibility in combining traditional practices with modern health care while also educating about any risks involved.

2021-271	Poster	Medical and Health Sciences

Student Presenter: **Desai, Karan; *Duke University***
Wang, Yun and Posner, Jonathan; *Duke University and NYSPI at Columbia University*
Mentor:

A Novel Deep Learning Based Brain Segmentation Toolbox for 0- to 2-year-old Infants/Toddlers

The first few years of life after birth mark the most rapid periods of postnatal growth and development for the human brain; however, little is known about developmental trajectories of brain structure, especially in the first two years. This scientific gap is due partially to current technical limitations on the rigorous and valid quantification of brain structure in infants via MRI – an important approach for the study of brain development. In this project, we aim to leverage novel deep learning techniques to address the fundamental methodological limitations for longitudinal infant brain segmentation and ultimately provide researchers with a reliable toolbox and graphical user interface (GUI) for studying early brain development. Leveraging state-of-the-art domain adaptive and transformer techniques, our deep learning pipeline is primarily developed on a medium-size training dataset (n=50 scans from 0 to 24 months, 2 scans per age) with "ground-truth" manual labels (e.g., hippocampus, putamen). The deep learning pipeline will function on the backend of a GUI to intake MRI scans from the user and run them independently by age range, outputting a corresponding segmentation mask for each scan. The GUI will contain several sections, including File I/O, Deep Learning Model (segmentation and domain adaptation models separately), View (input and output view on ITK-SNAP), and Help (GitHub repository and user instructions). Collectively, this project aims to yield reliable tools within a GUI for studying early brain development, and ultimately improve our capacity to efficiently measure and identify MRI-based brain features relevant to neuropsychological development.

2021-272	Poster	Medical and Health Sciences

Student Presenter: **Dixit, Gargi; *UNC Chapel Hill***
Sellers, Kailyn
Bamberg, Kayla
Khan, Samia
Mentor: **Mostafa, Javed; *UNC Chapel Hill***

Data and Text Mining and Analysis To Determine the Significance of Ten Potential Risk Factors of Stroke Occurrence

Stroke affects approximately 795,000 people in the United States per year. Some variables that are associated with stroke have been identified while others are still being studied. This study addressed ten variables including age, hypertension, gender, heart disease, work type, marriage status, residence type, average glucose levels, and BMI. The project's focus was to utilize data analysis techniques to find an association between these ten previously identified variables and the occurrence of stroke. Univariate and bivariate analyses in R were performed to do so. The univariate distributions of the variables were visualized through bar charts (numerical variables) and histograms (categorical variables). Chi square tests and paired t tests were done to compare categorical and numerical variables with stroke occurrence. With the exception of residence type and gender, the chi-squared tests with stroke occurrence were found to be statistically significant for all categorical variables, showing a correlation of each variable with stroke. A higher median average glucose level was associated with the occurrence of stroke, which was visualized in a box plot. Another objective of the project was to use text mining to analyze documents from a comprehensive literature review and identify the most relevant terms and document similarity. Text analysis was done using Python programming by finding term frequency and inverse document frequency, and visualized in the form of n-grams showing the most frequent terms. Document similarity was also found using cosine similarity index and Euclidean distance techniques.

2021-273	Poster	Medical and Health Sciences

Student Presenter: **Farrow, Sophia; *East Carolina University***
Mentor: **Abdel-Rahman, Abdel; *Brody School of Medicine***

Angiotensin-Converting Enzyme 2 Concentration in Ovariectomized Rat Kidney: Effects of Ethanol and Estradiol

The COVID-19 pandemic has prompted discussion and research on ACE2. Angiotensin converting enzyme 2 lowers blood pressure by catalyzing hydrolysis of angiotensin 2 (Ang II) into angiotensin 1-7 (Ang 1-7). ACE2 receptors are utilized as a membrane receptor for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), also known as COVID-19. The number of ACE2 receptors located within the kidney affects the severity of symptoms caused by COVID-19. Estradiol (E2), the form of estrogen produced by the ovaries, and ethanol (EtOH) have been proven to separately affect the expression of ACE2 within the kidneys of female rats, with emphasis on the effects of EtOH on male rat kidneys. The objective of this research was to study the effect of EtOH and E2 on ACE2 concentrations in ovariectomized (OVX) female rat kidney, alongside the effect of EtOH on male rat kidney. The Western blot technique was utilized to determine the expression of ACE2 and how E2 and EtOH concentrations increased or decreased the ACE2 expression in corresponding OVX rats. By researching E2 and EtOH effects on ACE2 expression, scientists can further explore how COVID-19 treatment can be improved for alcohol consuming females.

2021-274	Poster	Medical and Health Sciences

Student Presenter: **Hansel, Rachel; *East Carolina University***
Mentor: **Forbes, Thompson Hollingsworth III; *East Carolina University***

Understanding the Sustainability of Quality Improvement In an Academic Medical Center: A Case of the Falls Prevention Toolkit

Most nurses providing care at the bedside have a story about a patient who experienced a fall that either sped up their disease process or prolonged their hospitalization. Due to the potential severity of harm from falls, health systems and payers have placed an intentional focus on reducing the incidence of falls. Numerous studies have explored interventions to decrease the incidents of falls, for example, tailoring interventions to the specific unit's environment (Jacobs, 2016), increasing staff training (Montejano-Lozyoa, 2020), and talking with patients about their fears to bridge the fall risk perception gap that often occurs between patients and staff (Kityoshi-Teo, 2020). While there is an abundance of research on individual interventions, there is a deficiency in knowledge about intervention sustainability. The purpose of this project is to conduct a quality improvement assessment to understand the impact and sustainability of the Vidant Health Falls toolkit implementation on reducing falls. Understanding the impact of this toolkit, we can adjust it to provide better outcomes for both our patients and our hospital payers. In 2021, Vidant Health implemented a fall reduction tool kit in its effort to address the incidence of falls across their academic medical center. Focus groups with key staff members were conducted after units had been using the toolkit for at least 6 months. ”Key staff members” will be used throughout this paper to describe individuals whose units utilize the toolkit and have had personal experience with its usage. Interviews with these key staff members revealed that there were two overarching barriers to successful implementation: lack of time to execute the toolkit, and lack of understanding why the toolkit is important. These findings reinforce that health systems implementing falls reduction toolkits should include education during new hire education that explains the rationale behind the toolkit in order to create a foundation for a falls prevention culture.

2021-275	Poster	Medical and Health Sciences

Student Presenter: **Loudermilt, Madison; *UNC Greensboro***
Wallace, Conner
Mentor: **Fordahl, Steve; *UNC Greensboro***

Fasting Enhances Dopamine Release and Restores the Rate of Dopamine Uptake, Slowed by a High Fat Diet

Diets high in saturated fat promote obesity and dampen dopamine neurotransmission in the nucleus accumbens (NAc), a brain region that integrates food reward and helps communicate satiety to the hypothalamus. Our study explored whether fasting changed dopamine neurotransmission in male and female mice fed high fat. Six-week-old male and female mice were given diets with high or low saturated fat for six weeks. We then used fast scan cyclic voltammetry to measure dopamine neurotransmission in the NAc. In non-fasted mice, the high-fat diet significantly reduced the dopamine uptake rate in male, but not female mice. Reduced uptake rate is thought to interfere with satiety signaling from the NAc to the hypothalamus, causing overeating in high-fat fed mice. Conversely, a 12-hour fast enhanced dopamine release and uptake rate in high-fat fed males and females, but only low-fat males had elevated dopamine release and low-fat females had elevated dopamine uptake. Overall, our data shows that fasting enhanced dopamine neurotransmission in the NAc, which may promote food seeking when mice are hungry. Our data support the hypothesis that a diet high in saturated fat disrupts dopamine in a way that impairs satiety signals when fed, but does not impact food seeking when fasted.

2021-276	Poster	Medical and Health Sciences

Student Presenter: **Natarajan, Sarabesh; *Duke University***
Mentor: **Kamal, Arif; *Duke University***

Exploring the Comprehensiveness, Quality, and Understandability of Hospice-Related Educational Videos on YouTube

Due to insufficient knowledge and misconceptions about hospice, about 40% of eligible hospice patients do not receive hospice care. We examined the use of YouTube for hospice education, as YouTube is the principal form of health-related social media use. We used the YouTube Data API to search YouTube for the top 100 videos under the keyword "hospice," and we excluded videos based on certain criteria. We developed questions to characterize the comprehensiveness with which videos addressed information about hospice services, team-based care, and misconceptions. We also examined the quality and reliability of videos using the mDISCERN measure and their understandability using the PEMAT-A/V measure. Finally, we recorded demographic characteristics of patients, caregivers, and members of the hospice care team in videos. Among included videos (n=50), only 38% of videos addressed the definition of hospice, and only 40% addressed services offered by hospice. Further, less than 20% addressed various misconceptions around hospice. While 64% of videos were rated as high quality, only 18% provided additional resources for patients. While 62% of videos had high understandability, they lacked strategies that promote retention. Comprehensive representation of the hospice care team was also sparse, as two or fewer social workers, chaplains, therapists, and hospice volunteers were shown among all videos. Additionally, 89.3% of video characters were Caucasian. Our findings suggest that hospice-related video purveyors should publish more comprehensive content about hospice. The diversity of the hospice team should be prioritized, and videos should aim to be more understandable and informative for patients.

2021-277	Poster	Medical and Health Sciences

Student Presenter: **Padovano, Destiny; *East Carolina University***
Mentor: **Arnold, Nicole; *East Carolina University***

Evaluating Viability of Epinephrine Injector Stocking within U.S. Restaurants

Epinephrine Injectors (EIs) are authorized to be stocked within restaurants in most U.S. states, but not all. There are two different categories of EIs; those that provide audio-administered instructions, and those that provide written instructions. The objective of this project was 1) to evaluate which states have legislation and guidance for EI stocking at restaurants; and 2) to determine the major themes, such as types of EIs authorized and/or recommended, associated with available legislation and guidance. A systematic review was conducted to determine the current landscape of EI guidance and legislation accessible to the general public online. Predetermined terms were used in Google searches to find articles, guidance documents, and legislation relating to EI stocking at restaurants. Twelve states do not have accessible legislation or guidance on stocking EIs in restaurants. In most states where there was legislation (38), the guidance mentions: 1) that EI's need to be stored in an emergency accessible area according to healthcare standards (18); 2) the restaurant needs a prescription for the EI (38); and 3) an employee needs to be trained/certified to administer it (37). This data can be used to bring awareness about the lack of clear guidance, and inability for some states to stock EIs in restaurant settings to groups such as policymakers, the food and restaurant industry, and consumers. Further research is needed to explore whether some states do not authorize EI stocking at restaurants outright, or if guidance and legislation are merely not accessible online. EI stocking in restaurants should be prioritized because EIs can potentially save someone with a fatal food allergy from having an anaphylactic reaction and/or death, and the majority of allergic reactions resulting in anaphylaxis take place in restaurant settings.

2021-278	Poster	Medical and Health Sciences

Student Presenter: **Parrish, Taylor; *Pfeiffer University***
Prestwood, Malea
Mentor: **Martin, Dana R.; *Pfeiffer University***

Natural Immune Therapies Against COVID-19

According to the Johns-Hopkins dashboard, there have been more than 238 million reported cases of COVID-19 infection globally, with almost 45 million of those cases occurring in the United States (Johns Hopkins University and Medicine, 2021). Primary measures to prevent COVID-19 have been implemented including proper handwashing, physical distancing, mask-wearing, and vaccination. The general population may present concerns of the use pharmaceuticals to treat COVID-19 due to safety concerns, fear of the unknown, and misinformation about the current treatments. The purpose of this presentation is to discuss complementary and alternative therapies that can be utilized to enhance the immune system, and therefore, decrease the risk of developing COVID-19. Additionally, nursing implications related to the use of these practices will be described. Complementary and alternative therapies have long been used to improve health, and there are many practices that have demonstrated enhancement of immune function. Natural products such as herbs may be favored in the place of commercial pharmaceuticals due to their antiviral properties. Herbs that are significant in managing COVID-19 symptoms include astragalus, echinacea, ginseng, peppermint, thyme, and garlic. With no known treatment for this virus, and rapid COVID-19 cases, it is imperative that individuals are informed about the different treatment options so that they can make informed decisions for their health. In this review, we have identified complementary and alternative methods to manage the COVID-19 virus and outlined nursing implications related to these practices.

2021-279	Poster	Medical and Health Sciences

Student Presenter: **Potts, Jennifer R.; *North Carolina State University***
Mentor: **Cole, Jacqueline H.; *North Carolina State University***

Effects of Brachial Plexus Birth Injury on Gait and Grip Strength

Occurring in 1-3 out of every 1,000 births, brachial plexus birth injury (BPBI) is a common nerve injury in children and causes muscle paralysis, bone deformities, and lifelong arm impairment, often requiring surgery. Previous studies have reported osseous deformities that differ with injury location, but little is known about the extent to which limb disuse exacerbates these deformities or about the changes that can occur to limb strength following injury. Our objective was to determine how injury type and limb disuse contribute to gait impairment and grip strength in a rat model of BPBI.

Sprague Dawley rats (n=6 per group) underwent surgery at postnatal day 3-6 for postganglionic neurectomy (mimics nerve rupture), sham injury, or elbow disarticulation (mimics disuse without nerve injury). Three and four weeks after surgery, grip strength of both forelimbs was assessed using a force gauge with 5 trials per limb. Gait patterns were recorded for walking (5 m/min) and running (10 m/min) on a treadmill. For rats who functionally bear weight with their affected limb, stride length and duty factor were measured for each speed using Kinovea. Groups were compared with ANOVAs (α=0.05).

Preliminary results indicate that rats with postganglionic injury can grip only with their unaffected limb. As expected, sham rats gripped the force gauge with both limbs simultaneously or individually with no decrease in the strength of the affected limb compared to the unaffected limb. Collection of quantitative grip strength data and gait analysis is ongoing.

2021-280	Poster	Medical and Health Sciences

Student Presenter: **Ramchandra, Suhani; *North Carolina School of Science and Math***
Mentor: **Bates, Lauren; *North Carolina School of Science and Math***

Sedentary behavior-based interruption strategies to reduce cardiometabolic disease risk in breast cancer survivors

Cardiometabolic disease (CMD) is an overarching term encompassing a cluster of diseases that affect the metabolic and circulatory systems. As individuals become more technologically dependent, their physical activity is decreasing and sedentary behaviors, prolonged periods of inactivity, are increasing. This has led to an elevated risk of CMD. The standard treatment involves medical procedures and lifestyle changes. This literature review will identify sedentary behavior interruption strategies to reduce CMD risk in breast cancer survivors as this population is more likely to attain CMD due to overlapping symptoms such as hormonal changes. The FITT (frequency, intensity, time, and type) model is a token used to develop exercise routines to combat sedentary activities. In this literature review, components of the FITT model will be analyzed to identify the best sedentary-behavior interruption strategies to reduce CDM risk in breast cancer survivors. So far, observations show that as components in the FITT model are increased, the likelihood of CMD decreases. The findings of this review can potentially be used to advance the prevention and treatment of CMD through physical activity as an alternative method for medical and surgical operations.

2021-281	Poster	Medical and Health Sciences

Student Presenter: **Sadula, Mahita; *UNC Charlotte***
Luba, Catherine
Sawhney, Monika
Mentor: **Sawhney, Monika; *UNC Charlotte***

Assessing the Impact of COVID-19 on the Health and Well-being of Healthcare Professionals in North Carolina, United States

The emergence of the Coronavirus Disease 2019 (COVID-19) pandemic has significantly altered social and economic activities, work conditions, and overall everyday life. Currently, there are limited studies that examine how these changes influence the health and well-being of healthcare professionals. Around the world, the COVID-19 crisis continues to overwhelm healthcare systems. Healthcare professionals, especially, are more likely to be in unprecedented situations and are at a higher risk of contracting COVID-19 than the general public. The purpose of this study is to examine the continual effect COVID-19 has on the health and well-being of healthcare professionals by assessing the prevalence of stress, burnout, psychological distress, and other factors experienced among healthcare professionals. A cross-sectional, anonymous survey through an electronic application (Qualtrics®) will be administered to a sample of 1000 participants from three medical organizations in North Carolina. Demographic information and job characteristics will be collected, including occupation, length of working experience, experience in a COVID-19 hospital unit, and total working hours during the COVID-19 pandemic. The self-administered online questionnaire also encompasses the Perceived Stress Scale (PSS), Oldenburg Burnout Inventory (OLBI), and the Impact of Event Scale-Revised (IES-R) to evaluate the perception of stress, burnout, and distress caused by traumatic events, respectively. The preliminary results show that healthcare professionals experienced higher levels of burnout, stress, and other negative effects on their mental health and well-being since the start of the COVID-19 pandemic. This study will help to address and reassess coping and supporting needs of healthcare workers during future outbreaks.

2021-282	Poster	Medical and Health Sciences

Student Presenter: **Sasser, Georgia; *East Carolina University***
Mentor: **Buckman, Cierra; *East Carolina University***

Examining the Relationship between Poverty, Urbanicity, and Child Maltreatment Fatalities

While deaths attributed to maltreatment represent a minority of child fatalities, the official rate of child abuse deaths was 2.39/100,000 children in 2018. There are geographic variations in maltreatment and fatality rates between states, counties, and neighborhoods. Previous literature has come to conflicting conclusions about whether maltreatment fatalities are higher in rural or urban areas. This distinction may be related to differences in defining "rural" and "urban", as some studies use the Rural-Urban Continuum code, which is based partially on commuting rates, and others use population density data. There are variations in how data on child maltreatment is collected, with databases including the National Violent Death Reporting System, and the Kids Inpatient Database. Poverty has been reported as an important variable in maltreatment fatality rates both independently and when intersected with rurality, as one study claimed that counties with a high level of poverty had more than three times the abuse fatality rate of low poverty counties. One study that found higher abuse in urban areas also found that maltreatment in families receiving government welfare, including food stamps and unemployment insurance, was higher in rural areas. Family stress and financial insecurity are more common in rural victims, while factors like parental drug abuse, which is involved in 19.3% of maltreatment fatalities, are more common in urban environments. Eligibility for public insurance and demographic characteristics are also debated as risk factors. We hypothesize that individual-level and regional poverty rates are more strongly associated with higher maltreatment fatality rates than urbanicity.

2021-283	Poster	Medical and Health Sciences

Student Presenter: **Shah, Esha; *North Carolina School of Science and Math***
Mentor: **Brantley, Kelly; *Lake Norman High School***

Variability of Testing Protocols and the Impact of Concussions on Student Athletes in Iredell Statesville Schools

I observed whether different concussion testing protocols can affect an athlete's ability to return to play. This project started with research to understand the basics of sports-related concussions. Three high schools in Iredell County were chosen to evaluate testing protocols used on student-athletes. I contacted the Licensed Athletic Trainer (LAT) for School A, School B, and School C to obtain concussion data; the athlete's name, ID and age were kept confidential. Three different testing protocols were identified, SCAT3, Concussion Vital Signs and imPACT. Once these protocols were identified, research was conducted on each protocol. Data for student-athletes between 2017-19 was reviewed. School A had a total of 383 athletes who completed baseline imPACT testing. School B had 452 athletes who underwent baseline concussion vital signs testing. School C had 366 athletes who took the sideline assessment (SCAT3) if a concussion was sustained. Among all three schools, football reported having the highest concussion risk. Soccer at School A and School C had the second-highest concussion rates. The average amount of days it took a School A and School B athlete to return to play (RTP) was 23.3 days and a School C athlete only took 6.7 days to RTP. In conclusion, the results showed baseline neurocognitive assessment played a significant role in the football athletes ability to return to play. Results revealed football players took an average of two weeks longer to return to play than athletes who only completed a sideline assessment.

2021-284	Poster	Medical and Health Sciences

Student Presenter: **Williams, Britney; *North Carolina A&T State University***
Mentor: **Wade, Jeanette; *North Carolina A&T State University***

Social Determinants of Black Women's Sexual Health

Black women face numerous health disparities which is partly due to the compromised health care they receive. The complex relationship with Black Americans and the medical system is influenced by historical racism. That negative influence lives on today and influences the thoughts and practices of physicians. To account for the experiences faced in the healthcare system, data was collected via in-depth interviews. In-depth interviews have great advantages which include providing substantial information and only needing fewer participants for useful insights. College students (N=39) from A&T and UNC Chapel Hill ranging from 18-25-years-old.The social determinants of health paired with institutionalized discrimination across age, weight, and race continues to heighten issues Black women face within the healthcare system. These determinants were put into codes based on participants' responses. Participants who reported high concerns with their age, gender or race were put into the codes of blackness as a barrier to care, feeling race/gender connection, and other intersectional identities. Those who reported feeling that care received is historically influenced were put in the code of anxiety from historical medical racism. Those who did not have problems or real-life experiences were put in the codes of blackness as a non-factor or other codes. Experiences that someone faces everyday attribute to one's own identity. Specifically, Black women who are in the forefront of this due to the color of their skin. Medical personnel are challenged to actively change their perceptions of these individuals and treat them in a respectable way.

2021-285	Poster	Medical and Health Sciences

Student Presenter: **Luba, Catherine; *UNC Charlotte***
Sadula, Mahita
Mentor: **Sawhney, Monika; *UNC Charlotte***

Assessing the Impact of COVID-19 on the Health and Well-Being of Healthcare Professionals in North Carolina, United States

The Coronavirus Disease of 2019 (COVID-19) disrupted everyone's life, but it arguably affected healthcare professionals the most. The impact of COVID-19 is great, but few studies have been done on healthcare professionals, and even fewer have been done on the gender dynamics in healthcare. The purpose of this study is to find out how substantially it directly affected healthcare professionals in regards to mental health and well-being, with a focus on gender. We will be able to look at North Carolina, U.S., along with the medical sites being private facilities and cross-sectors, which shows a different perspective. This cross-sectional study will focus on demographics (gender, race, job characteristics), burnout, stress, and how COVID-19 as an event affected healthcare professionals. This study will be conducted by distributing a completely anonymous survey (Qualtrics®) through an anonymous link by a blind copy email to 1000 probable participants, which will be sent through the three medical organizations in North Carolina's respective databases. Three analytical instruments are used in the survey: Perceived Stress Scale (PSS), Oldenburg Burnout Inventory (OBI), and the Impact of Events Scale (IES-R), which look at their respective areas of burnout, stress, and COVID-19. Preliminary analysis shows that there is an increase in stress, burnout, PTSD, due to COVID-19. especially in women when comparing gender. The results of this study will address the gender gap and reassess the needs of healthcare providers in the future to create appropriate intervention and coping strategies.

2021-286	Poster	Physical Sciences and Astronomy

Student Presenter: **Desikan, Hari; *North Carolina School of Science and Math***
Mentor: **Bennett, Jonathan; *North Carolina School of Science and Math***

The Nature of the Relationship Between Ultrasound Shadows and Tissue Geometry

Recent findings show that metastasizing cancer cell clusters form in a manner that allows them to be detected in ultrasound images. If the contrast-to-noise ratio (CNR) metric is used to characterize the detectability of a region of tissue (CNR>1), acoustic shadows can disrupt such measurements and hinder diagnosis. We seek to quantitatively show the degree to which acoustic shadows disrupt diagnosis by measuring CNR values corresponding to a shadowed abnormal square region of tissue. Using the Field II software package for MATLAB, we model a transducer imaging a square region of tissue as a collection of discrete scatterers that reflect ultrasound waves. At the center of the imaging area is a “target region” (TR) that will appear bright in ultrasound images, and a brighter “shadow caster region” (SC) with scattering properties of bone is located between the transducer and the TR. The lateral position of the SC is varied and the CNR for each simulated lateral position is measured. Due to Field II software limitations, the simulation was unable to produce acoustic shadows. To circumvent this limitation, the shadow’s effects were hard-coded into the software to reduce the scattering intensity directly underneath the SC by 10 dB. Results show CNR<1 when the shadow obscures approximately two-thirds or more of the TR, but CNR>9 when the TR is unobscured. In circumstances where strong shadow-casters might exist, it is recommended that regions directly underneath are imaged using alternative techniques to avoid the large losses in detectability observed here.

2021-287	Poster	Physical Sciences and Astronomy

Student Presenter: **Kern, Madeline; *UNC Charlotte***
Mentor: **Trammell, Susan; *UNC Charlotte***

Stabilization of protein-based biologics using light-assisted drying

A variety of biomedical products use proteins to treat or detect diseases. The current standards for processing and storing protein-based biologics include freeze-drying, freezing, and/or refrigeration. Freeze-drying is time-consuming and costly and not all biologics can be stabilized using this method. Freezing and refrigeration are not possible without the proper infrastructure to transport and store biologics. Anhydrous preservation offers a low-cost alternative and can allow for high temperature storage. A novel process known as light-assisted drying (LAD) has proven to be a robust method for dehydrating small amounts of biological samples into amorphous trehalose (sugar) solids using near-infrared light. The noncrystalline trehalose matrix prevents mechanical stress, slowing the biological degradation of the embedded proteins. Thus far, only small volumes (< 50 µl) have been processed using LAD, but standard drug/vaccine doses are much larger (0.1-1 ml). In this work, the ability of LAD to consistently form amorphous preservation matrices from larger volume solutions is assessed. Samples (250 µl) were dried with a 1064 nm laser in a low humidity chamber for 140 minutes. After LAD processing, samples showed an average end moisture content (EMC) of 0.204 ± 0.002 gH2O/gDryWeight. This value is beyond the desired EMC range, 0.15-0.17 gH2O/gDryWeight (based on previous results), and indicates that the samples were not dried enough. Polarized light imaging performed immediately after drying also showed significant crystallization in the dried samples. Further experimentation is being done to determine the proper parameters with which to process larger volumes in order to create the protective structures.

2021-288	Poster	Physical Sciences and Astronomy

Student Presenter: **Konu, Muzaffer Y.; *East Carolina University***
Pullen, Adam
Cooper, John T.
Mentor: **Beltran-Huarac, Juan; *East Carolina University***

Magnetic Extracellular Vesicles as MRI Contrast Agents to Diagnose Cancer

Magnetic resonance imaging (MRI) contrast agents (CAs) are proving agents used to improve the visibility of internal body structures. However, in certain biological settings, they can yield false imaging and results, and induce harsh side effects such as hypersensitivity. As a result, FDA has recently decided to discontinue some particle-based contrast agents. Therefore, more competitive and safe-by-design CAs that can address these issues is urgently needed so as to obtain more accurate and safer MRI scans to diagnose cancer. In this project, we have developed a dual CA nanoplatform, which possesses high relaxivity, target-based tumor linking, and minimal immune system response. The CA nanoplatforms are based on nitro-dopamine PEG grafted iron oxide nanoparticles (ND-PEG-SPIONs) with star shape. The nanoplatforms exhibit superior magnetic response (saturation magnetization of 68 emu/g, and almost-zero values of coercivity and remnant fields) when exposed to magnetic fields whose strength is similar to that used in MRI procedures. In addition, the nanoplatforms show strong colloidal stability in cell culture media at different time points (up to a few days). They also exhibit high cellular internalization in T11 breast cancer cells. Preliminary results indicate that CA nanoplatforms do not cause any major side effects and produce accurate results in discriminating healthy and cancerous cells, which could represent a step forward to advance this research field.

2021-289	Poster	Physical Sciences and Astronomy

Student Presenter: **McLaurin, Tristen; *North Carolina School of Science and Math***
Mentor: **Bennett, Jonathan; *North Carolina School of Science and Math***

Hard and Soft X-ray States of the Black Hole Binary System LMC X-3

A majority of binary systems that consist of a star and black hole are known as low mass X-ray binaries (LMXRB). The Chandra X-ray telescope collected data from LMC X-3, a LMXRB located in the Large Magellanic Cloud, that we then analyzed to find the X-ray energies and draw a connection between the energy and luminosity. By obtaining the luminosity and X-ray spectra of LMC X-3's accretion disk, we can determine whether it is in its hard or soft state. We used CIAO software to produce a graph of LMC X-3's energy spectra, which possessed one notable peak. We analyzed four separate energy spectra, with three being from February to May 2004 and another one from May 2000. This helps to answer our research question of how long LMC X-3 remains in one of its states. If the data results in two or more consecutive detections of the same state, an estimate of the minimum time spent before switching can be determined by taking the difference in the earliest and latest dates. We compared other LMXRB peaks to those of LMC X-3 and based on preliminary observations, we predict that LMC X-3's accretion disk is in its soft state at the time the data was collected.

2021-290	Poster	Physical Sciences and Astronomy

Student Presenter: **Panebianco, Katherine; *North Carolina School of Science and Math***
Mentor: **Bennett, Jonathan; *North Carolina School of Science and Math***

Simulating Quantum Key Distribution in Three Polarization Bases

With the rise in quantum computing's potential to break current encryption schemes, new methods of data encryption are needed to keep messages secure. Quantum key distribution (QKD) presents a solution that ensures perfectly secure encryption by utilizing the superposition of quantum states and measurement of said states in various polarization bases. Our research simulated an established method of QKD in two polarization bases (BB84 Protocol) and a proposed new method in three polarization bases (3 Basis Protocol). Data collection was focused on the key rate (number of particles sent to obtain a key of a certain length) in a non-eavesdropper setting and error rate (percentage of the key that contains errors) in an eavesdropper setting. We hypothesized that the 3 Basis Protocol would have a key rate of 0.33, lower than the BB84 Protocol's 0.5 key rate, but that the BB84 Protocol would have a lower error rate (of 0.25), making it harder to catch an eavesdropper. 500 simulations were run of each protocol, confirming the 3 Basis Protocol's hypothesized lower key rate of 0.33, but revealing both protocols to have an error rate of 0.25. These results suggest that there is no efficiency advantage to adding a third basis to QKD procedures. Further experimentation with the number of bases in QKD protocols has led to evidence that the 0.25 error rate is constant for any number of bases, supporting the conclusion that the two basis BB84 Protocol remains the most efficient.

2021-291	Poster	Physical Sciences and Astronomy

Student Presenter: **Pullen, Adam; *East Carolina University***
John Cooper
Mentor: **Juan Huarac-Beltran; *East Carolina University***

Magnetic extracellular vesicles as therapeutic agents to treat cancer remotely

Traditional therapeutic methods to treat cancer are currently suffering from invasiveness, severe side effects, and aggressive radiation exposure. To address these issues, we aim to develop safe-by-design and non-invasive therapeutic nanoplatforms based on nitro-dopamine PEG superparamagnetic iron oxide nanoparticles (ND-PEG SPIONs) incorporated in extracellular vesicles (EVs). We have elaborated a procedure for synthesizing and coating the particles and test their safety and effectiveness to treat cancer. We have characterized the coated particles to ensure consistency in size, shape, and magnetic response. Then ND-PEG SPIONs were incorporated into EVs via electroporation; this nanoplatform is referred as magnetic EVs. The natural ability of magnetic EVs to target specific cancer cells into the body will increase the specificity of our approach. Once the magnetic EVs are taken up by cancer cells, they will offload the particles and then an exogeneous AC magnetic field is applied to induce cell killing via magneto-mechanical actuation. TEM, confocal microscopy, and ICP-MS will be used to study the uptake. We hypothesized the realignment of the magnetic moments in particles with anisotropic shape can trigger off cytoskeleton disruption and in turn cell destruction. This non-invasive nanoplatform has the potential to advance the field of nanomedicine and cancer nanotechnology.

2021-292	Poster	Physical Sciences and Astronomy

Student Presenter: **Smith, Jazmyne D.;** ***Elizabeth City State University***
Pierce, Taylor D.
Mentor: **Adedeji, Adetayo;** ***Elizabeth City State University***

Etch Rate and Surface Morphology of Gallium Oxide Thin Films

Gallium oxide is an ultra-wide energy gap, transparent semiconductor with many potential applications including high power electronics and opto-electronics device fabrications. The oxide layer was grown by magnetron sputtering method at elevated substrate temperature on silicon substrate. Etch rate of gallium oxide in micron sizes circular structures define by photolithography was achieved by wet etching with phosphoric acid. Vertical and lateral etch thickness were measured with contact profiler. Surface morphology and roughness of the etched layer was monitored with Scanning Electron Microscopy (SEM) imagines and Atomic Force Microscopy (AFM) analysis.

2021-293	Poster	Physical Sciences and Astronomy

Student Presenter: **Wang, Lucia;** ***North Carolina School of Science and Math***
Mentor: **Riehn, Robert;** ***North Carolina School of Science and Math***

Tertiary DNA Structure Probing Using Nanochannels

DNA confinement in nanochannels (channels with at least one dimension between 1-100 nm) has proven to be a valuable technique for manipulating DNA configurations to study semiflexible polymer physics, DNA-protein interactions, and more. In this research, we simulated DNA under nanochannel confinement with proteins to investigate the mechanisms of the shelterin protein complex. Shelterin protects telomeres in cells from unwanted DNA repair mechanisms by forming large, stable DNA loops. This is particularly important because telomeres protect the ends of the genome from degradation and shortened telomeres are associated with aging and cancer. A 3D model of a DNA molecule initialized in a hairpin curve and confined in a 34 nm channel was created using Brownian dynamics in HOOMD-blue. The unrolling of the DNA molecule was observed and measured with and without the presence of modeled proteins TRF1 and TIN2, which are part of the shelterin complex, as well as SA1, an important cohesin subunit. Based on the simulations, high-interaction TRF1 proteins were able to stabilize the DNA loop, and low-interaction TRF1 with TIN2 proteins are also expected to be successful. These results are compared to experimental data to test if the proposed protein model is supported. Additionally, an artificial intelligence model was developed as a tool for more efficient image analysis of DNA molecules from fluorescence microscopy images. This AI automatically detects the keypoints of a DNA configuration, including endpoints and loops, which will be very useful for further experiments on DNA in nanochannels.

2021-294	Poster	Physical Sciences and Astronomy

Student Presenter: **Siekierski, Noah; *North Carolina School of Science and Math***
Mentor: **Bennett, Jonathan; *North Carolina School of Science and Math***

The Effects of Basal Underlayment Roughness and Angle on Granular Chute Flows

Granular materials such as sand are ubiquitous, appearing everywhere from beaches to industrial processing. Dense granular flows like landslides can have devastating impacts on both people and infrastructure. In this experiment, we utilized a chute apparatus to study how the mass of retained sand varies with inclination angle for different underlayments of 40 grit and 400 grit sandpaper. For the 40 grit underlayment, we found that flow occurs and sand is retained for angles between 29.1 and 39.5 degrees, as opposed to between 25.1 to 29.7 degrees for the 400 grit sandpaper. For both underlayments, more sand was retained on the incline at lower angles, and a graph of retained mass versus inclination angle shows a nonlinear relationship. More mass was retained on the 40 grit underlayment than the 400 grit underlayment for all angles where data were collected on both underlayments. We are able to fit our data from the 40 grit underlayment using an empirical model originally derived for spherical particles. Furthermore, we observe that flows on the 400 grit underlayment are significantly more susceptible to erosive effects. The results suggest that smoother underlayments are less effective at stopping granular flows, and that flows on smoother underlayments may be more sensitive to irregularities in the underlayment than flows on rougher underlayments. A possible application of our work is to artificially control the roughness of surfaces along which hazardous flows can occur, which may significantly reduce their impact on surrounding infrastructure and populations.

2021-295	Poster	Social and Behavioral Sciences

Student Presenter: **Ahmad, Sarosh; *UNC Charlotte***
Mentor: **Galati, Alexia, Ph.D.; *UNC Charlotte***

Task Goals Influence Interpersonal Alignment in Referential Expressions and Expressions Indicating Agreement in Joint Tasks

A prominent view of dialogue posits that task partners converge conceptually as they align their behavior. This is documented through observing tasks that require partners to actively monitor each other's perspective closely and then documenting the benefits of interpersonal alignment while the task is performed. The goal of this study is to examine the effect of task goals on task performance and interpersonal communication in dyad dialogues. In this study, dyads interacted with maps to complete 10 trials under different task goals: 5 trials involved planning a route from an origin to a destination (route planning), and 5 involved searchings for landmarks (visual search). We transcribed a subset of the dialogues in detail. In each conversational turn, we coded for the presence of acceptances (e.g., mm-hm, yeah), references to landmarks, and the use of metacomments (comments about the state of the task) through which task partners negotiated strategies. This presentation will focus on the presence of acceptances and references to landmarks. Route-planning entails more perspective-monitoring of the partner's subgoals in the task, leading us to believe that we will find more acceptances and a stronger alignment in the use of landmarks in those tasks compared to visual search. Our findings would suggest that speakers use linguistic strategies differently across tasks, in a way that serves task goals.

2021-296	Poster	Social and Behavioral Sciences

Student Presenter: **Buck, Ainsley E.; *Duke University***
Mentor: **Gaffrey, Michael S.; *Duke University***

Resting-State Functional Connectivity of the Ventral Attention Network and Non-Clinical Anxiety in Early Childhood

Childhood anxiety results in abnormal attentional patterns, including bias towards threat and negative perception of neutral stimuli. The Ventral Attention Network (VAN), which directs stimulus-driven attention, has been posited as a driving factor behind these differences. This study aims to determine if there is a relationship between the VAN and experience of anxiety in young children. This was accomplished by analyzing correlations between resting-state functional connectivity (RSFC) data of regions of interest (ROIs) in the VAN and Preschool Anxiety Scale (PAS) scores in 36 participants ranging from 4 to 8 years old. Specifically, ROIs used in our analysis consist of the frontal operculum of the ventrolateral prefrontal cortex (vlPFC), the temporoparietal junction (TPJ), and the ventral supramarginal gyrus (vSMG). Preliminary results reveal that TPJ-vSMG and vSMG-vlPFC RSFC are significantly associated with PAS scores, and thus, experience of non-clinical anxiety. These results support existing literature in clinical populations, indicating that neurobiological mechanisms between non-clinical and clinical anxieties are similar. Our findings that different ROIs are differentially correlated with PAS scores suggest that both hyper- and hypoconnectivity are associated with anxious experience, which counters previous literature that only decreased VAN RSFC is associated with clinical anxiety. While neural correlates of early childhood anxiety are not yet well understood, emerging work suggests that the underlying mechanisms are malleable. Thus, understanding this VAN neurobiology more thoroughly may allow for new leverage points that increase the durability of anxiety interventions and treatment.

2021-297	Poster	Social and Behavioral Sciences

Student Presenter: **Cooper, Diamond S; *Fayetteville State University***
Mentor: **Wall, Whitney; *Fayetteville State University***

Exploring The Relationship among Work Discrimination, Health Status, and Race

Health disparities persist within the United States despite national efforts to reduce/eliminate health-related inequalities. Discrimination experiences have been identified as a significant factor associated with health disparities among racial/ethnic minorities. Discrimination experiences are associated with increased stress and worse health outcomes. Workplace discrimination is one type of discrimination that is problematic and has been associated with health status indicators. Experiences of workplace discrimination may be compounded for racial-ethnic minorities with poorer health who also experience race-related discrimination. The present study explores, in a national sample of working adults, the relationship between workplace discrimination, health status, and race. Specifically, we explore if workplace discrimination predicts health status and if this relationship is moderated by race (minority vs. White). A linear regression established that workplace discrimination statistically significantly predicted health status, whereas higher reported experiences of workplace discrimination were associated with lower health status (worse health). Workplace discrimination accounted for 8.2% of the variation in health status. Hierarchical multiple regression was run to assess the statistical significance of the interaction between work discrimination and race. There was not a statistically significant moderator effect of race.

2021-298	Poster	Social and Behavioral Sciences

Student Presenter: **Cucuzzella, Cameron; *Duke University***
Sierra Jones
Preetha Ramachandran
Mentor: **Eve Puffer; *Duke University***

Coping Together: A Virtual, Community-Based Family Strengthening Intervention

A secondary mental health epidemic has emerged alongside COVID-19 as families across the US have experienced social isolation accompanied by economic stressors. Despite this secondary mental health epidemic, there are many disparities in accessing mental health care, with barriers including transportation, a shortage of professionals in one's area, the cost of care, and limited in-person services due to COVID-19. To address these disparities, we have partnered with Durham community organizations (Together for Resilient Youth and the West End Community Foundation) to develop and pilot a virtual, lay-delivered, family strengthening program, "Coping Together." The aim of this pilot trial is to develop a feasible and acceptable way to address the need for scalable interventions to strengthen families and foster resilience during and after the COVID-19 pandemic. Coping Together's content was adapted from a family strengthening program provided in Kenyan religious congregations. We held focus groups with leaders of Durham community organizations to better understand community needs and inform session content. Findings demonstrated that families were overburdened and faced concerns ranging from academic challenges to strained relationships. The findings also revealed inadequacies in mental health services and parent-focused care. To address this need, we worked to pilot Coping Together with a small number of families in North Carolina, conducting qualitative and quantitative data through a number of surveys, participant interviews, and focus groups. Next, we plan to begin data analysis to assess the effectiveness of the Coping Together program and the feasibility of scaling up Coping Together throughout North Carolina.

2021-299	Poster	Social and Behavioral Sciences

Student Presenter: **Darakjy, Gwen; *Belmont Abbey College***
Mentor: **Jensen, Erin; *Belmont Abbey College***

Juvenile Transfer and Recidivism

The relationship between juvenile transfer to adult court and juvenile recidivism has been extensively researched since the get-tough approach of the 80's and 90's. Many researchers and policy-makers question whether transferring juveniles to adult court through methods such as statutory waiver and Raise the Age legislation is a tactic that has any effect on deterring these violent offenders. Also in question is whether the correctional treatment they receive in adult court is attuned to the general needs of juveniles and young adults, who differ in their developmental profile from adults. This poster examines eight empirical studies to assess whether there is a relationship of juvenile transfer to juvenile recidivism. Results of the assessment suggest a null effect. Policy implications are then discussed using a theoretical criminological framework.

2021-300	Poster	Social and Behavioral Sciences

Student Presenter: **Gbedee, Eneye J;** ***Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***

Mentor: **Elowson, Allison;** ***Summer Ventures in Science and Math (App State, UNC-C, UNC-W, ECU)***

The Role of Artificial Intelligence in Social Media

This study examines the correlation between the two factors; our mental health and social media. For this research project, I investigated how various social media companies use artificial intelligence (AI) in order to keep users engaged for long periods of time. Researchers and health professionals consider the recommended time for adolescents to be 2 hours. I explored how social media applications like Facebook, Instagram and Tik Tok use artificial intelligence. Many of these widely-used social media platforms use AI to personalize the experience of each user, but the long-lasting effects of excessive amounts of time on social media can result in issues from a poor self-image to unrealistic perceptions of reality (Throuvala et al., 2019). I analyzed the self-reported data of my 14 participants within the age range of 12-23 who used social media on average and then I provided the participants with information about how AI is used in social media and tips on how to reduce the amount of time they spend on social media. I compared the preliminary data I collected and then the change among the participants as a way to measure their reaction to the information that I provided. The secondary data was collected based on the average time the participants spent online on a Friday and Saturday. From the comparison between the two sets of data, I noticed that the amount of time participants were spending on social media was both increasing and decreasing because of different factors.

2021-301	Poster	Social and Behavioral Sciences

Student Presenter: **Geddis, Kyndell;** ***North Carolina A&T State University***

Mentor: **Williams , Jacqueline;** ***North Carolina A&T State University***

Professional Power & Polish : An exploratory study of nail color and style

When one thinks of professionalism, nails are one of the last things that comes to mind (Universities UK et al. 2004). Yet, there are a variety of nail designs and a variety of opinions on what nail designs are deemed as professional (Sun, Chen, et al. “An Exploratory Study of the Factors That May Affect Female Consumers’ Buying Decision of Nail Polishes.” Cosmetics, vol. 2, no. 2, 2015, pp. 187–195). This exploratory research examines what can be defined as a professional nail look.

Through a series of interviews and focus groups with college students, faculty, recruiters, and working professionals we will investigate perceptions of nail color and styles and their likelihood of use by occasion (professional and non-professional situations.

Our findings compare across groups and find similarities and differences in opinions of what makes a professional nail look.

2021-302	Poster	Social and Behavioral Sciences

Student Presenter: **Grubich, Sarah T.; *North Carolina State University***
Bush, Kimberly A.
Mentor: **Bush, Kimberly A.; *North Carolina State University***

Understanding the Physical and Psychological Impacts of the COVID-19 Pandemic on Football Players at a Division 1 University in the Atlantic Coast Conference

The COVID-19 pandemic and all that came with it for campuses in the United States (e.g., academic delivery modifications and health concerns) created significant stress among the general student body. The pandemic combined with the social justice movement and the loss of revenue for athletic departments were added sources of stress among many student-athletes. In March of 2020, student athletes were directed to leave campus and move back home. This qualitative research study examined the physical and psychological impacts of COVID-19 on football players at a Division I University. Data collection methods included two focus group interviews with a total of 5 football student athletes. Results indicated three major themes including: mindset, physical changes and nutrition, and physical conditioning. Furthermore, eleven sub-themes were identified as they relate to the three major themes. The findings indicated significant disparities at home which led to new mindsets, less accountability, changes in body weight and strength, as well as changes in the types of training activities student athletes engaged in. The results indicated a need to create an accountability plan that takes into account the disparate access to resources student-athletes have at home. Additionally, aspects of the plan should relate to how to maintain communication, how to uphold a positive team culture, and how to hold student athletes accountable for physical training.

2021-303	Poster	Social and Behavioral Sciences

Student Presenter: **Hamilton, McAlister; *North Carolina State University***
Mentor: **Gruehn, Daniel; *North Carolina State University***

Relationship Between Marital Status and Well-being Under COVID-19 Stress

Objectives: People who are married tend to have higher overall life satisfaction compared to people who are not married (Bucher et al., 2019; Diener et al., 2000; Moss & Willoughby, 2018). In the present study, we examined whether marriage provided an additional buffer to covid-related stress controlling for confounding variables (i.e., age, sex, general stress).
Methods: One hundred sixty-nine participants (M= 37.4, SD= 11.9, age range: 21-72 years) completed an online survey between May and June 2020. The survey included demographic information, such as age, gender, education, marital status; satisfaction with life; and experiences of COVID-related stress or general stress.
Results: Consistent with past research, married individuals (M=5.72, SD=1.00) were more satisfied with life than single individuals (M=3.90, SD=1.83). Using linear regression, we examined if marital status predicted overall life satisfaction when age, gender, and general stress were controlled as well as if covid-related stress may moderate the effects. We found that only marital status predicted overall life satisfaction (β=1.89, t=7.39, p<.001) above and beyond COVID-related stress, general stress, age, and gender; moreover, covid-related stress was not a significant moderator.
Conclusions: Marriage provides multiple benefits to an individual, such as increased well-being and greater emotional support (Gove et al., 1990; Williams, 1988). We found no empirical evidence that marital status is an additional buffer to the stress during the global pandemic. Future research may examine more specific factors that may account for enhanced life satisfaction in a long-term relationship.

2021-304	Poster	Social and Behavioral Sciences

Student Presenter: **Hurewitz, Sophie; *Duke University***
Buck, Ainsley
Mentor: **Franklin, Michelle; *Duke University***

Ensuring Equity in Early Childhood ASD Services in North Carolina

Children from racial and ethnic minority populations are diagnosed with Autism Spectrum Disorder (ASD) at a significantly later age, and with more severe symptoms, than their White counterparts. As such, Black and Latinx children experience poorer outcomes. The purpose of this study is to understand the barriers and facilitators to early childhood diagnosis of ASD among Black and Latinx children to inform the North Carolina Early Childhood Action Plan issued by the Department of Health and Human Services. First, we conducted a review of the literature. Then, informed by existing research, we conducted 6 focus groups with 25 stakeholders in North Carolina, including pediatric clinicians, ASD researchers, advocates, social workers, and policymakers. This approach facilitated examination of the current statewide landscape and identification of potential solutions for addressing barriers to early detection of ASD among Black and Latinx populations in North Carolina. Findings reveal prominent barriers including limited workforce capacity, long waitlists, language barriers, lack of education and awareness, and insurance-related obstacles in accessing specialized care and therapies. Prominent facilitators of equitable diagnosis and access to services include education and awareness of early signs of ASD, care coordination between providers and other early childhood systems, cultural humility, and increased racial, language, and geographic diversity in providers. Our results illuminate the need for improved infrastructure, stronger community partnerships, and increased workforce development to help improve equity in early childhood ASD services.

2021-305	Poster	Social and Behavioral Sciences

Student Presenter: **Jaliawala, Mariam; *UNC Charlotte***
Mentor: **Peterson, Nicole; *UNC Charlotte***

Adaptations and resilience in the Mecklenburg County food system during COVID-19: opportunities and next steps

According to research, the Covid-19 pandemic has aggravated existing structural inequities. It has also shown the need for community-based food systems that help communities link together, to share valuable resources and funding in this ongoing disruption. Every country has marginalized populations, and their food insecurity is aggravated by man-made and natural disasters. The number of people affected is unpredictable. The Charlotte-Mecklenburg Food Policy Council is working to understand how the food system has been affected by the pandemic. The purpose of this research is to document how community-based food system initiatives are responding to the pandemic and to understand the root problem of food insecurity. In order to document the challenges, the council needs to consider the perspectives of food organizations, the toll the pandemic has had on the populations they serve, and the ways they are trying to overcome these obstacles. The method we will use is interviewing organizations about their experiences with Covid-19, with questions such as “How have food system actors responded to emergency needs and changing landscapes as a result of the coronavirus pandemic? What assets and barriers at individual and larger food system scales have impacted the ability to innovate and flexibly respond to changing needs?” We have found in these interviews that Covid-19 has made it more difficult for organizations to work for various reasons. Furthering the research allows us to gain a better understanding of the communities around Charlotte and develop recommendations for how local food systems can support communities and increase resilience.

2021-306	Poster	Social and Behavioral Sciences

Student Presenter: **Jewell, Ansley; *North Carolina State University***
Vaka, Sowmika
Ganim, Juliana
Prestemon, Fiona
Mentor: **Mulvey, Kelly Lynn; *North Carolina State University***

The Influence of Gender on STEM Gender Perceptions in Children

Studies show that gender representation plays an important role in the development of children's attitudes towards STEM fields and their interest in pursuing STEM-related careers (Miller et al., 2018). Because women are underrepresented in STEM careers, research on children's STEM attitudes is vital in judging their level of interest and predicting future involvement in STEM fields. Therefore, we assessed current youth perceptions of gender in STEM by developing a study to capture their notions of scientists. To do this, we surveyed 69 children and adolescents visiting a children's museum whose ages ranged from 4-16 years (Mage= 7.6, 66.6% female). Participants were tasked with drawing their idea of a scientist. In order to establish the gender of their scientist, we prompted participants to describe their drawings. Next, we collected the participants' demographic information. We examined how participants' gender correlates to the scientist they were tasked to create. Results show that female participants were significantly more likely to draw a female scientist compared to male participants; however, results show that older children, regardless of their gender, were significantly less likely to draw a female scientist as compared to younger children. Our research implies that with increased socialization and age, both genders are more likely to visualize male scientists. There is a need for increased diversity in gender representation in STEM so that a wider range of people feel empowered to pursue careers in these subjects.

2021-307	Poster	Social and Behavioral Sciences

Student Presenter: **Kustka, Emily; *East Carolina University***
Mentor: **Schwartz, Abby; *East Carolina University***

Exploration of Interest and Development of Intergenerational Facilities in Pitt County

Research has shown that residents in nursing homes often experience isolation, loneliness, and boredom, which can lead to mental and physical decline. To address this, some facilities provide intergenerational care, by combining nursing and childcare with daily interaction between adults and children. There are no intergenerational facilities in Pitt County, and the extent to which intergenerational programming is offered is unclear. This research project aimed to explore the benefits and challenges associated with developing an intergenerational facility in Pitt County, and to propose key considerations in developing such a facility. A qualitative research method was used, and 10 stakeholders were interviewed by phone or virtually due to COVID-19. Stakeholders were recruited via faculty mentor contacts and snowball sampling. Preliminary themes related to benefits and challenges include: using older adults' talents to provide educational experiences for children, children's exposure to difficult conversations (e.g., death), and older adults' exposure to flu and other illnesses. Preliminary themes related to considerations in developing a facility include: researching and implementing appropriate licensing and certifications, development of activities catered to different ability levels of older adults and children, and interprofessional and community collaboration to ensure facility success. The results suggest that an intergenerational facility in Pitt County is feasible if stakeholder input were to be addressed. Ideas for future research are also discussed (e.g., costs, diverse racial/ethnic perspectives of potential consumers) to gain additional detail needed to develop an intergenerational facility.

2021-308	Poster	Social and Behavioral Sciences

Student Presenter: **Leyva, Diana; *North Carolina State University***
Mentor: **Gruehn, Daniel; *North Carolina State University***

Memory and Facets of Mindfulness

Mindfulness has proven beneficial for college students by buffering high levels of stress and anxiety that often result from social and academic responsibilities (Bai et al, 2020; Ying et al. 2018). Studies on the impact of mindfulness on memory performance show inconsistent findings (e.g., Im et al., 2021), possibly due to the many different ways mindfulness is conceptualized throughout the literature. The purpose of this investigation was to examine the relationships between memory, anxiety, and five different facets of mindfulness (Baer et al, 2006) in a sample of college students. We expected positive associations between memory and the two facets of acting-with-awareness and non-reactivity; and mainly non-significant associations with the other three facets: observe, non-judging, and describe. Moreover, we expected that anxiety might be a moderator for the relationship between mindfulness and memory. After assessing trait anxiety and mindfulness, participants viewed emotional images and completed a surprise recognition memory test for these one week later. Contrary to our expectations, memory performance was not significantly related to any of the five mindfulness facets (all $b < \pm .243$, $p > .191$). Although anxiety was significantly correlated with the two mindfulness facets of interest, there was no evidence that anxiety was a moderator ($b = -.072$, $p = .762$). Future research may benefit from investigating the impact of mindfulness practice rather than mindfulness trait characteristics on memory.

2021-309	Poster	Social and Behavioral Sciences

Student Presenter: **Macy, Samuel G.; *North Carolina State University***
Neupert, Shevaun D.
Mentor: **Neupert, Shevaun D.; *North Carolina State University***

COVID-19 Vaccine Hesitancy: The Synergistic Effect of Anxiety and Proactive Coping

In the context of a nation divided on beliefs in the safety and efficacy of the coronavirus disease 2019 (COVID-19) vaccines, this study sought to identify potential interactions between COVID-19-specific anxiety and proactive coping on the likelihood of COVID-19 vaccine hesitancy in the United States. An online survey of proactive coping strategies (strategies to reduce or avoid future stressors), anxiety related to developing COVID-19, and vaccine hesitancy was administered in October 2020 to 534 adults aged 21-79 years from 42 U.S. states. Gender, race, years of education, COVID-19 knowledge, age, self-rated health, and perceived constraints were included in the model as covariates since they are known to either influence vaccine hesitancy or health in the context of the COVID-19 pandemic. Results revealed that 56.7% were hesitant to receive a COVID-19 vaccine. Anxiety about developing COVID-19 showed a significant negative correlation with vaccine hesitancy. A significant COVID-19 Anxiety x Proactive Coping interaction showed the odds of vaccine hesitancy was highest among individuals with low anxiety about developing COVID-19 and high proactive coping, whereas vaccine hesitancy was lowest among those with high COVID-19 anxiety and high proactive coping. Results support a future-oriented approach to public health outreach efforts regarding COVID-19 vaccines. Improvement of proactive coping skills and emphasis on the likelihood of contracting COVID-19 may even be more effective in increasing vaccine uptake, as well as booster shot uptake in the coming months, to reduce the spread of COVID-19.

2021-310	Poster	Social and Behavioral Sciences

Student Presenter: **McAllister, Vivian; *High Point University***
Mentor: **Danzis, Deborah; *High Point University***

Routine Work-Separation and Relationship Satisfaction

Routine work-separation refers to people who are routinely separated from their partners due to their occupation (Diamond et al., 2008). This study focused on how routine work-separation is related to relationship satisfaction, from the perspective of truck driver partners. Using Qualtrics, a survey was distributed online to Facebook groups that identified as groups for girlfriends/partners/spouses/wives of truck drivers. There were 135 participants in the study, all from 35 states in the United States and 3 provinces in Canada, ages ranged from 21 to 70. Within the sample, there was 56 single-career households, 72 dual-career households and 90 households with children. Scales were used for relationship satisfaction, relationship maintenance behaviors, perceived stress, and belief in gender roles. A positive correlation was found between engaging in relationship maintenance behaviors and relationship satisfaction, $r (60) = 0.54$, $p = 0.000$. A negative correlation between levels of perceived stress and relationship satisfaction was observed, $r (65) = -0.41$, $p = 0.001$. A group difference for levels of perceived stress was found between routine monthly separation and routine daily or weekly separation, $F (1, 111) = 3.51$, $p = 0.064$. People whose partners are home monthly reported higher perceived stress than people whose partners are home daily or weekly. The amount of routine work-separation, whether daily, weekly or monthly, is related to the relationship satisfaction and the perceived stress that partners of truck drivers report.

2021-311	Poster	Social and Behavioral Sciences

Student Presenter: **Mijumbi, Ryan; *High Point University***
Mentor: **Spain, Jana; *High Point University***

The Relation of Extraversion Facets with Covid-related Loneliness, Covid-related Social Isolation, and Neuroticism

During the beginning of the Covid-19 pandemic, the internet popularized the belief that introverts were thriving in lockdown while extraverts were suffering due to social-deprivation. While pre-Covid research indicates a strong negative correlation between extraversion and loneliness, research during the pandemic has shown differing results on how extraversion interrelates with loneliness and social isolation. Given the absence of research on five-factor model facet-level interactions between personality and responses to social-distancing and lockdowns, this study examined the association between two extraversion facets (gregariousness and positive emotions) and Covid-related loneliness and social isolation, and explored group differences in neuroticism levels. Participants (N = 93) were adult volunteers ranging in age from 18-56. Participants completed a Qualtrics survey and were assessed using the Revised NEO-Personality Inventory to measure personality traits and facets, the Revised UCLA Loneliness Scale to measure feelings of loneliness, and the Revised Lubben Social Network Scale; Modified Version to measure levels of perceived social support. Analyses revealed a significant negative correlation between gregariousness and Covid-related social isolation ($r = -0.29$, $p = 0.01$), but no other significant correlations were found with positive emotions. Individuals high on neuroticism did not differ from those low on neuroticism for the correlations between gregariousness and both Covid-related loneliness and social isolation. The results of this study suggest that individuals higher on gregariousness (i.e. extraverts) were less likely to feel socially isolated during the initial months of the pandemic due to their sufficient perceptions of and access to their social support network.

2021-312	Poster	Social and Behavioral Sciences

Student Presenter: **Reisert, Hailey D.; *Duke University***
Mentor: **Gaffrey, Michael S.; *Duke University***

Associations Between Emerging Hand Preference & Communication Development in 9-24-month-old Infants & Toddlers

Children with autism spectrum disorder often exhibit deficits in social communication and language development, as well as a disproportionate prevalence of non-righthandedness (i.e., mixed or left-handedness) compared to typically developing peers. In the developing brain, language production is typically lateralized to the left hemisphere whereas manual action is contralaterally controlled. Therefore, emerging infant hand-preference and communication development may be related. The present study examined whether features of infant hand use during naturalistic play could be used to predict caregiver-reported measures of language (MacArthur-Bates CDI) and social communication development (CSBS-dp) among a sample of 9-24-month-olds (n=36).

Infant manual action was coded for every frame (30 frames/second) over 6 minutes of naturalistic, caregiver-infant play with a standardized set of toys. Relevant features of infant hand use were derived from these manual action data. Linear regressions were used to investigate associations between infant hand use features, age, and percentile scores of the CDI and CSBS-dp.

Among our younger subsample of 9-18-month-olds (n=22), those who portrayed stronger right-hand preferences for single-handed play had significantly more advanced expressive language (CDI) than no-preference or left-preferring infants, respectively. Additionally, among our full sample (n=36), older infants used both hands to simultaneously contact separate toys for a significantly greater proportion of play than younger infants, and this both-handed separate play predicted significantly more advanced social development (CSBS-dp). Our findings suggest that features of infant hand use during naturalistic play may be associated with linguistic and social development, though future research should replicate these findings using larger samples.

2021-313	Poster	Social and Behavioral Sciences

Student Presenter: **Reynolds, Devin; *North Carolina A&T State University***
Jones, Vanessa
Mentor: **Singh, Vijay; *North Carolina A&T State University***

Characterization of human lightness discrimination thresholds to spectral variations of visual scene

The human visual system provides a reasonably stable perception of several object intrinsic properties, such as its shape and color, despite variation in the visual signal to the eye due to object extrinsic properties of the visual scene. To characterize such stability in the context of object lightness, a one-dimensional analogue of three-dimensional perceived color, we measure thresholds for discriminating two objects based on their lightness. We measure how these thresholds depend on object extrinsic properties of the visual scene, such as the color of the background objects and the intensity of the light source. For this, we measure lightness discrimination thresholds using computer generated images in which we systematically vary the spectra of the background objects and the light sources. The variation in the spectra is controlled through a parameter that sets the variance of the distribution from which the spectra are generated. We find that for low variance, the thresholds remain nearly a constant, indicating that threshold in this region is set by the internal noise of the observers. As the variance increases, the effect of extrinsic variation starts dominating performance and the discrimination thresholds increase.

2021-314	Poster	Social and Behavioral Sciences

Student Presenter: **Slack, Olivia; *Meredith College***
Mentor: **McLennan, David; *Meredith College***

Exploring Hispanic Nationalism in the United States

This study seeks to determine whether a significant number of Hispanic/Latino individuals in the U.S. feel similarly nationalistic as white Americans. It was hypothesized that a strong minority of Hispanic/Latino individuals will favor racial exclusion, and that these feelings will likely stem from the same kind of racial resentment that white nationalists feel. Data from the Pew Research Center's 2018 National Survey of Latinos was analyzed to determine whether dependent variables of support for racial exclusion or anti-immigration policies and party affiliation or support for Donald Trump were influenced by demographic variables. Questions about immigration policies were used because nationalism often coincides with xenophobia in the U.S., and anti-immigration rhetoric is prominent among nationalist leaders. The hypothesis was supported, with 20.3% of participants favoring expanding the wall along the U.S.-Mexico border, and 26% believing there are too many immigrants in the U.S. Overall, Hispanic men, older people, or people who identified as Republican or evangelical Christian or Catholic were the most likely to feel nationalistic or highly conservative. However, the data also indicated that Hispanic/Latino individuals in the U.S. were still less likely than white people to indicate nationalistic feelings.

2021-315	Poster	Social and Behavioral Sciences

Student Presenter: **Sun, Kennedy; *Duke University***
Mentor: **Hard, Bridgette; *Duke University***

The quest to do it all: How college students' conceptions of balance relate to well-being

There is increasing pressure to be balanced in corporate settings, academic applications, and more. So far, balance has been largely researched through the concept of work-life balance, which emphasizes an equilibrium between personal and professional pursuits. However, this idea does not reflect the lives of students. My project aims to better understand how students spend their time, try to achieve balance, and how balance relates to well-being. Through pilot data collected from Duke Psychology 101 students during Spring 2021 and SONA, a Duke Undergraduate study pool, I identified that students spend most of their time focusing on academics, social/fun, friendship, and family--these are also students top priorities. It seems that student balance is better represented by a multi-point star, like an octagon, rather than the traditional dyadic model of work-life balance suggests. Moreover, students often feel 'somewhat successful' at their top priorities, rather than extremely successful, neutral, or unsuccessful. Finally, the majority of students think balance is extremely or somewhat important.
Moving forward, I want to identify how the way students spend their time and what they prioritize differs based on demographics such as class year, major, first-generation college student, gender, and underrepresented minority status. Our continued research questions include:
1. How do Duke students prioritize their time?
2. How do the ways that students prioritize their time differ across groups?
3. How do different ways of prioritizing time relate to social belonging and well-being?

2021-316	Poster	Social and Behavioral Sciences

Student Presenter: **Tortoriello, Victoria; *North Carolina State University***
Mentor: **Grühn, Daniel; *North Carolina State University***

Critical Thinking in Psychology: A Revised Instrument

Critical thinking is an essential skill for psychology majors to develop valid and relevant advancements for psychological knowledge, to solve real-life problems in a reasonable manner, and to evaluate and conduct research. Lawson and colleagues (2015) developed the Psychological Critical Thinking Exam (PCTE) consisting of 14 scenarios for participants to identify problems with the conclusions in different studies in an open-response format. Despite showing good reliability and validity, the PCTE relies on manual coding of written responses, which makes it very time- and labor-intensive. To employ a simpler method, we revised the PCTE into a forced-choice format, in which one has to specify the stronger argument of two statements. We included measures of metacognition, the monitorization of one's own memory, and extrinsic or intrinsic motivations for taking a Psychology course. We gave the forced-choice PCTE to 161 students (80.8% female) from a large public university. The forced-choice PCTE score was positively correlated with the student's GPA ($r = .32$, $p<.001$) and their earned credit hours ($r = .18$, $p=.025$) suggesting that higher achieving students and more senior students earned better scores. In contrast, the forced-choice PCTE was not correlated to motivations nor metacognitive strategies, showing that these scores are robust against potential confounders. Future research should investigate convergent validity with other general critical thinking tests. In conclusion, the forced-choice PCTE is a valid alternative to the classic PCTE.

2021-317	Poster	Social and Behavioral Sciences

Student Presenter: **Williams, Madi; *UNC Charlotte***
Tirunagari, Anvi
Carlson, Hannah
Kissler, Neha
Mentor: **Mennicke, Annelise; *UNC Charlotte***

Team Science

Team science is a collaborative approach between individuals from different fields coming together to solve a health or social issue (Calhoun, 2013). This presentation will outline how women from diverse disciplines came together to create a measure of bystander intervention, and provide recommendations to facilitate team science amongst faculty, graduate and undergraduate students. First, members of the team were recruited from different fields such as public health, psychology, and social work. Second, each team member took the lead on a portion of the study. This allowed each individual to capitalize on their strengths (e.g., organization, group management, etc.) while also allowing them to evolve in weaker areas (e.g., data collection, data cleaning, social media management, etc.). Challenges to team science include timeline adherence and clarity on roles and responsibilities. Differences in task management may alter deadlines, leading to timeline changes. Flexibility is key to ensuring tasks are successfully completed. While we overall view the division of labor as an asset to team science, it can cause complications without clear, consistent communication. Communication is central to overcoming lack of clarity on roles and responsibilities. We recommend weekly lab meetings, monthly individual meetings, optional weekly office hours, and rapid communication tools such as Slack to facilitate communication across all team members. While there are downsides to team science, this is a vital tool for innovation in current research. If practiced, it can increase productivity, skills gained by researchers, and create positive group interactions, and lead to advances to sciences.

2021-318	Poster	Social and Behavioral Sciences

Student Presenter: **Wucherer, Aimee; *North Carolina School of Science and Math***
Mentor: **Gotwals, Robert; *North Carolina School of Science and Math***

The 9 Keys to Predicting the NC Governorship

As hard as people try, the results of an election are never definite until all the votes have been counted. However, Allan Lichtman already created his own '13 Keys to Predicting the Presidency' in the 1980s, which has proven to be 100 percent accurate in predicting the next popular vote for the US presidential election since 1860. Presidential elections are not the only important elections around, though. I wanted to see how Allan Lichtman's Keys could be used for predicting the Governors of North Carolina (NC) by modifying them to target the powers of Governors. This paper will explain why the new keys were chosen and present how effective they are for predicting past elections of NC Governors. The paper will further simulate a possible outcome for the 2024 NC Governor election based on hypothetical and limited available information.

For past NC Governor elections dating back from 1992 to 2020, the new 9 Keys for Predicting the NC Governorship were found to be 87.5 percent effective at predicting the correct Governor to win the race, meaning the keys correctly predicted 7 out of the 8 elections looked at. Possible Republican and Democrat candidates were then subbed into the keys to predict the 2024 election. However, most necessary information for the keys was not available so hypothetical situations that are logical to occur were used. In conclusion, the new 9 Keys to Predicting the NC Governorship show moderately high success, but should be explored further to increase effectiveness and range.

2021-319	Poster	Social and Behavioral Sciences

Student Presenter: **Yancy, Madeleine; *Duke University***
Mentor: **Bergelson, Elika; *Duke University***

The Impact of Electronic Input on the Language Learning of Visually Impaired, Hearing Impaired, and Typically Developing Infants

The linguistic development of children is essential for their communication and subsequent advancement in life; this area has been highly studied in order to understand it better. However, there is a gap in research about differential input, specifically from electronics, and how this may affect the linguistic abilities of young children. There is even less literature on whether electronic input could have a dramatic impact on children with impaired access to language or extra-linguistic information, such as visually impaired or hearing impaired children. This study attempts to alleviate this gap by exploring the electronic input received by children across conditions, and whether this affects their receptive or productive vocabulary. T-tests and one-way ANOVAs comparing electronic input were non-significant, indicating that all groups received similar amounts of linguistic input from electronic sources. Correlation tests comparing the amount of electronic input with measures of receptive or productive vocabulary were also non-significant, suggesting that the amount of input did not have an effect on linguistic development. In conclusion, the present research did not reveal differences between electronic input across conditions, nor did it show links between electronic input and vocabulary counts, but further research with larger samples is needed to come to a resolution about electronic input and its impacts on linguistic development.

2021-320	Poster	Social and Behavioral Sciences

Student Presenter: **Smith, Akia; *Fayetteville State University***
Mentor: **Hardy, Kimberly; *Fayetteville State University***

Antiracism and Social Work Education

The Council of Social Work Education (CSWE) determines the standards by which social work curricula is developed. This shapes the ways in which social work scholars are educated on the principles, values, and standards of the profession. It is significant that the competencies that are taught within academia prepare scholars for practice that reflect the value and principles of the profession. This study seeks to analyze the curricula of accredited social work programs to observe whether the scholars are prepared to be antiracist change agents. The research study will consist of a content analysis of social work programs within the United States. Additionally, one may infer that social work is not antiracist because of the lack of resources that speak to the social and racial issues of minoritized populations within research literature. Through integrating an antiracist perspective into the curricula, social work education expands it perspective while diversifying the literature with the inclusion of research whose expertise focuses on minoritized populations.

The result of this study supports that the social work curricula of MSW programs, within the United States, focuses more on multicultural education rather than antiracist education. In addition, there is a greater focus on individual change rather than institutional change. The same is true for informing practice rather than policy. There is a total of ten accredited programs included in the data analysis for this research.

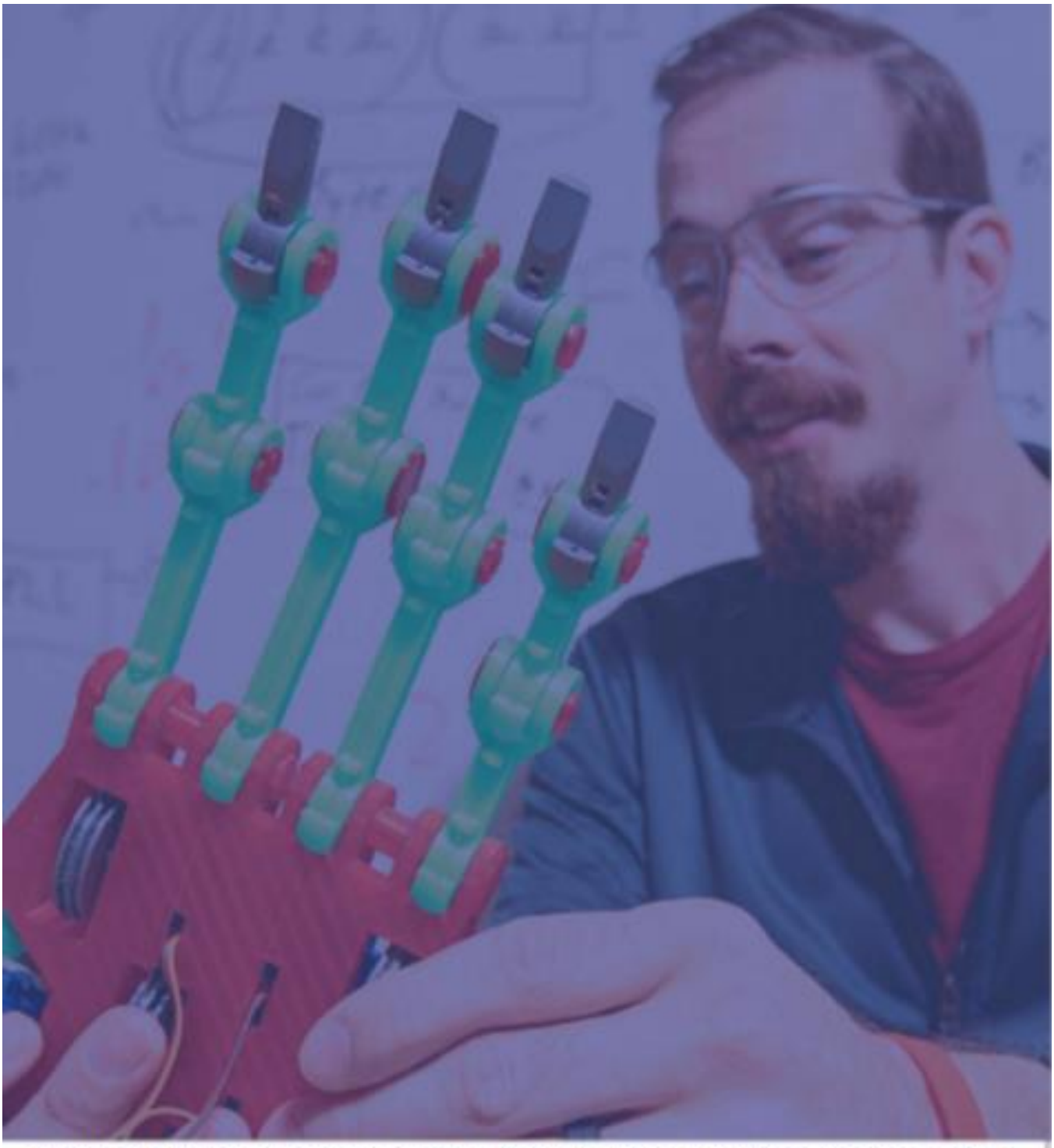
Keywords: Social work, education, content analysis, antiracism, pedagogy, research, oppression, minority populations

2021-321	Poster	Social and Behavioral Sciences

Student Presenter: **Wairagu, Stephanie; *Meredith College***
Mentor: **Perez-Heydrich, Carolina; *Meredith College***

COVID-19 Vaccine Hesitancy Among College Students and Staff

Vaccines have long been a controversial topic. Despite their ability to provide herd immunity in a less riskier way compared to actually contracting a disease, some people remain hesitant about getting vaccinated. The purpose of the study was to identify perspectives expressed by individuals who self-identify as being hesitant towards COVID-19 vaccines. The study further sought to assess factors that influence attitudes towards COVID-19 vaccines and to understand how people go about making personal decisions about vaccination. A systematic review of peer reviewed literature was carried out to interpret different aspects of vaccine hesitancy such as factors that increase hesitancy, and ways to gain public confidence. The study involved the use of an anonymous Google form to collect views of Meredith College students and staff who self-identify as vaccine hesitant. Participants were asked about their perceived risk and severity of COVID-19 infection, sources of credible information, concerns about the available COVID-19 vaccines, views on safety and efficacy of vaccines, and whether any incentives would encourage them to get vaccinated. Some common themes identified among the participants' concerns include: lack of FDA approval, the unknown long-term effects of the vaccine, and the short time of research and testing. Overall, results show that different uncertainties about the vaccine need to be addressed thoroughly so that people can understand the science behind vaccines and have confidence in them.



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