Summer Research Symposium

Friday, August 5, 2022

Popp Martin Student Union

Abstract Book

Summer 2022 Office of Undergraduate Research Participating Programs

NanoSURE REU

NC LSAMP REU

NIH RA (Physics) REU

NSF Criminal Justice REU

NSF Water Purification REU

OUR Summer Research Scholar

Charlotte Teachers Institute

Title: Quantifying Reproductive Behavior in the Sea Anemone Nematostella vectensis

Program: OUR Summer Research Scholar

Student Author (s): William Alexander

Faculty Mentor (s): Dr. Adam Reitzel Co-Advisor: Hannah Justin (Graduate Student)

College: Liberal Arts and Sciences

The Starlet Sea Anemone Nematostella vectensis (Nv) exists widely in coastal estuarine environments across North America. Nv has become a popular cnidarian model organism with a growing number of applications, including evolutionary developmental biology (EvoDevo), genomics, and cell biology. While previous research has established the ability of Nv to reproduce sexually and asexually, their reproductive behavior patterns have not been compared in any quantitative manner. As such, the purpose of this research is to understand how alterations in husbandry mechanisms, such as feeding schedule, aquarium substrate quality, temperature, and light exposure impact reproductive behavior of Nv and to establish trends for both modes of reproduction over time. Separate experiments are conducted to evaluate the aforementioned variables. Population data is collected over a period of five weeks and subsequently analyzed to determine reproductive impact. Additional experimentation is conducted utilizing singly-housed individuals under identical husbandry conditions, and the frequency of cloning and production are recorded over a two-month period. All experimental data is then analyzed using the appropriate statistical tests. Results of this analysis will pinpoint an optimal substrate quality, feeding frequency, temperature, and optimal light/dark period for both methods of reproduction. These results will also provide information regarding reproductive frequency and cycles in Nv maintained within a laboratory setting. The major aims of this body of work are to deepen the field's understanding of reproductive behavior patterns within Nv, in an effort to optimize clonal generation for experiments, as well as improve quality of care for laboratory housed animals.

Title: Identifying Atg27 Vacuolar Localization Dependence to Further Understand Atg27's Function

Program: NC LSAMP REU

Student Author (s): Maya Alexander

Faculty Mentor (s): Dr. Richard Chi

College: Liberal Arts and Sciences

The transmembrane protein Atg27 is known to be required for the facilitation of the localization of Atg9, as well as the formation of Atg9 vesicles, making it essential for effective autophagy in yeast cells. Atg27 is found to move between the pre autosomal membrane structure, the Golgi and the endosomes. In particular, it has been found that Atg27 localization to the vacuole membrane is dependent on its interactions with the AP-3 clathrin adapter protein complex, through clathrin coated vesicles. With the exact function of Atg27 being largely unclear, investigating what other proteins require Atg27 for transport will help us understand the breath of its function. To do this, the Lemmon dataset, a dataset of fluorescent microscopy images was used. Approximately 240 proteins that are known to localize to the vacuole, were N-terminally and C-terminally fluorescently tagged with GFP in strains of yeast. These yeast strains then had Atg27 deleted from their genomes and were imaged through fluorescent microscopy. The AP-3 subunits Apm3 and Apl5 were also deleted separately in the yeast strains. These images were then observed for mislocalizations of tagged proteins to the vacuole. Observation of these deletions allow us to identify which proteins require Atg27 in order to localize to the vacuole. With this approach, we can find proteins and investigate how their function relates to Atg27's function. Our preliminary results have identified proteins that require Atg27 for vacuole localization. After identification, functional investigation of candidates and Atg27 will proceed.

Title: Examining the Risk of Bird-Window Collisions on Campus

Program: OUR Summer Research Scholar

Student Author (s): Joseph Amodeo

Faculty Mentor (s): Dr. Sara Gagné

College: Liberal Arts and Sciences

Window collisions are among the most common causes of death for birds worldwide. With urbanization on the rise, window collisions may increasingly become a persistent threat to bird populations. Bird-window collisions most often occur at low-rise buildings, where over half (56%) the collisions involve buildings that are four to 11 stories high, while the remaining collisions (44%) occur at one to three story buildings. We collected preliminary data for the occurrence of bird-window collisions on a campus where vegetation and low-rise buildings are interspersed. We monitored 22 building sides at the University of North Carolina at Charlotte that were deemed most likely for bird collisions, based on the number and size of windows, vegetation cover, and bird activity. We walked along the building side slowly over an average of five minutes looking for dead or injured birds at each site three times per week. The preliminary results of this assessment showed that, of the 680 monitoring surveys performed thus far, there were 26 deaths involving 10 species, two of which were unknown. The species most at risk from bird collisions were American robins (Turdus migratorious) with 10 deaths and mourning doves (Zenaida macroura) with four deaths. This is consistent with the abundance of these species. These results suggest that locations with thick patches of vegetation nearest the building may be areas of concern for bird collisions. Sides of buildings with dense vegetation patches may be good candidates for the use of bird-friendly glass in windows to reduce bird-window collisions.

Title: Race, Ethnicity, and Beliefs about the Benefits of the Arts

Program: OUR Summer Research Scholar

Student Author (s): Lee-Anne Andre

Faculty Mentor (s): Dr. Vaughn Schmutz

College: Liberal Arts and Sciences

A variety of arts programs in Charlotte provide children, teens, and adults with the space and resources to promote self expression, build confidence, gain exposure to new opportunities, and develop skills that are applicable in settings within and beyond the artistic realm. Some of these programs also aim to address racial disparities in arts participation in Charlotte. As part of a larger study of the impact of the arts in Charlotte, I will explore how race shapes perceptions of the benefits of arts programs. While previous research has identified a wide range of benefits, there is little research on the ways that race and ethnicity may be associated with beliefs about the benefits of arts participation. Based on 48 semi-structured interviews with artists and providers of arts programming in Charlotte analyzed through NVIVO, I will identify beliefs about the impact of the arts and examine differences across racial and ethnic groups. Given the growing racial and ethnic diversity of Charlotte and its arts community, it is an ideal setting in which to explore this question. The findings of this study will provide better understanding about the value of arts participation, the role that it may play in accumulating cultural capital, achieving social mobility, self actualization, and skill attainment.

Title: Effect of Loneliness and Coping During the SARS-Cov-2/COVID Pandemic on Clinical and Biological Indicators of Alzheimer's Disease

Program: OUR Summer Research Scholar

Student Author (s): Saghar Kholghi Arris

Faculty Mentor (s): Dr. Jeanette M. Bennett

College: Liberal Arts and Sciences

Alzheimer's disease (AD), a subcategory of dementia, is considered a progressive mental disease that reduces quality of life and independence as one ages; it is estimated to triple by 2050. Further, AD is linked to tau protein tangles and beta-amyloid deposits that lead to neurodegeneration of the hippocampus and cortex. Chronic stress appears to be connected to the development and prognosis of AD. In March 2020, the COVID-19 global pandemic created a major disruption in everyday life and increased feelings of loneliness, affecting mental health across all age groups, especially among older adults. Thus, the loneliness experience may accelerate cognitive decline. Yet, coping specifically, the use of emotional and instrumental support, may buffer the relationship between loneliness during the pandemic and cognitive function. Thus, the purpose of this study is to examine the relationship among loneliness, coping and AD-related indicators. Using secondary data from the Wake Forest Alzheimer's Disease Research Center (WF ADRC) clinical core, loneliness and coping skills were measured using valid and reliable self-report questionnaires collected from March thru Oct 2021. AD indicators will be estimated as cognitive functioning measured by Clinical Dementia Rating scale and AD-related neurodegeneration assessed by MRI. It is predicted that higher loneliness will be related to lower cognitive function and more significant neurodegeneration. In addition, it is expected that individuals who utilize emotional support to cope with stress will have better cognitive functioning and less neurodegeneration compared to their counterparts who use emotional support less.

Title: Maternal Entrainment of the Circatidal Clock in Fiddler Crabs

Program: OUR Summer Research Scholar

Student Author (s): Isabella Balch

Faculty Mentor (s): Dr. Paola López-Duarte

College: Liberal Arts and Sciences

The circatidal clock is an adaptation of coastal organisms to life in very dynamic environments associated with the tide. This clock can be entrained to changes in pressure, salinity, and/or temperature associated with the tidal cycle. Fiddler crabs (Family Ocypodidae) are a classic model species for studying this clock. The successful completion of the fiddler crab life cycle depends upon this timekeeping mechanism, including embryonic development and larval release. Fiddler crab reproduction is timed to the tidal cycle and synchronous spawning typically occurs during night time high tides to avoid predators. Release during the high tide also ensures the transport of larvae away from adult habitats to coastal, development waters. The objective of this study is to determine if the circatidal clock is entrained via physical stimulation of the embryos by their mother. Spawning times and abdominal pumping activity were recorded under constant laboratory conditions. The number of abdominal pumps was recorded every 15 minutes for several days and the activity was compared to the local tides (collection site in Georgetown, SC). Spawning times were also compared to tidal conditions at the collection site. Both pumping activity and spawning are expected to be synchronized with the high tide and an increase in the intensity of pumping behavior is expected as development progresses. Concurrent to this study, we are also characterizing the pheromones released during embryonic development. The combined results will provide insight into the factors that entrain the circatidal clock in fiddler crab embryos.

Title: Plastic Composition of Black and Turkey Vultures along an Urban-Rural Gradient

Program: OUR Summer Research Scholar

Student Author (s): Sophie Barnett

Faculty Mentor (s): Dr. Sara Gagné

College: Liberal Arts and Sciences

Plastics are pervasive pollutants found in ecosystems worldwide and can cause harmful effects to organisms and constituent environments when accumulated. Previous research shows that black and turkey vultures within the Charlotte Metropolitan area are roosting in larger numbers in areas with high urban landcover and low deer carcass densities, suggesting an adoption of alternative food sources. If urban vultures are adjusting their roosting sites in accordance with higher urban landcover and lower deer carcass densities, then it is likely that they are ingesting more anthropogenic materials than rural counterparts. To measure this, eight roosting locations were selected across an urban-to-rural gradient. Regurgitated vulture pellets were collected biweekly from the studied roosting sites for 15 total collections between January 2021 and July 2022. We evaluated the effect of developed landcover at 10 different spatial scales (0.4, 0.5, 1, 2, 3, 4, 5, 10, 15, 20 km), commercial food establishment density, landfill density, and the density of livestock production sites on the amount of plastic in vulture pellets using repeated measures linear mixed models. We used Fourier Transform Infrared (FTIR) spectroscopy to identify collected plastics. Preliminary results of 880 pellets suggest that developed landcover within 0.4km and 15km landscapes surrounding roosting sites is associated with higher amounts of plastics in pellets. These preliminary results reveal that vultures in closer proximity to urban landcover are utilizing anthropogenic sources as food sources, having unknown implications for the population and the functioning of the urban ecosystem of which they are a part.

Title: Picture Perfect: Public Relations of the American Military during World War I through Postcards

Program: OUR Summer Research Scholar

Student Author (s): Abigail Barrett

Faculty Mentor (s): Dr. Heather Perry

College: Liberal Arts and Sciences

At the outbreak of the First World War, the American military had a problem with how the public viewed them. As a place where men drank, gambled, and had relations with sex workers. To combat this image, Secretary of War Newton Baker and Raymond B. Fosdick, an urban reformer, decided to change the environment of military training camps to focus on soldiers' physical health and moral purity. To achieve this, the government pared with different organizations, an example being the Y.M.C.A to entrain the men in a wholesome manner. The historiography of the U.S. Military training camp reforms during World War I focuses on these organizations and how they worked. I will focus on how the military communicated these reforms to the general public to ensure them that men were not partaking in immoral activities. To do this, I will look at postcards sent from Camp Greene in Charlotte, North Carolina, in the World War I and II Ephemera collection at Atkins Library, noting which parts of the camp they highlight, the activities the men participated in, and their portrayal of the soldiers. Postcards were a popular form of communication at the time as people could send messages to their loved ones with a photograph included to better explain where they were and what they were doing. I will also explore how accurate the clean-cut portrayal of camp life in postcards was by reading Joseph B. Mathews' letters that he wrote to his girlfriend.

Title: Typology of Fame-Seeking Mass Shooters

Program: NSF Criminal Justice REU

Student Author (s): Jessica Benitez, Abryana Kevelier-Williams

Faculty Mentor (s): Dr. Michael Turner, Dr. Beth Bjerregaard

College: Liberal Arts and Sciences

A comparative study found that 56% of all high-fatality mass shootings were committed by fame-seeking individuals and that these incidents have been on the rise since 2010 (Lankford & Silver, 2019). Previous research has shown that fame-seeking mass shootings typically result in larger death totalities and are significantly different from non-fame-seeking incidents (Lankford, 2016). Fame-seeking perpetrators are also generally younger than non-fame-seeking perpetrators (Lankford & Hoover, 2019). These perpetrators also often struggle with personality disorders, such as Narcissism, and exhibit suicidal tendencies resulting in violent behavior (Allwinn, Tultschinetski, Görgen, 2022). Because of their motives, these offenders also attempt to cause maximum destruction. Another feature of fame-seekers is their relationship with the media as they desire validation through social media platforms. Using data from both the Violence Project (Peterson & Densley, 2022) and the State Firearm Law Database, 1991-2020 (Seigel, 2022), this research seeks to develop a thorough typology of the fame-seeking mass shooters by examining the differences between these shooters and other mass shooters by examining the times and locations of these shootings, the background characteristics of the offenders, the lethality of these events, the weapons used in the shootings and the type of gun legislation in effect in the state at the time of the shooting. Policy implications and suggestions for future research will be discussed.

Title: Assessing the Impact of COVID19 on the Health and Well-being of Healthcare Professionals

Program: OUR Summer Research Scholar

Student Author (s): Kritika Reddy Bokka

Faculty Mentor (s): Dr. Monika Sawhney

College: Health and Human Services

The recent pandemic Covid-19 has created a major change in our daily aspects of life. During Covid-19 many groups were affected that range from children to the elderly population. Healthcare professionals must constantly think about protecting themselves, while trying to save and protect others. The increasing amount of responsibility has taken a huge toll on their health and overall wellness. After taking the time to review many literatures that took place from the very beginning of Covid-19, I learned that many Healthcare professionals who were dealing with patients have been dealing with burnout due to becoming emotionally exhausted from working long hours, experiencing a lot of fear, anxiety, and depression from the lack of personal protective equipment (Shreffler et al., 2020). In addition, certain limitations can cause gaps in research because a study done in Italy was done in the very beginning of Covid and the data samples were self-reported questionnaires (Barello et al., 2020). This research will fill gaps through collecting data from healthcare professionals of different demographics to get a broader understanding. This study will partner with the independent physicians of the Carolinas and collaborate with UNCC stakeholders, such as the library staff and the Institutional Review Board (IRB) to conduct a thorough literature survey, maintain databases, and evaluate available instruments. As of now we do not have results, however, we believe that the expected results will help our community focus on improving Healthcare Professionals health and well-being.

Title: Community Resilience in the Face of Gentrification: How are Charlotte's West Davidson and Optimist Park Neighborhoods' Sense of Community Impacted by Neighborhood Revitalization?

Program: OUR Summer Research Scholar

Student Author (s): Katherine Bolt

Faculty Mentor (s): Dr. Erin Banks, Dr. Nhi Cao, and Boris Henderson

College: Office of Undergraduate Research

Gentrification is a phenomenon that disproportionately impacts historically disinvested urban neighborhoods through the influx in development of high-priced real estate properties and retail spaces. This attracts people of higher socioeconomic status to move into the neighborhood and push out long-term residents of lower socioeconomic status. These changes often lead to housing issues faced by black communities which results in significant changes in their community and displacement of residents. This is described by the term "root shock", where dispossession of Black spaces occurs (Croff et al., 2021). The purpose of this project is to listen to the voices of these neighborhoods and learn about the similarities and differences regarding the sense of community and how it has been affected by gentrification.. The methods include a literature review, focus groups, and community surveys. The focus groups are coded for themes and will receive an inter-reliability test for accuracy. We expect the preliminary results to show similarities between the communities in the context of cultural displacement, where there is a loss of community spaces, and a neighborhood that reflects their cultural identity.and familiarity. These findings will contribute to the growing body of literature regarding gentrification and its impact on long-term residents, Black communities, and neighborhood dynamics. Additionally, this project is a part of a larger study of the Charlotte affordable housing issues that seeks to learn from residents and advocate for them to remain in their homes and create a resource guide to help address their needs.

Title: Integration of Habitat Use and Dietary Biomarkers in Marsh-Dependent Fish

Program: OUR Summer Research Scholar

Student Author (s): Kathryn Brinegar

Faculty Mentor (s): Dr. Paola López-Duarte

College: Liberal Arts and Sciences

Several fish enter estuaries during the larval stages and remain there throughout the juvenile stage, where they feed and grow before returning to coastal areas as adults. In contrast to these transient fish, we also find permanent residents that complete their life cycle within estuaries. The first objective of this study is to compare diets of transient and resident fish in southern Louisiana salt marshes. To that end, fish were collected from three sites at varying distances from the coast. Muscle tissue samples from two transient species at the juvenile stage: spot [Leiostomus xanthurus] (n=18), and sand seatrout [Cynoscion arenarius] (n=7) and one permanent resident at juvenile and adult stages, Gulf killifish [Fundulus grandis] (n=57) were stable isotopes indicative of diet (δ13C: energy source; δ15N: trophic position, and δ34S: source and trophic level identification). Preliminary isotopic results suggest that sand seatrout exhibit more marine signatures and a higher trophic position than the killifish and spot. The second objective of this study is to determine whether dietary signatures reflect habitat use. We anticipate fish with more marine dietary markers are more recent arrivals in the marsh, and would have signatures that differ from the marsh resident fish. To evaluate habitat use, we will examine the otolith microchemistry signatures for the same samples. Through the integration of otolith microchemistry and dietary stable isotopes, the life history of the fish will be reconstructed which provides insight into habitat use patterns across the salinity gradient.

Title: A Comprehensive Investigation of Low Energy Availability in Female Athletes

Program: OUR Summer Research Scholar

Student Author (s): Samantha Brooks

Faculty Mentor (s): Dr. Joseph Marino

College: Health and Human Services

Energy availability is the amount of energy a person's body has to perform its normal physiological functions after exercise and is a person's dietary energy intake minus exercise energy expenditure. When energy availability is insufficient, the body is forced to suppress long term health processes in favor of immediate needs, damaging most physiological processes and organ systems. This is caused by athletes intentionally through disordered eating habits to optimize body size for competition, or unintentionally when dietary intake does not compensate for high levels of energy expenditure. The clinical outcomes of low energy availability are usually studied in relevance to the female athlete triad, or the newer male-inclusive syndrome: Relative Energy Deficiency in Sport (RED-S); however, this limits research to symptom based approaches as opposed to a comprehensive investigation of energy availability.The purpose of this project is to examine the holistic impact of low energy availability on female health. This will be accomplished through writing a current narrative review paper and completion of a research project. The study will investigate the role of perfectionism as a factor of female athlete triad development. Perfectionism is a personality disposition focused on flawlessness and achieving high standards set by oneself. When perfectionistic strivings become maladaptive, it can push athletes too far and cause obsession over fitness, disordered eating, and overtraining to develop, ultimately causing low energy availability. This project will achieve a better understanding of low energy availability, its effects on the entire body, and the psychological role perfectionism plays in development.

Title: An Analog Method for Deducing the Self-Diffusion Coefficient of a Single Particle Introduced to a Steady Flow Condition

Program: OUR Summer Research Scholar

Student Author (s): Philip Brown

Faculty Mentor (s): Dr. Russell Keanini, Dr. Jerry Dahlberg, and Dr. Peter Tkacik

College: Engineering

Prior research at UNC Charlotte has shown favorable results in demonstrating the potential for using a vibrating grain bed as an alternative method to study molecular hydrodynamic flow. Unlike other methods, using a grain bed as a macroscopic analog allows for direct observation of molecular flow and particle interactions. In this inquiry, it was desired to track the random displacements of a grain relative to the mean path through a flow field of identical grains. The objective centers on using these measurements to estimate the effective self-diffusion coefficient of a single, molecule-like grain within a vibrated granular fluid. Experimentally, a single grain was first heated in a convection oven and then introduced into a granular flow field having a lower, spatially uniform ambient temperature. The grain was then tracked with a thermal imaging camera, allowing direct observation of the grain's random path within the flow. The experiment was performed multiple times and each iteration was processed into individual vector paths using a PIV (Particle Image Velocimetry) program. Using adaptive PIV software, a quantitative, time dependent, vector path was created for each experimental run. This path was then averaged across all experimental iterations, creating a mean vector path; this, was then expressed in quantitative form using a curve fit method. To extract the self-diffusion coefficient, individual grain paths are modeled as single realizations of a stochastic Weiner process. Finally, using the estimated self-diffusion coefficient, the effective grain fluid viscosity can be determined using the Stokes-Einstein relation.

Title: A Case Study on the Notorious Serial Killer Richard Ramirez

Program: OUR Summer Research Scholar

Student Author (s): Devin Carbonaro

Faculty Mentor (s): Dr. Charisse Coston

College: Liberal Arts and Sciences

From 1970 to 1999, serial murder increased dramatically across the United States. Society's understanding of homicide changed, as did the fear of murder. Although significant attention has been given to serial murders, the definition is still unclear. Serial killers have received an extensive amount of research. Thus there is no factual causation to make a killer. They all go through similar experiences but are never the same. The best way into the mind of serial killers is to study their lives and the crimes committed. The historic nature of serial murderers is that they act similarly, whereas I will focus on proving that wrong. Therefore, to better understand this phenomenon, I will perform a case study on the serial murderer: Richard Ramirez, also known as the Night Stalker. Ramirez was a serial killer who tormented Los Angeles county in 1984. In my study, I will review Ramirez's life while comparing the literature learned from other notorious killers. After assessing the research literature on common characteristics of serial murderers, I can better understand what common features are present in serial killers. The case of Richard Ramirez will then be dissected to compare which of his characteristics match the standard literature. In my research findings, I have found the causation of Richard Ramirez's actions throughout his life and crimes and how that relates to other killers.

Title: Research in Charlotte and Gaston County Concerning Ella May and the 1929 Loray Mill Textile Strike in Gastonia

Program: OUR Summer Research Scholar

Student Author (s): Keely Carlson

Faculty Mentor (s): Dr. David Goldfield

College: Liberal Arts and Sciences

In the 1920s Gaston County was a booming center for the textile industry. However, in the 1920s, it was also booming with unions and strikes as a result of unfavorable working conditions and general abuse of the worker. One such worker was a woman by the name of Ella May. A strong woman, a Communist union organizer and a folk-singing minstrel, murdered in September of 1929. Shot and killed on her way to one such strike in Gaston County. Who was Ella May (Wiggins) and how did different newspapers view her both while she was alive and after she was murdered? The purpose of this research The purpose of this research follows two tracks. First is Ella May herself -- her family, what she was up to, and, ultimately, her legacy. Second, I am researching the reaction to her efforts to bring dignity and justice to an exploitative textile industry and the tragic result of that effort. The methods used included data gathering from microfilm and digitized forms of the various newspapers in and around Gaston county, Charlotte, and other parts of North Carolina, focusing on the years 1928-1936 and 1928-1988, with a focus on any reference made to Ella May. Also included will be data gathered from the Communist Party newspaper, and various American magazines, also for 1928-1936. with reference to Ella May (Wiggins), American Mill #2 in Bessemer City, and Frank Goldberg, the mill owner. Another source will be audiocassettes of interviews of two of Ella May's daughters, Charlotte Wiggins and Millie Wiggins Wandell from the 1980s, conducted at UNC Chapel Hill. Results so far show little mention of Ella May outside of her death, with opinions from various sources showing either sympathy or disdain towards her.

Title: Si(EtHexOBzimpy)2, A Hexacoordinate Silicon Complex for Solution Processable ETLs and OLEDs

Program: OUR Summer Research Scholar

Student Author (s): Michelle Cho

Faculty Mentor (s): Dr. Tom Schmedake

College: Liberal Arts and Sciences

An OLED is an organic light-emitting diode containing a thin film of organic material acting as an electroluminescent layer. Most often, these layers are made of compounds such as tris(8-hydroxyquinolinato) aluminum in most organic electronic devices and instruments. However, there has been rising interest in utilizing new ligands exhibiting lower molecular weight and higher levels of solubility, thermal stability, and fluorescence. Using a rigid hexacoordinate silicon complex design as a scaffold provides a material that meets many of these criteria, but the solubility of silicon pincer complexes to date suffer from poor solubility. The focus of this project will be to use a ligand synthesized from 2,6-bis(benzimidazol-2-yl)-4-hydroxypyridine, or hydroxybzimpy, modified with a 2-ethylhexyl group to enhance solubility. The product of this ligand with silicon tetrachloride will produce a soluble hexacoordinate silicon complex, Si(EtHexOBzimpy)2, which will be able to act as an efficient electron transport material for OLEDs. The ligand is developed through synthesizing hydroxybzimpy and alkylating the material. The resulting ligand is then reacted with silicon tetrachloride and chloroform to produce a hexacoordinate silicon pincer complex that can be spin-coated onto a thin glass slide. The resulting spin coat samples will then be tested to determine the thickness of the film and its charge transport properties, along with surface quality. We predict our samples will show that the hexacoordinate complex synthesized with the 2-ethylhexyl bzimpy ligand will deliver the most favorable results, because of its predicted higher solubility levels due to its longer ethyl group.

Title: Substrate Selectivity of WcfS in B. fragilis

Program: OUR Summer Research Scholar

Student Author (s): Hope Clements

Faculty Mentor (s): Dr. Jerry Troutman

College: Liberal Arts and Sciences

Antibiotics used to fight infectious diseases rarely target specific bacteria and can lead to complications due to the ability to impact symbiotic organisms in addition to the infectious organism. The purpose of the research conducted in our lab is to find new targets for antimicrobial agents that are selective for specific organisms. My research focus is on important enzymes from the pathogenic organism Campylobacter jejuni and the mammalian symbiom Bacteroides fragilis. These enzymes play a similar role in both organisms, but act on slightly different biological molecules. The enzyme PglC from C. jejuni catalyzes transfer of an acetylated amino sugar to a lipid which initiates the formation of a key virulence factor, which is a component of the microbe required for infection. The enzyme WcfS from B. fragilis catalyzes an identical reaction to PglC except it transfers an unacetylated amino sugar with a different stereochemical configuration. WcfS initiates the production of a key symbiosis factor that promotes the development of a healthy mammalian immune system. My goal is to test whether these enzymes can select for the small differences in sugar substrate to determine if that selectivity can be exploited to target one organism over the other. Methods developed for this project can be used with many different kinds of bacterial enzymes to advance the understanding of targeting specific bacteria.

Title: Automated Analysis of Cellulose Nanoresin Membranes in Water Purification

Program: NSF Water Purification REU

Student Author (s): Jenna Costelloe

Faculty Mentor (s): Dr. Jordan Poler

College: Liberal Arts and Sciences

Water purification is currently achieved through single-use, non-regenerable methods. The improvement of this process is being studied with cellulose nanoresins (CNRs) as a novel nanomaterial for reusable water purification. Testing the regeneration and reusability of these materials requires successive cycles that are tedious and time consuming. Each cycle requires deionized (DI) water, sodium fluorescein, and brine to pass through a regenerable, functionalized, CNR membrane. This manual process is inefficient, with only 5-7 cycles completed daily. In a streamlined procedure, we utilize automation to achieve faster testing with a peristaltic pump, with a maximum flow rate of 2.987 mL/min, allowing for approximately 54 trials per day. This new model measures contaminant concentration by UV-Vis absorption. I have calibrated the voltage output of a spct 20 to known concentrations for a calibration curve that is used to determine the stopping point of the contaminant injection. The brine must be removed before the next cycle so I use a calibrated conductivity meter and its output voltage to determine when the system is ready to start again. The conductivity meter and spectrometer 20, allowed me to determine the volume at which a membrane must be regenerated, and the maximum number of regenerations each membrane can function for. This information will indicate the status and success of the CNR membrane in removing contaminants. Through this fully automated system, we demonstrate a more efficient rate of testing novel nanomaterials for environmentally-friendly methods of water purification.

Title: A Systematic Review on Differentiation in Mathematics: Analyzing Publications from 2000 to 2022

Program: OUR Summer Research Scholar

Student Author (s): Abby Dailey

Faculty Mentor (s): Dr. Andrew Polly

College: Education

Differentiation is important in cultivating an equitable classroom environment for all students. When implemented effectively, differentiation in mathematics allows students to work on appropriate skills at the pace that is most conducive to their learning needs and abilities. Students are given multiple avenues of reaching the same goal, building a conceptual understanding of mathematical ideas. Some teachers lack the necessary professional development to properly incorporate differentiated instruction into their mathematics lessons and need to be aware of the dangers of teaching math from a one-dimensional approach (Daniela Căprioară, Virgil Frunză; 2013). This systematic review of abstracts examined trends and commonalities published between 2000 and 2022. The abstracts of 248 publications were examined based on the methods, data sources, grade-level focus, keywords, and findings. Preliminary analyses indicated that differentiating instruction in mathematics for all students is an effective teaching strategy (Muthomi, Mercy W.; Mbuga, Zachariah K.; 2014), but the burden of creating resources for teachers that meets every students' needs can be overwhelming. Teachers are seeking ways that differentiation can be made practical through ideas for implementation (Christenson, Bridget; Wager, Anita A.; 2012) and through professional development (Ensign, Jacque; 2014) on recognizing what students' weaknesses are and how they can be addressed. Findings indicate that most studies focused on how differentiating mathematics instruction positively affects test scores and how differentiation can be effectively integrated using technology and other resources. Future research should include studies about how professional development for educators in differentiating instruction impacts student achievement and growth.

Title: Photophysical Properties and Characteristics of Blue Emissive Thiazolothiazole Systems

Program: NC LSAMP REU

Student Author (s): David Diaz

Faculty Mentor (s): Dr. Michael G. Walter

College: Liberal Arts and Sciences

Blue light emitting materials are notorious for being unstable due to their wide bandgap. Most people already interact with this material as it’s found in many OLED consumer grade products such as the phone found in most people's pockets. It can also be found in many medical applications such as phototherapeutics. Currently, most of industry utilizes rare earth element containing (REE) material to create stable blue light emitting diodes (LEDs) thanks to the Nobel Prize winning work of Isamu Akasaki, Hiroshi Amano, and Shuji Nakamura. With the growing concern of planet preservation, REE containing materials have faced scrutiny for the carbon footprint left behind from the extraction and purification process required for its use; the cost of fabrication also poses an issue to manufacturers. I seek to tackle those problems with thiazolothiazole (TTz) systems; a cheaper solution processable blue light emitting material. TTz systems do not contain REEs, are easy to synthesize, and most importantly are underexplored in terms of blue light emitting research. An array of symmetric donor-acceptor-donor TTz and asymmetric push-push TTz dyes will be studied as polymer processed systems as well as organic aggregates. These systems will be studied for their optical properties using UV-vis, solid-state photoluminescence spectroscopy and time resolved emission spectroscopic methods. An integrating sphere will be used to measure fluorescence quantum yield in the solid state. Properly cataloging an array of stable blue emitters means contributing to the future growth of new technologies that will benefit from the easily processable, environmentally sustainable, and inexpensive solutions provided by TTz systems.

Title: Design of a Water Surface Robot to Effectively Locomote through Machine Learning

Program: OUR Summer Research Scholar

Student Author (s): John Driver

Faculty Mentor (s): Dr. Scott David Kelly

College: Engineering

Machine learning has several applications in robotics, allowing robots to improve their performance in specific tasks through practice in a test environment. A simple fishlike water surface robot is being developed at UNC Charlotte to achieve locomotion through a Hitec-1425CR continuous servo motor that rotates a rotor and causes the foam raft to rotate in the opposite direction due to conservation of angular momentum. The fishlike nature of the robot comes from the oscillatory movement patterns produced by the servo motor. The robot will utilize reinforcement learning, a machine learning technique that allows an autonomous agent such as a robot to interact with its environment and learn an optimal behavior through trial and error. In this research, we aim to optimize the design of the water surface robot and its locomotion. Machine learning algorithms will allow the robot to move in a specified direction in the water. The robot will be constructed of a buoyant teardrop-shaped foam material to operate on the surface of a body of water. The foam material will ensure the safety of the robot's electronics and the hydrodynamic teardrop shape will support efficient locomotion on water. An Intel RealSense T265 tracking camera and a Raspberry Pi 3B will be utilized for the robot's position tracking and locomotion operation. A CAD model will be created to support the robot's design and obtain information such as the robot's center of mass. The fishlike robot can test the effectiveness of using machine learning in a water locomotion environment.

Title: Quantifying Algal Biomass to Understand Water Quality in Urban Ponds

Program: OUR Summer Research Scholar

Student Author (s): Emma Dyson

Faculty Mentor (s): Dr. Sandra Clinton

College: Liberal Arts and Sciences

Globally, water quality degradation is a growing concern. One source of decline is increased algal biomass that can be tied to high concentrations of nitrogen and phosphorus. To understand this relationship, we quantified algal biomass and environmental parameters in urban ponds. Water samples were collected in the Charlotte-Mecklenburg area from two stormwater ponds and two beaver dam ponds of comparable size. Water samples and environmental parameters were collected from four different locations around each pond at relatively equal intervals due to the variability of the algal blooms across the ponds. Algal biomass was measured as chlorophyll a concentration using a fluorometer. Samples from each site were filtered for total suspended solids, then ashed to analyze percent carbon. The remaining field data (conductivity, dissolved oxygen, and temperature) were collected using YSI hand-held meters. Algal taxa were identified qualitatively by counting the number of green algae, blue-green algae, diatoms, and desmids under a compound microscope. Based on preliminary data, stormwater ponds have higher algal biomass variability over time compared to beaver dam ponds that have high consistency in amounts of algal biomass over time at each site. The Beaverdam stormwater site shows the highest variability in algal biomass over time for each sampling location at the site. The inflow area shows the lowest algal biomass while the outflow location has the highest algal biomass. By understanding variability in algal biomass among different types of ponds, we can better assess water issues and improve decision making for water quality in urban areas.

Title: How Access PACs Undercut Effective Lawmaking by Devaluing Minorities, Women, and Working-Class Men

Program: OUR Summer Research Scholar

Student Author (s): Shae Eggert

Faculty Mentor (s): Dr. Eric Heberlig

College: Liberal Arts and Sciences

When determining campaign legislative effectiveness, research has shown that being a minority or a woman in the U.S. House of Representatives provides greater challenges at raising campaign funds from their political action committees (PACs). This results in advantages for white men candidates who are identified by access PAC directors to have greater value in policy areas than women or minority candidates. The value that is placed on white men candidates results from institutional discrimination which provides increased opportunities such as occupations, education, and the degrees they obtain. PACs value candidates who exhibit legislative skills, influential power, and institutional capital which is more difficult for women and minorities to achieve in a white male dominated workspace. This study builds upon previous research on women and minorities in relation to access PAC fundraising to see if white men candidates who come from working class backgrounds face the same disadvantages as women and minority candidates when raising PAC funds. Examining data from the 2000-2014 election cycles, this study looks at candidates' socioeconomic backgrounds, specifically their previous occupations, highest level of education, and the place where they received their education, to find its effect on candidates' legislative effectiveness through PAC funds. To determine if there is an effect on candidates PAC funds who represent low-income districts, this study will examine in-state and out-of-state contributions to determine if candidates who represent lower income districts face additional challenges by raising funds non-locally. If women, minorities, and working-class men represent lower income districts, they are likely to try and identify out-of-state contributions resulting in further challenges to raise PAC funds.

Title: Antibiotic Collateral Sensitivity in Burkholderia Species

Program: OUR Summer Research Scholar

Student Author (s): Ruthie Freedman

Faculty Mentor (s): Dr. Todd Steck

College: Liberal Arts and Sciences

Burkholderia cenocepacia (B. cenocepacia) is a pathogenic bacterium that is highly resistant to a multitude of antibiotics and causes lung infections in cystic fibrosis patients. Collateral sensitivity (CS), a phenomenon where acquired resistance to one antibiotic results in decreased resistance to a different antibiotic, offers a potential long-term antibiotic therapy for treating chronic bacterial infections in cystic fibrosis patients. Preliminary results have identified genes and mutations that may be involved in collateral sensitivity. Confirmation requires introducing those candidate mutations into other strains and seeing if CS is observed. This will be done via lambda recombineering; an established method used once before in a Burkholderia species different from the species I'll be using. To do recombineering requires introducing into Burkholderia a plasmid, pKaKa3, containing the lambda-red genes. I will use two methods to introduce this plasmid into a Burkholderia strain: electroporation and conjugation. Successful introduction will be determined based on phenotype changes and PCR targeting the plasmid. If successful and time permits, I will test whether other candidate mutations take up the plasmid or not.

Title: Practitioner Perspectives on Teaching for Social Justice in English Language Arts (ELA)

Program: OUR Summer Research Scholar

Student Author (s): Tara Gabriel

Faculty Mentor (s): Dr. Heather Coffey

College: Education

Research indicates a need for preservice (PTs) and newly licensed practicing teachers to become knowledgeable and aware of how to teach for social justice. This qualitative study incorporates a culturally relevant education (CRE) theoretical framework, examining the perspectives of practicing teachers on: what it means to teach for social justice, be a critical English educator, and, incorporate social justice topics and culturally relevant teaching into classroom instruction and standard-based curriculum. Purposeful sampling, combined with criterion sampling, was utilized to gather current practitioners; all participants have completed the ELA methods courses in the Middle Grades or Secondary Education program at The University of North Carolina at Charlotte. The methodology of the study includes pre- and post-participation surveys, bi-directional interviews and focus group discussions (whole-group oriented) related to critical English education pedagogy. The data collected will be triangulated and coded for consistency. A formulation of themes will be presented in hopes of better understanding current challenges, strategies, and perspectives of critical pedagogy in the field of education—more specifically, in the English content area. A limitation of this study would be its small sample size, raising possible concerns of replication to a larger population. The researchers anticipate the findings between the learned knowledge about critical pedagogy and applied praxis in the classroom environment to be progressive throughout the study as participant teachers reflect and learn from each other.

Title: Si(bis-triazolylpyridine)2 Pincer Complex for Solution Processable ETL's in OLEDs

Program: NanoSURE REU

Student Author (s): MacKenzie Gascon

Faculty Mentor (s): Dr. Tom Schmedake

College: Liberal Arts and Sciences

Nanoscience has been investigating the use of organic compounds in organic light-emitting diodes (OLEDs) as a cost-effective alternative to the metals used in other LEDs today. OLEDs can be used in monitors and TVs, and also in devices that are paper thin but still emit light. Commercial OLEDs are generally fabricated using thermal evaporation methods that are effective, but slow and expensive, greatly increasing the cost. An alternative fabrication method would be to apply the various layers that make up the OLED using a solution processing procedure, like spin coating or printing. Researchers have been successful in printing many of the OLED layers, but there is a general lack of high quality electron transport layer materials that are solution processable in a manner complimentary with the rest of the stack. There is a great need for solution processable electron transport layers (ETLs) that are able to be processed in solvents that won't dissolve the underlying layers of the OLED stack. The ETL is the layer that transfers electrons from the cathode to the active luminescence region, and it is a critical layer for the OLED device. Dr. Schmedake and his group at the University of North Carolina at Charlotte have been developing ETL materials for OLEDs using hexacoordinate silicone pincer complexes. This project builds upon the study of OLEDs and involves creating a new complex to use in these devices, Si(bis-triazolylpyridine)2. Characterization of the ligand and complex will be conducted, including NMR, crystal x-ray diffraction, Ultraviolet-visible and IR spectroscopy. Preliminary results show good promise in the solubility for ETL's. If time allows, we are hoping to prepare an OLED and determine its spectrum and efficiency.

Title: Functional Genomic Basis of Olfaction in Aquatic and Terrestrial Turtles

Program: OUR Summer Research Scholar

Student Author (s): Pasipanodya Gonese

Faculty Mentor (s): Dr. Laurel Yohe

College: Computing and Informatics

Whether terrestrial or aquatic, turtles have well-developed olfactory systems relative to other vertebrates. With nearly 300 species of turtles, quantitative comparative investigations of turtle olfaction are lacking with respect to this immense diversity. The olfactory system of turtles is split into the olfactory organ, which is speculated to be represented by the Upper Channel Epithelium (UCE), and the vomeronasal organ (VNO), which is speculated to be represented by the Lower Channel Epithelium (LCE). Furthermore, turtles have three subcategorized olfactory receptors: odorant receptors (OR), type 1 vomeronasal receptors (V1R), and type 2 vomeronasal receptors (V2R). My preliminary research suggests that the UCE detects airborne signals while the LCE detects waterborne signals. Typically, animals have class 1 and class 2 olfactory receptors, respectively detecting waterborne and volatile cues. According to early research, turtles tend to have more class 1 olfactory receptors. Early indications show that turtles have some of the most diverse olfactory systems. UCE and LCE have a mixture of all these subcategorized types of olfactory receptors, making it difficult to distinguish which receptors are fully responsible for their separate specializations. My project quantifies these values of the different olfactory chambers in the noses of different turtle species at different stages using μCT-scan data. Given how the VNO may specialize in detecting waterborne signals, I expect vomeronasal receptors to be essential in detecting waterborne cues. Early research has shown V1R receptor genes to be found mainly in more terrestrial animals, while V2R genes are the mechanism for detecting waterborne chemicals, equivalent to class 1 olfactory receptors. Therefore, I expect to see much more V2R genes expressed in the LCE.

Title: State of the Plate 2022: A Current Assessment of Food Insecurity and the Effects of COVID-19

Program: OUR Summer Research Scholar

Student Author (s): Rae Gordon

Faculty Mentor (s): Dr. Nicole Peterson

College: Liberal Arts and Sciences

Food insecurity is dependent on many contributing factors. Often, intersections of social, physical and economic disparity correlate to unequal ability of some individuals to meet basic needs, such as healthy foods. Additionally, COVID-19 has potentially exacerbated these inequities through shifts in employment, or through restriction of those who are immunocompromised, and unable to leave their homes. This study is aimed at analyzing the characteristics associated with greater risk of food insecurity in Mecklenburg County and the pandemic's direct effects. To assess this we, in collaboration with the Charlotte Mecklenburg Food Policy Council, Loaves & Fishes, Mecklenburg County Health Department, Farmers Market Management Services, and many other local organizations, have surveyed about 260 respondents above the age of 18 and living in Mecklenburg County. Our results were compared to demographic data in current county records to gauge if this information is representative of the population. The responses were analyzed with SPSS, including calculating a USDA food insecurity score for each respondent. This data was also assessed to determine trends and populations with higher levels of food insecurity as well as how food insecurity may have been affected by the COVID-19 pandemic. This is a part of a much larger ongoing project aimed at identifying the most common elements involved with the threat of food scarcity and inaccessibility. Armed with this insight we hope to propose new recommendations, and facilitate better access to current available solutions, with the end goal of assuaging the problem of food insecurity in the county.

Title: Synthesis and Development of Radialene Catholytes in Neutral pH Redox-Flow Batteries

Program: NanoSURE REU

Student Author (s): Isabella Grayson

Faculty Mentor (s): Dr. Christopher Bejger, Dr. Mitch Anstey

College: Liberal Arts and Sciences

Aqueous redox-flow batteries (RFB) are an energy storage technology currently in need of catholytes that offer high solubility alongside electrochemical reversibility and stability in relevant charge states. Radialene derivatives are now found to be an excellent catholyte in RFBs due to their reversibility, stability, and ability to be synthesized for further solubility. Increasing the solubility of these radialene derivatives can be done by adding mono-, bis-, and tris- ester groups onto the [3]radialene compound. Factors affecting RFB efficacy, including solubility and reversibility, will be discussed.

Title: Idealized Simulations of High Shear, Low-CAPE Supercell Thunderstorms in Great Plains and Southeastern U.S. Environments

Program: OUR Summer Research Scholar

Student Author (s): Jasen Greco

Faculty Mentor (s): Dr. Casey Davenport

College: Liberal Arts and Sciences

High-shear, low-CAPE (HSLC) environments occur when anomalously high vertical wind shear makes up for a lack of convective available potential energy (CAPE); the combination of these ingredients can result in severe weather that is particularly difficult to forecast. Supercell thunderstorms in such environments are not very common, but when they do occur they can generate high wind speeds, large hail, and spawn numerous tornadoes. Previous research rooted in observations has demonstrated that the initial conditions, severity, and longevity of HSLC supercell cases differ depending on their location in the United States, with an emphasis on comparing events in the Great Plains and the Southeastern U.S. This study leverages idealized model simulations to conduct a more detailed comparison of the intensity, duration, and severe weather production of supercells evolving in the differing background environmental conditions. The Cloud Model 1 (CM1) non-hydrostatic numerical modeling software was used to run the simulations. Base-state model conditions were selected from inflow soundings from previous research of 10 supercell events (5 from the Great Plains and 5 from the Southeastern U.S.). Each experiment tests a different sounding to identify how those environments impact supercell characteristics. Comparisons are then made between supercells that developed in the different geographic environments. Such information will be useful to forecasters to better anticipate HSLC storm impacts in various regions of the U.S.

Title: Identifying Emotions that may Arise within a Bystander in Response to Witnessing Problematic Alcohol Use

Program: OUR Summer Research Scholar

Student Author (s): Gabrielle Haley

Faculty Mentor (s): Dr. Annelise Mennicke

College: Health and Human Services

Many college students are introduced to alcohol in social settings during college. The social nature of alcohol consumption during college contributes to excessive drinking and leads to dangerous outcomes. Given that there are other students in these social settings, these other people are bystanders who could possibly intervene to mitigate harm. Though, the emotions that a bystander has in these situations can act as a barrier or facilitator when deciding whether to intervene. The purpose of this study is to identify the emotions that arise within bystanders as they decide to intervene in situations where problematic drinking occurs. Virtual focus groups discussions and interviews that lasted 60-120 minutes were conducted to gain a realistic understanding of what bystander intervention looks like among college students. A focus group interview guide containing questions on situations involving problematic alcohol use and being a bystander in those situations was developed to facilitate discussions. Participants were full-time students enrolled at UNC Charlotte between the ages of 18 and 25 years old. Participants in the study consisted of first year students, sexual and gender minority students, racial and ethnic-minority students, members of fraternities and sororities, intercollegiate student athletes, and general students who were not a part of these groups. The focus group discussions and interviews were transcribed, and a codebook was created to identify the range of opportunities and types of reactions to alcohol-related situations. Thematic coding was conducted to group common concepts to form themes. Final results are forthcoming; however, initial results reveal the importance of emotions in using bystander intervention strategies. Those that emerged within emotions were fear/worry, annoyance, aggression, pride, and guilt/shame/regret. Identifying the emotions, a bystander has as they are intervening in situations of problematic drinking could help guide training in a bystander intervention, to increase helpful bystander behavior used by peers.

Title: The Relationship between Racial Discrimination and Mental and Physical Health among College Students

Program: OUR Summer Research Scholar

Student Author (s): Rhoen Hoff

Faculty Mentor (s): Dr. Jeanette M. Bennett

College: Liberal Arts and Sciences

Racial discrimination is unfair treatment one receives because of their racial or ethnic characteristics. Many ethnic minorities report experiencing a greater quantity and more distressing levels of racial discrimination in comparison to White individuals. Racial discrimination is associated with poorer mental and physical health outcomes. Situational discrimination, such as in the healthcare setting, occurs more frequently among racial minorities and is associated with unmet healthcare needs and a greater likelihood of delaying healthcare until condition severity meaning poorer health outcomes. In spaces meant to improve health, minorities can experience the opposite. This study's purpose is to examine if experiences of racial and healthcare discrimination are linked to negative mental and physical health outcomes among college students.Young adults at UNC Charlotte (n=302) were recruited to complete an online study about being treated unfairly and health. Lifetime experiences of racial discrimination and mental and physical health outcomes were assessed through validated and reliable self-report questionnaires. Experiences of healthcare discrimination will be estimated by averaging two health-setting specific items from two discrimination measures. It is expected that greater racial discrimination will be associated with poorer mental and physical health compared to those with lower levels. Additionally, it is expected that participants who experience more healthcare discrimination will have poorer mental and physical health compared to those with little to no experiences with healthcare discrimination.

Title: Robotic Aquatic Reinforcement Learning Using Stereo Vision and Inertial Measurement Unit Localization Sensor

Program: OUR Summer Research Scholar

Student Author (s): Beren Hollingsworth

Faculty Mentor (s): Dr. Scott David Kelly

College: Engineering

Autonomous robots are useful in performing a variety of tasks more efficiently than humans could. However, to design and program an autonomous robot, significant effort must be devoted to understanding and modeling the interactions of the robot with the environment around it. Machine learning algorithms allow a computerized robot to automatically test different inputs and check to see how the desired outputs are affected. A machine learning algorithm can learn to characterize a complex system that would otherwise be difficult and time consuming for a human to model. This project uses machine learning to attempt to control the locomotion of a simple hydrofoil across the surface of a body of water. A foam raft is assembled out of teardrop shaped buoyant foam with a continuous rotation servo placed on the top middle. The servo rotates a rotor which causes the hydrofoil raft to rotate in the opposite direction due to conservation of angular momentum. The raft can translate by wiggling the tail of the hydrofoil back and forth. As the desired behavior of the raft is to maximize translational control, understanding the raft's position is critical to the success of machine learning training. An Intel Realsense T265 device uses stereo vision and inertial measurement unit (IMU) data to estimate the raft's location as it is moved. This sensor can be used to accurately detect the position of a raft in a pond to use to train a reinforcement learning model to locomote across the surface of a body of water.

Title: The Stationer's Widow: The Executrix, Probate, and the Early London Book Trade

Program: OUR Summer Research Scholar

Student Author (s): Katie Holly

Faculty Mentor (s): Dr. Kirk Melnikoff

College: Liberal Arts and Sciences

Recent scholarship dedicated to the wills, inventories, and other probate documents of the men and women who participated in England's early book trade has given us new insights into its practices, management, and personnel. Women, it turns out, were given far more power and responsibility over family and business affairs than scholars previously assumed. We now know that 89% of women were legally appointed executrix of their husband's will before 1640, a position that required significant knowledge of their husband's financial and business affairs, British laws, and court and legal proceedings. This study builds upon previous research by closely following an early modern woman's role and responsibilities as executrix. Specifically, it will focus on Elizabeth Burby, widow of London stationer Cuthbert Burby, and her extensive work as the appointed executrix of his will. While her husband is well known as a publisher and bookseller in the 1590s and 1600s, Elizabeth has been mostly ignored by scholars, assumed to have had little to do with her husband's successful career in the book trade, despite her continuing to publish titles and operating the bookshop after his death in 1608. Elizabeth's responsibilities as executrix suggest a considerable knowledge of the book trade and her husband's business, from hiring a scribe and being appointed executrix to getting court approval, collecting and settling debts, distributing legacies, and settling matters with the probate court and Stationer's Company of London. Furthermore, it implies wills and probate documents are influential tools in uncovering the power and responsibility of women in the early English book trade.

Title: Examining the Roles of Neuroticism and Extraversion with Social Support on Depression: Potential Pathways to Enhance Mental Health

Program: OUR Summer Research Scholar

Student Author (s): Jasmine Hopkins

Faculty Mentor (s): Dr. Jeanette M. Bennett

College: Liberal Arts and Sciences

Depression is a common worldwide illness that affects the quality of life, alters brain structures, and can even lead to suicide. Over the past few decades, the increase in depression and depressive symptoms among college students has increased from ~10% to nearly 45%. Personality characteristics like elevated neuroticism or lower extraversion may influence the development of depressive symptoms or episodes. Additionally, greater social support can prevent the development of and treat depressive symptoms. In light of the ongoing pandemic, social support may be especially important for college students as they navigate the transition to adulthood. The purpose of this study is to examine if certain personality traits, along with differences in social support levels, are associated with depression in college students. College students (n = 601) at University of North Carolina at Charlotte completed an online survey about health from Sept 2020 thru July 2021. Personality, levels of social support and depressive symptoms were assessed using validated and reliable self-report questionnaires. Regression based analyses will be used to examine the main and interactive effects among neuroticism, extraversion, and social support on depressive symptoms. It is expected that participants reporting lower levels of social support, regardless of their personality type, will have greater depressive symptoms compared to those with higher social support. However, those with higher neuroticism and lower extraversion will be particularly sensitive to their level of social support, such that those with lower social support will be linked to the greatest levels of depressive symptoms.

Title: Analysis of Student Reflections in Computer Science Courses Using Text Processing Tools

Program: OUR Summer Research Scholar

Student Author (s): Quinn Howard

Faculty Mentor (s): Dr. Modsen Dorodchi

College: Computing and Informatics

Student reflections are a tool used by professors to obtain student feedback throughout the semester. Professors can use this feedback to improve their course and deliver the information to students in a more effective fashion. This also allows professors to get direct feedback from ‘at-risk of failing the course’ students who are struggling in the course and may need additional help and resources. The purpose of this study is to use visualizations, machine learning, and additional software tools to arrange and organize the information for the professors. Algorithms include statistical analysis, natural language processing and sentiment analysis techniques using Python. This study uses students’ feedback as well as their performance as the input data. These reflections include multiple types of multiple-response and open-ended questions such as: 1) How do you feel about the course so far? As well as topic-specific questions, such as 2) How confident are you that you could apply linked structures (such as linked lists) effectively in a programming project or coding question? To visualize this data, tools such as Matplotlib in Jupyter Notebooks are used. In this work, I will investigate the insight gained from reflections, analyze the relationship between reflections and students’ experience in the classroom, and assess the usability of reflection visualization techniques .

Title: Multi-Robot Prioritized Exploration with Dynamically Introduced Time Limit

Program: OUR Summer Research Scholar

Student Author (s): Adam Hudson

Faculty Mentor (s): Dr. Srinivas Akella

College: Computing and Informatics

Most robotic exploration algorithms allow us to map a building completely. While a very useful approach, it isn't always needed. Some situations call for a different priority in what is mapped. For example, situations where emergency responders need to know the interior of a building in a short period of time. A thorough mapping is not always necessary and doesn't provide the information in a rapid manner. In a previous work, by Datta and Akella (2021), a prioritized exploration algorithm was introduced to have a robot explore an unknown environment with a dynamically imposed time limit. This algorithm allows us to tell a robot how to explore an indoor area and report back after a dynamically introduced time limit. The first task in this project is to experimentally demonstrate the original algorithm on a Turtlebot 3 mobile robot. The second task is to improve upon the algorithm by distributing the exploration across several robots. Distributing the work allows for the system to have redundancy, accomplish it more thoroughly, and cover more area in the same amount of time. One of the major issues with any multi-robot path planning is that the code needs to simultaneously localize the robots and corroborate the maps generated by each of them to create a unified map. Another issue is how to have the robots communicate which robot is exploring where. This work plans to demonstrate how multiple robots can be used to effectively explore the environment collaboratively and distribute the prioritized exploration algorithm.

Title: How Does Fine-Scale Urban Development Affect Air Quality? An Evaluation of Urban Spatial Patterns and NO2 Across Seasons

Program: NC LSAMP REU

Student Author (s): Javon Jackson

Faculty Mentor (s): Dr. Gang Chen

College: Liberal Arts and Sciences

As the world population continues to grow, cities all over the world have to build more to accommodate this issue. Meanwhile, reactive gases induced air pollution, such as NO2 will also grow, which are harmful to our health causing various cardiovascular diseases and making life difficult for people who already have cardiovascular diseases. Many researchers are now focusing on a solution for controlling levels of NO2 using geospatial science and technologies, such as remote sensing. Our goal for this research project is to find a statistical relationship between the time of the year involving urban development patterns and NO2 levels and what types of patterns can effectively address this issue. I will first extract NO2 concentration and urban land cover data collected from satellite sensors throughout the county. I will then form a regression model to see if there is a relationship between the time of year and levels of NO2 and assess what urban spatial patterns can effectively reduce NO2.

Title: Visualizing Alignment in Joint Attention

Program: OUR Summer Research Scholar

Student Author (s): Daniel Jackson

Faculty Mentor (s): Dr. Alexia Galati

College: Liberal Arts and Sciences

Success in joint tasks requires shared understanding and coordination between team members. Some studies suggest that, in motor tasks, various coordination patterns (including alignment and complimentary) can support achieving shared goals (Wallot et al., 2016; Gorman et al., 2017; M. J. Richardson et al., 2015). I aim to continue to narrow down predictors of joint task efficiency. However, beyond motor coordination, it's unclear how task partners coordinate other aspects of their behavior, including their language user and shared attention. This study is designed to test and further develop existing models of interpersonal coordination. Pairs of participants used maps to either count landmarks that shared some features or to plan a route between two given stations. Their eye movements and their conversations were recorded. In this project, I will focus on evaluating alignment in joint attention, as indicated by participants' eye fixations. I will do so by visualizing alignment in two ways: (1) generating videos that illustrate the pairs' eye fixations over the course of a trial, and (2) generating cross-recurrence plots, which illustrate the density of recurrence points during the trial (i.e., when pairs are looking at the same locations). I hypothesize that pairs' eye fixations align more closely during route planning than landmark counting tasks. This trend should emerge from task-specific requirements for sharing a consistent joint perspective to obtain the correct answer. This project has the potential to shed light on the patterns of coordination (e.g., alignment vs. complementarity) that support language use during collaborative problem-solving.

Title: The Impact of Mass Shootings on the Stock Market

Program: NSF Criminal Justice REU

Student Author (s): Lauren Jaeger, Megan Rivera, Matthew Lehman

Faculty Mentor (s): Dr. Michael Turner

College: Liberal Arts and Sciences

Mass shootings are a subject of increased scrutiny in the United States. According to the Gun Violence Archive, mass shootings occur when four or more individuals are shot (injured or killed) in a single incident, at the same general time and location, not including the shooter. From 2014 to 2021, data sources have reported 3,393 mass shootings; approximately more than 1 incident per day. Existing research on mass shootings has largely focused on their impact on gun sales, gun control, mental health, and various socioeconomic conditions. Comparatively, fewer studies have been conducted analyzing the economic impact of mass shootings; particularly in relation to the stock market. This project provides an investigation into the effects mass shootings have on various sectors of the stock market. To assess the impact, we investigated the trend in stock values of several publicly traded companies following notable high fatality mass shootings. Preliminary findings and policy implications will be discussed.

Title: Funding Challenges in the Mecklenburg County Food System During COVID-19: Opportunities and Next Steps

Program: OUR Summer Research Scholar

Student Author (s): Mariam Jaliawala

Faculty Mentor (s): Dr. Nicole Peterson

College: Liberal Arts and Sciences

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 wants to understand the perspectives of food organizations, the toll the pandemic has had on the populations they serve, and the ways organizations are trying to overcome these obstacles. I conducted interviews with organizations about their experiences with Covid-19, with questions related to funding and collaboration and the barriers the food system faces. The method we used to analyze the interviews was by coding through nvivo for themes like partnership and collaboration and funding challenges. We found in these interviews that partnership and collaboration were a huge asset during the pandemic. Covid-19 opened doors for many organizations including the ones that were growing because they were able to reach more people through zoom. We also found that partnerships have increased during Covid and allowed organizations to create opportunities to initiate and accelerate distribution of food and labor through building resilience and economic mobility (see also Boyacı-Gündüz et al.). Furthermore, the research allows us to gain a better understanding of the communities around Charlotte and to develop recommendations such as having a farmer's market near neighborhoods so healthy foods are accessible and local food systems can support communities and increase resilience.

Title: Using Image Kernels and Edge Detection to Mitigate the Effects of Noise in Machine Learning Identification Algorithms

Program: OUR Summer Research Scholar

Student Author (s): Aiden James

Faculty Mentor (s): Dr. Xingjie Li

College: Computing and Informatics

Machine learning technology is becoming increasingly proficient at identifying objects in images. However, the detection software that relies on pixel values is often interrupted by imperfections in the quality of the image, such as Gaussian noise. Most solutions to this problem require artificial intelligence. We aim to mitigate this issue using a simpler and more efficient algorithm. Using image kernels, an outline was created on an image and the same image with Gaussian noise applied. In order to maximize the efficiency of this algorithm, the black and white outline was stored as a binary matrix of only ones and zeroes. Only having two possible numbers allows the matrix functions to be executed much faster. After this outline is created, we tested edge and corner detection using both applied kernels and Harris corner detection. Any value of one in the matrix that is not identified as a corner or an edge is removed due to the high likelihood that it is noise. We will test this system on the sharp images and their counterparts using supervised learning algorithms to verify that it improves the accuracy of machine learning programs. We expect that this system will be a more efficient way to mitigate the effects that noise has on machine learning algorithms.

Title: DNA and Protein Interactions

Program: OUR Summer Research Scholar

Student Author (s): Maanav Jariwala

Faculty Mentor (s): Dr. Jun-tao Guo

College: Computing and Informatics

Single-stranded DNA (ssDNA) binding proteins are crucial for biological processes including replication, transcription, and genomic integrity. We can better comprehend the function of the proteins and their interactions with ssDNA with structures of ssDNA binding proteins. However, the number of known ssDNA binding protein structures is still very small, despite recent advances in experimental protein determination methods. Lately, the implementation of AlphaFold2, a state-of-the art, artificial intelligence-based method, has led to a breakthrough in protein structure prediction. In this project, we will use the predicted ssDNA binding protein structures from AlphaFold2, on a dataset of annotated non-redundant ssDNA binding proteins. The goal is to identify novel folds for ssDNA binding proteins from the predicted structures by comparing them with existing structures. A comparison with several structure similarity search methods will also be performed.

Title: Testing of Mechanical Properties of 3D Printed Ceramic-Polymer Composites

Program: OUR Summer Research Scholar

Student Author (s): Micah Jenkins

Faculty Mentor (s): Dr. Erina Joyee

College: Engineering

Cellular bone scaffolds have been widely used for biomedical bone implants and multi-tissue regenerations. In recent years, 3D printed honeycomb lattice structures have been utilized as bone scaffolds. 3D printing, or additive manufacturing, is an avant-garde manufacturing technology that constructs 3D objects in a layer-by-layer manner from a 3D design model. The purpose of this study is to investigate the design and mechanical properties of two different lattice structures for such scaffold application by using digital light processing (DLP) 3D printing process. Acrylic based photopolymers and resins reinforced with ceramic particles have been used to print. In this study, a 10 mm sided cube was designed and printed by using two different honeycomb structures with square and hexagonal unit cells. Different printing process parameters and orientation of support structure have been optimized for the overhanging structure with 0.4 mm wall thickness.The 3D printed honeycomb structures are then examined by uniaxial compressive tests to evaluate the mechanical behavior of such cellular structures. Finite element analysis (FEA) is also used to evaluate the compressive performance of the honeycomb structures in order to extract the stress-strain response of these fabricated structures. Testing of the lattice structures is still ongoing, however we expect the results to reveal the hexagonal honeycomb structure to display increased stiffness and strength as compared with the square honeycomb structure. Furthermore, the addition of ceramic material in the polymer matrix will improve the overall strength, stiffness, and hardness of the printed specimens as well as the compression performance of the honeycomb structures.

Title: The Impact of COVID-19 on Mass Shootings

Program: NSF Criminal Justice REU

Student Author (s): Sarah Jimenez, Stephanie Vail, Ariana Rodriguez, Brooks Mattey

Faculty Mentor (s): Dr. Michael Turner, Dr. Beth Bjerregaard

College: Liberal Arts and Sciences

Recent research has shown that the COVID-19 pandemic has caused behavioral changes across the American population. The COVID-19 pandemic and resulting quarantine increased isolation behaviors around the country, affecting mental health, gun buying purchases, and overall crime rates. Thus, if behaviors such as mental health, gun buying, and crime were affected, then a clear question over whether mass shooting behaviors were affected can be made. This study builds upon past research by investigating whether the COVID-19 pandemic affected temporal trends of mass shooting behavior. To investigate this, we will be using data from the Gun Violence Archive to conduct statistical analysis on mass shootings between the time periods of April 1, 2017 to June 1, 2019 and April 1, 2020 to June 1, 2022. To gain as comprehensive of an understanding over mass shooting incidents as possible, our research will also investigate whether there are any differences in mass shooting rates when three independent filters of analysis are applied to the data: geographic region, state political affiliation, and gun law legislation restrictiveness. We expect to find that mass shootings have increased since the COVID-19 pandemic, and that when analyzing the data through the lens of our three variables, the rate of mass shootings will vary, respectively. The results of our study will serve to potentially help aid law enforcement and policy makers better navigate their response to mass shootings.

Title: Classifying EEG Data To Detect And Forecast Mistakes

Program: NC LSAMP REU

Student Author (s): Miguel Jover

Faculty Mentor (s): Dr. Jake Lee

College: Computing and Informatics

To match the increasing demand for interactions with artificial intelligence (AI) in medicine and science, many strive to find the most efficient and accurate method to interact with AI models. Brain-computer interfaces (BCI) allow for direct communication between the human brain and the AI model by interpreting biosignals into commands and predictions. Direct brain communication with AI accelerates the development and heightens the reliability and accuracy of AI research. One of the most popular biosignals for BCI, electroencephalogram (EEG) data, has been widely used because of cost-effectiveness and high precision time measurements. Error-related potential (ErrP) is the brain's automatic response to errors and mistakes, which can be captured with EEG devices. Therefore, detecting ErrP signals enhances human interactions with AI and improves reliability in the medical and behavioral science fields. For instance, error detection can aid in motor neurorehabilitation by analyzing the ErrP signals of a rehabilitating patient's intended motor movements. After establishing an ErrP classifier, it is possible to branch off to build an ErrP forecasting model, which predicts future brain signals and detects mistakes before they occur. Forecasting mistakes would enhance training and safety tenfold in domains of artificial intelligence where mistakes are catastrophic and must be avoided at all costs (i.e., self-driving car algorithms). In this project, we analyze the collected EEG brain signal data and develop predictive machine learning models to forecast possible future erroneous events. Various machine learning methods are explored and tested to be able to relate human behaviors and brain signal patterns.

Title: Identifying, Verifying, and Facilitating Solution Paths and Vocabulary Use in College Algebra Problems

Program: OUR Summer Research Scholar

Student Author (s): Abraham Kalani

Faculty Mentor (s): Dr. Michael Smalenberger

College: Liberal Arts and Sciences

In mathematics instruction, verbal descriptions of steps are necessary to assist students with understanding the completion process of a particular math problem. However, instances of omissions, inaccuracies, or avoidances of proper math vocabulary hinder instruction and learning. The purpose of this study is to promote the use and fluency of proper math vocabulary by college students with the assistance of a conversational agent embedded in an intelligent tutoring system. To achieve this purpose, hand-written explanations of solution steps to college algebra exam questions were used to create natural language processing models in LightSide that provided labels to each description. The sample of exam explanations came from 237 students enrolled in three sections of an introductory mathematics course taught by a single instructor during the Fall 2021 semester. Initial accuracy and kappa values ranged from 78% to 88%, which indicate promise in this project. Future work will involve an expanded dataset that includes additional mathematics and statistics topics, model-tuning, and an identification of appropriate responses from the conversational agent. This study provides the following: insights to authoring conversational agents embedded in intelligent tutoring systems and expansions of self-explanation and help-seeking literature.

Title: Influence of Quantum Entanglement on Bohmian Trajectories

Program: OUR Summer Research Scholar

Student Author (s): Ethan Keller

Faculty Mentor (s): Dr. Donald Jacobs

College: Liberal Arts and Sciences

The Bohmian formulation of quantum mechanics simultaneously tracks positions and momenta of particles and enables the determination of trajectories of quantum objects through the quantum potential that accounts for entanglement. Quantum entanglement occurs due to the superposition of quantum states in such a way that it is impossible to factor the quantum state into a product of uncorrelated states. Due to statistical correlations, particle motions are affected by the degree of entanglement, which is strictly a quantum effect not seen in classical systems. We study the influence of quantum entanglement on particle trajectories by controlling different entanglement levels for one or more particles moving through a channel. Starting with the simplest case of one particle in one dimension, we add orthogonal degrees of freedom that confine the particle to a channel, and then consider a collection of non-interacting particles. The number of product states increases with the increase in the number of degrees of freedom. The phase of each term in the sum over the product states is dynamically determined through entanglement. A quantum system is classified as coherent when there is a phase relationship between product states. A quantum system becomes decoherent when the phases on product states are randomized. Decoherence is the root cause for quantum motions to transition to the classical motions observed in our daily lives. We characterize the transition from quantum to classical behavior as the entanglement from the environment increases to elucidate the measurement problem within the Copenhagen interpretation of quantum mechanics.

Title: Comparative Study of Protein-DNA Interactions

Program: OUR Summer Research Scholar

Student Author (s): Zarin Khan

Faculty Mentor (s): Dr. Jun-tao Guo and Dr. Fareeha Malik

College: Computing and Informatics

Hydrogen bonds play a significant role in protein folding and protein-ligand interactions, especially in specific protein-DNA recognition. Protein-DNA interactions are essential in many biological processes such as regulation of gene expression, DNA replication, repair, transcription, recombination, and packaging of chromosomal DNA. These protein DNA-binding proteins encompass different binding affinity and specificity levels to both single-stranded DNA (ssDNA) and double-stranded DNA (dsDNA). However, the distribution of hydrogen bonds, especially hydrogen bond energy (HBE) between the different types of protein-DNA complexes needs to be investigated. This project will look into the differences in hydrogen bonds between protein-ssDNA and protein-dsDNA interactions. More specifically, we will compare the hydrogen bond energy distribution in different types of protein-DNA interactions. Both protein-ssDNA and protein-dsDNA interactions will be grouped into specific and non-specific categories for the comparison of hydrogen bond energy. Specific DNA-binding proteins only bind specific DNA target sequences while non-specific DNA-binding proteins bind DNA sequences indiscriminately. The overall findings of this project will contribute to our understanding of the role of hydrogen bond energy in protein-DNA interactions.

Title: Effects of Consistent Exercise Training on Handgrip Strength in the Older Adults

Program: OUR Summer Research Scholar

Student Author (s): Adam Khrais

Faculty Mentor (s): Dr. Trudy Moore-Harrison

College: Health and Human Services

Handgrip strength is a viable screening tool that can be used to assess the overall health and any risk factors for older adults. Implementation of physical activity can help improve strength and mobility, but the association with handgrip strength has not been thoroughly examined. Thus, the intention of this study is to determine if any relationship is present between weekly physical activity and hand grip strength. A total of approximately 20 participants aged 60 years and over will be participating in this study for the initial phase; participants will be gathered from one individual senior citizen center. Participants will engage in consistent physical activity for 6 weeks, 2 times a week for 45 minutes. The physical activities will be randomized every week and will engage every major muscle group (physical activities will be adapted for seniors). Physical activities will include chair and standing exercises of durations less than 40 minutes. Participants will be heavily monitored when engaging in physical activity to ensure their safety. Prior to the workouts, examinees will participate in a hand grip strength test; this will be measured prior to the physical activities for all 8 weeks. A digital grip strength dynamometer will be used for the measurements. We predict that the implementation of weekly physical activities will improve hand grip strength by at least 10 pounds of force in older adults. Developing a connection between physical activities and hand grip strength will provide more awareness of the importance of having a physical lifestyle and the benefits that can arise from it.

Title: Development of Cycloquinquepyridine (CQQP) for Organic Electronic Applications

Program: NanoSURE REU

Student Author (s): Charles (Charlie) Knust

Faculty Mentor (s): Dr. Thomas A. Schmadeke

College: Liberal Arts and Sciences

The goal of this project is to create a more efficient and stable matrix for thermally activated delayed fluorescent (TADF) enabled organic light emitting diodes, OLEDs. In an OLED, various organic materials are deposited in layers that are designed to transfer electrons and holes from the electrodes to the active region that contains an electroluminescent compound. A singlet exciton that can relax radiatively emits a photon of light, whereas 75% of the time, charge carriers combine to form a triplet exciton which is non-radiative. Consequently, the energy efficiency of the OLED is greatly reduced. Promising Newly-developed TADF dyes are able to harvest the triplet exciton by thermally converting the triplet exciton to a singlet exciton state, which provides a pathway to OLEDs that would be much more efficient (approaching 100% quantum efficiency). To enable the TADF dye, new wide band gap hosts are necessary. The TADF host should have excellent charge carrier mobilities, thermal stability, thin film properties, and a wide band gap. CQQP, a molecule consisting of five pyridine units linked together in a circle, is hypothesized to possess the properties needed for a TADF host material. The synthetic procedure for CQQP involves in-situ production of Ni(COD)2, a catalyst for pyridine coupling. Bipyridine, NiBr2 and 1,5-cyclooctadiene (COD) are mixed then combined with freshly-activated zinc dust to make the catalyst. 2,6-dibromopyridine is then added dropwise to the catalyst solution. CQQP complexed with nickel is a major product of this reaction based on mass spectroscopy (MALDI) evidence. Procedures for the purification of the Ni(CQQP) complex are being developed with goals to remove the nickel and generate our metal-free CQQP compound. Once isolated and purified, the CQQP compound will be characterized and its electronic and chemical properties will be analyzed to determine the suitability of CQQP as a host for TADF emitters. This work is made possible through NSF grant #1757619.

Title: Paleoneurobiology of Olfaction in Non-avian Dinosaurs and Stem Archosaurs

Program: OUR Summer Research Scholar

Student Author (s): Saipriya Kotcharlakota

Faculty Mentor (s): Dr. Laurel Yohe

College: Computing and Informatics

At the end of the Permian period, one of the greatest mass extinctions occurred in Earth's history. This event was known as the Permian-Triassic extinction, where approximately ninety percent of the species on earth were killed and surviving species were placed into an extensive variety of niches with decreased competition. As early Triassic archosaurs were adapting to these ecological niches, changes in sensory perception are often necessary. Although many archosaurs such as ancestral birds and crocodiles were seen to evolve an elevated sense of acoustic and visual abilities, the evolution of the sense of smell in response to the environment of that time is less understood. While acoustic and visual senses process signals that can be understood through physical properties, chemosensory systems such as taste and smell are less straightforward and process signals from a multidimensional chemical space, one which would have been very complex, especially after the End-Permian Extinction. Moreover, the olfactory receptor genes are considered the largest multigene family in terrestrial vertebrates, which function in detecting and binding odor molecules in the environment. Therefore, it is important to understand how these genes evolved in non-avian dinosaurs and other stem archosaurs since many were known to have keen sense of smell to detect plants, predators, and even mates. This research aims to understand the diversity of olfaction in non-avian dinosaurs and other stem archosaurs and will also trace the evolutionary history of smell using modern taxa of related clades. Additionally, regression models will be created to analyze relationships between the olfactory subgenome size and the whole genome size for genome size prediction in fossils.

Title: Using Neural Networks to Measure Differences in the Error Related Protocol Patterns Across Multiple Brains

Program: OUR Summer Research Scholar

Student Author (s): Aiden Lamar

Faculty Mentor (s): Dr. Minwoo Lee

College: Computing and Informatics

Brain Computer Interfaces (BCIs) allow a user's brain signals to control or alter a computer system. However, due to our lack of understanding of the human brain, and the noise in brain signals, specific instructions or action requests are difficult to pinpoint. Furthermore, nonstationarity of brain signals among individual subjects makes it even harder to facilitate BCIs in real-world applications. This study aims to leverage neural networks to analyze brain waves and recognize patterns correlated to Error-related Potentials (ErrPs) of different subjects. ErrPs are patterns found in brain signals when a subject perceives or enacts an erroneous action. By training a neural network to identify these patterns from large datasets, we can teach the classifier to detect the pattern and also the latent representation for it. In a simple gaming setting, we collect brain signals for data collection. This gaming setting has very clear goals, and when the user or program acts in such a way that fails to progress towards that goal, ErrPs can be detected. We utilize visualization tools and deep neural networks to analyze the similarities and differences between subjects. From this project, we expect to learn how to use tools like Docker and Jupyter Notebooks to design and implement a neural network that can be trained to discover patterns in impedance data from an EEG. We also hope to determine the magnitudes and amount of differences is ErrP patterns between subjects.

Title: Biodegradable Dissolved Organic Carbon in Stream Outflow of Urban Stormwater and Beaver Ponds

Program: OUR Summer Research Scholar

Student Author (s): Jordan Landis

Faculty Mentor (s): Dr. Sandra Clinton

College: Liberal Arts and Sciences

Urbanization has resulted in increased water runoff from impervious surfaces which has led to degraded local streams. In response, urban areas have relied on stormwater infrastructure to reduce runoff into streams by retaining water in ponds. However, stormwater ponds are likely to foster high density algae growth due to their surrounding anthropogenic environment. High algal concentrations create elevated concentrations of high quality dissolved organic carbon (DOC) that would be more bioavailable for microorganisms to respire. Beaver ponds are a natural alternative to stormwater ponds that have the potential to abate microbial respiration in-pond and downstream due to higher concentrations of terrestrially sourced, low quality DOC. This study seeks to measure biodegradable dissolved organic carbon (BDOC) at downstream progressions of urban stormwater and beaver ponds. Samples will be collected from pond in-flow, in-pond, and out-flow, and will be incubated containing an inoculum curated of native microorganism colonies to each pond to be measured intervally for DOC concentration and quality. The percent loss of DOC concentration, BDOC, will quantify DOC reactivity and quality. Additionally, the optical methods fluorescence index (FI), fluorescence humification index (HIX), and specific ultraviolet absorbance (SUVA) will be used to measure DOC quality by examining carbon compound characteristics to understand the input source of pond DOC. These findings will establish how urban stormwater and beaver ponds contribute to downstream DOC concentration and quality, which can impact carbon flow through freshwater ecosystems as well as carbon emissions from urban ponds.

Title: Understanding the Role of the Ras/MEK Pathway in the Permissiveness of Pancreatic Cancer Cell Lines to Oncolytic Vesicular Stomatitis Virus

Program: OUR Summer Research Scholar

Student Author (s): Daniel Langdon

Faculty Mentor (s): Dr. Valery Grdzelishvili

College: Liberal Arts and Sciences

Pancreatic ductal adenocarcinoma (PDAC) is one of the deadliest cancers due to late diagnosis and its resistance to standard cancer therapies. Oncolytic virus (OV) therapy is a new method in the battle against cancer, using viruses as a way to selectively infect and kill the malignant cells. Vesicular stomatitis virus (VSV) is one such OV, and different, clinically relevant, human PDAC cell lines have shown to have different levels of permissiveness to VSV. The major goal of our laboratory is understanding cellular pathways and individual molecules determining permissiveness or resistance of PDAC cells to VSV. A previous unpublished study in the lab involved screening about 1500 approved drugs by the Food and Drug Administration (FDA) to determine how these drugs affect the permissiveness of 4 different PDAC cell lines to VSV. I conducted a critical analysis of the screening results and discovered that all drugs that inhibited the Ras/MEK pathway had a strong negative effect on VSV replication in PDAC cell lines. I hypothesize that Ras/MEK pathway plays a major positive role in permissiveness of PDAC cells to VSV-based OV therapy. In my project, I will test this hypothesis by testing Ras/MEK inhibitors in a large panel of PDAC cell lines, and I will examine specific step(s) of VSV replication cycle affected by Ras/MEK pathway. These studies will allow us to determine why some PDAC cell lines are more permissive than others, and to develop more effective VSV-based therapy for PDAC patients in the future.

Title: The Teamwork of Silver Nanoclusters, Lectins, and Quantum Dots as Antibacterials

Program: NanoSURE REU

Student Author (s): Jalen London

Faculty Mentor (s): Dr. Afonin

College: Liberal Arts and Sciences

This research will attempt to solve the increasing issue with the use of current antibiotics on bacteria as a treatment. Due to bacteria's ability to quickly reproduce and introduce new mutations that can effectively help them survive, antibiotics are only temporary solutions. Furthermore, such antibiotics are not capable of discerning harmful bacteria from those beneficial to our microbiome. Such complications have led to new advances in the Nucleic Acid Nanoparticles, also recognized as NANPs. NANPs capitalize on the nature of DNA (high stability) and RNA (increased flexibility) to create various structures such as nanorings, nanocubes, duplexes, fibers, etc. Specifically, we will be attempting to use silver nanoclusters (AgNCs) held in a manufactured hairpin structure as a new form of antibiotics that propose a more permanent solution. Silver has already been used as a means of food packaging, air, and water purification, and treating textiles. As can be seen, it serves as an effective antibacterial agent. By using a cytosine-rich section of the hairpin structure, silver can attach to a scaffold to keep it from aggregating. Quantum Dots, nanoscale clusters of atoms comprising a core and shell, will be used as scaffolds for these hairpin + AgNCs. They haven't been shown to significantly affect bacterial growth. Moreover, lectins, proteins that bind specifically to sugars, can attach to these quantum dots and serve as targeting and biomarking. Thus, lectins promote higher selective antibacterial efficiency due to their ability to adhere to specific sugars on the lectins, allowing the treatment to target different bacteria strains. To test the efficiency of the bacterial growth inhibition, our research will be conducted in three progressive stages. First, we will experiment using different amounts of AgNC and quantum dots to see which binds the best by using an agarose gel, ChemiDoc, and varying ratios of these AgNC duplexes to quantum dots. Then we will be testing the ability of the lectins to bind to quantum dots by using agarose gel, ChemiDoc, and varying ratios of these lectins to quantum dots. Finally, we will complete a bacterial growth inhibition assay by using a Tecan spark plate reader to look at the absorbances over 20 hours with different treatments.

Title: Abundance and Composition of Saltmarsh Macroinvertebrate Species Across a Salinity Gradient

Program: OUR Summer Research Scholar

Student Author (s): Rachel Magallon

Faculty Mentor (s): Dr. Paola López-Duarte

College: Liberal Arts and Sciences

Southeastern Louisiana's levee system prevents flooding of metropolitan areas from the Mississippi River, while the West Pointe à la Hache siphon lowers river water levels by releasing freshwater. Biodiversity is high at both ends of the salinity spectrum (0-35 PSU) and low in brackish water (5-10 PSU). Therefore, a siphon can impact biodiversity by changing the area's salinity gradient. The purpose of this project is to determine how this created salinity gradient impacts the species abundance and composition of saltmarsh macroinvertebrate groups (nematodes, worms, insects, crustaceans, mollusks). This project aims to (1) predict the impact of freshwater input on macroinvertebrate community abundance and composition using previously established salinity tolerances, and (2) compare macroinvertebrate community abundance and composition across a salinity gradient. We hypothesize that saltmarshes further from the siphon will have lower macroinvertebrate biodiversity, following Remane's estuary diversity model. Specifically, with increasing distance, freshwater-adapted species will decrease in abundance while marine-adapted species will increase in abundance. Nylon litter bags filled with dried vegetation were deployed in the study sites for two months, prior to freshwater input. Collected macroinvertebrate samples were preserved in ethanol, sorted, and identified in the laboratory. A prior project's literature review results indicated that ~60% of the system's present taxonomic groups (e.g., poduridae, acari) have narrow salinity tolerances while ~40% (e.g., decapoda, gammaridae) have wider tolerances. It is expected that lower salinity conditions via freshwater input benefit macroinvertebrate community biodiversity, and that sites further from the siphon will have lower macroinvertebrate biodiversity.

Title: Gold Coated Superparamagnetic Nanoparticles to Eliminate Bacteria

Program: NanoSURE REU

Student Author (s): Innocenzo Martellucci

Faculty Mentor (s): Dr. Juan Vivero-Escoto

College: Liberal Arts and Sciences

Nanotechnology can have a major impact to solve some of the most challenging health issues of our time. In particular, the development of microbial resistance to antimicrobial agents is one of the biggest public health issues of the 21st century. Metallic-coated nanoparticles could be a step closer to solving the super bacteria problem and provide a better way to treat people with wound infections. In this project, we will fabricate Magnetic nanoparticles (MNPs) made from Iron Oxide, which will be further coated in a gold or silver shell or other antibacterial elements. In addition, The MNPs could be used to better penetrate biofilms by creating new channels within them, which in turn would help to attack the most protected bacteria. Their magnetic ability will also help remove the NPs from the treated area along with the treated bacteria. A major problem for this approach is to reliably synthesize core-shell MNPs coated with gold or other elements to be used against the bacteria. For example, The MNPs tend to aggregate with each other; in addition, the gold coating is not efficient enough to create a shell around the nanoparticles. In order to combat these problems, I have analyzed literature from across the field to further understand different processes to synthesize these core-shell nanoparticles. In this project, different synthetic approaches will be tested. To determine whether the synthesis of the core-shell MNPs has been successful or not, I will be using a series of analytical and structural techniques. These techniques include DLS (Dynamic light scattering) to understand the size and zeta potential of the MNPs, UV-vis (ultra-violet visible spectroscopy) to compare the uncoated MNPs to the coated allowing us to see if the gold coating worked. Eventually, I would get TEM (Transmission electron microscope) images to have a better characterization of the created particles to get a more appropriate sizing. Finally, if a successful synthetic approach is found in the timeframe of the summer program, the nanoparticles will be tested against bacteria.

Title: Determining Clustering Capabilities via the Tox21 Dataset

Program: NIH RA (Physics)

Student Author (s): Nate Mauney

Faculty Mentor (s): Dr. Donald Jacobs

College: Liberal Arts and Sciences

The Tox21 dataset, created by the National Institute of Health, is a collection of over 12,000 small molecules representing potential drugs. Each molecule has 16 characteristics listed that are intrinsic to its physical/chemical properties. Further, each molecule has experimental labels as yes, no or unknown, indicating whether it binds to 12 specific proteins. This dataset is used to challenge researchers to find more efficient ways of predicting if a drug candidate molecule will interact with any given protein before doing the measurement. The dataset was used to train machine learning algorithms and to test them in the Tox21 competition. Unfortunately, the classification problem is not fully solved. The most accurate method to date, DeepTox, has obtained about 0.85 for the area under the receiver-operator curve that quantifies specificity and sensitivity. The Tox21 dataset provides a benchmark for an in-house machine learning method called Supervised Projective Learning with Orthogonal Completeness (SPLOC) that is similar to a Hopfield neural network. SPLOC falls into the category of explainable artificial intelligence (XAI), and uses emergent properties of data characteristics to cluster data. There are two versions of the clustering measure used currently that relate to hard linear or soft non-linear decision boundaries. After benchmarking the performance of SPLOC on the Tox21 data, the outcome of this work will help understand the advantages and disadvantages of each clustering method, how to generalize the clustering method, and determine how well SPLOC performs compared to the state-of-the-art DeepTox results.

Title: Examining Inter-personal Difference with Brain Computer Interfaces

Program: OUR Summer Research Scholar

Student Author (s): Derrick Mayall

Faculty Mentor (s): Dr. Minwoo Lee

College: Computing and Informatics

When you get scared, feel accomplished, or even feel sad, your brain is processing an event or task that you are doing in a way that we can now measure using BCI (Brain Computer Interface) technology. It is hard to find research on how two people's brains process the same task in either a very different or similar way. What patterns might be very similar between the two people? Or how do they process it differently? Answering these questions is what we intend to do with my research. To do so, we will need to gather brain data on myself and another person that is working on the same task or witnessing the same event. With this data, we will compose a graph based on brain activity over a time interval doing a task and compare it, in the hopes of spotting any similarities and major differences between the two. We will also calculate the differences between both data sets to figure out how closely they relate or differ from each other using MSE (margin of squared errors). To make the data as accurate as possible, we will implement dimensional reduction (tSNE and PacMAP) and data visualization for observation. From this research, we are expected to learn and practice how to gather, handle, visualize, and compare the data. Gaining these skills will allow us to complete and continue these practices whether we are continuing to participate in this research or when we are working at another internship for a company or even in class.

Title: Solution Processable OLED

Program: NanoSURE REU

Student Author (s): Ebony Mayo

Faculty Mentor (s): Dr. Tom Schmedake

College: Computing and Informatics

Organic electronics offers the potential to reduce the costs and environmental impact of electronic devices. By passing power to the organic components sandwiched between the electrodes, OLEDs produce light. One of the challenges in the field of organic electronics is the need for solution processible electron transport layer materials (ETLs). ETLs are responsible for transporting electrons from the cathode to the active region of an organic light emitting diode (OLED). The purpose of this research is to develop an N-butanol soluble ETL that could enable the ETL to be spin coated from an N-butanol solution. N-butanol has the advantage of not dissolving any of the underlying layers in the OLED that get deposited before the ETL gets deposited. To accomplish this goal, modified Si(bzimpy)2 complexes will be synthesized, where bzimpy is the 2,6-di(benazamidazol-2-yl) pyridine ligand. N-butanol solubility is hypothesized to be enhanced by adding a hydroxyethylether to the bzimpy ligand. The solubility of the resulting complex in N-butanol will be quantified, and solutions of the modified complex will be used to spin-coat ETL films for testing and integration into prototype OLEDs.

Title: Is Fish Growth Impacted by River Diversions into Saltmarshes?

Program: OUR Summer Research Scholar

Student Author (s): Kenzie McNamara

Faculty Mentor (s): Dr. Paola López-Duarte

College: Liberal Arts and Sciences

Sand seatrout are transient fish species where adults live and reproduce in coastal waters and larvae enter the estuary and remain there during the juvenile stage. Different environmental conditions can influence the growth of these juvenile fish. Fish otoliths ($CaCO_3$ structures in the inner ear) incorporate trace elements associated with these environmental conditions as the fish ages. The relationship between otolith size and fish length is well studied; however, in the presence of river diversions, this relationship is less well understood. The objective of this study is to determine if fish growth is impacted by river diversions. Fish otoliths (n=93) were collected from four saltmarshes at <1, 5.5, 6, and 11 km from a Mississippi River diversion in southern Louisiana. If there is an observed difference in the relationship across the four sites, the microchemistry of the otoliths will be explored to see if high trace metal concentrations (e.g. copper, lead) are associated with said relationship. Based on otolith size, similar aged fish are expected to be smaller nearest to the siphon where trace metal concentrations should be highest. Otoliths were cut, polished, and cleaned for Laser Ablation Inductively Coupled Plasma Mass Spectrometry analysis. Otoliths were also photographed and measured using computer aided image analysis to generate size relationship graphs. The results of this work will help us to understand the influence of river diversion on fish growth and general impacts on the juvenile fish that inhabit these saltmarshes.

Title: “May Cause Dizziness”: The Intersection of Gender Identity & Disability

Program: OUR Summer Research Scholar

Student Author (s): Casey Mesaeh

Faculty Mentor (s): Dr. Jessamyn Bowling

College: Health and Human Services

Approximately 39% of transgender and gender non-conforming (TGNC) people report having one or more disability compared to 15% of the general population. Further, the dramatic social and physical changes of the pandemic led many individuals to reconsider their gender while navigating disability. As a growing percentage of the population identifies as TGNC, understanding the diverse perspectives of this group becomes increasingly important. The Gender Identity Development Framework maps the interactive effects of gender related sense of self and intrapersonal developmental process in TGNC individuals. Using this framework, we aim to examine how disability may impact gender identity shifts among adults in NC.

We conducted 25 photo-elicited interviews, in which participants’ photos prompted interview discussion. Participants reported experiencing a shift in their gender since the start of the pandemic, were at least 18 years of age, and lived in NC. Interviews and photographs were analyzed using content and thematic analyses in Dedoose qualitative software.

Preliminary results align with previous research reporting high rates of disability among TGNC people. Further, disability was reported as impacting all four dimensions of Gender Related Sense of Self in the Gender Identity Development Framework. Participants discussed how disability delayed or complicated their understanding and constrained their embodiment of gender. However, participants also expressed that authentic expression of their gender identity helped minimize the negative impacts of their disabilities and displayed abundant cognitive flexibility and resilience. By centering disability to examine its intersection with gender identity, we highlight processes and opportunities for strengths-based approaches.

Title: NinerUp

Program: NC LSAMP

Student Author (s): Tyler Minnis

Faculty Mentor (s): Dr. Marlon Mejias

College: Computing and Informatics

Preparing undergraduate students for life after they graduate is the most important pillar for every university. By using modern human-computer interaction and concepts from game design, it is possible to give students the skills that cannot be taught in traditional classrooms. This can be done through “gamification” which is the process of implementing games for specific purposes. According to the study “A Behavior Model for Persuasive Design” by BJ Fogg, the correlation between motivation, ability, and triggers can determine if an individual is likely to complete a task. This can be measured by using a behavioral model that represents various elements to each factor of one’s behavior. By using this knowledge in addition to the concept of gamification, we can create a user interface that will engage students in doing tasks like attending workshops and engaging with their peers that will prepare them for their plans after graduation and satisfy their interests. This program would improve their soft-skills, technical competencies, and research readiness. The long term goals of NinerUp are to create a platform which can be used by any department at the university and to use the socio-technical approach to bridge the tacit knowledge gap that first-generation and underrepresented students face when considering graduate school.

Title: Use of Biosynthesis Pathways to Express Non-native Uridine Diphosphate-Linked Sugars in E. Coli for Study and One-pot Synthesis of Bacterial Surface Glycans

Program: OUR Summer Research Scholar

Student Author (s): Claire Moneghan

Faculty Mentor (s): Dr. Jay Troutman

College: Liberal Arts and Sciences

Bacteria produce many different kinds of biomolecules on the surface of their cell membranes that serve a wide range of functions such as sensing nutrient sources, adherence to a surface, and formation of biofilms. Many of these biomolecules are glycans that interact with host organisms. Interactions between bacterial glycans and host organisms can be beneficial (with anti-inflammatory effects) or be harmful (causing illness). Assembled glycans from particular organisms can be used as potential anti-inflammatory therapeutics or as vaccines that would instill immunity against host-cell interactions that cause disease. Making glycans chemically has enormous challenges including problems with the availability and expense of starting materials and the sheer number of steps needed to prepare them. Previous work in our lab has shown that entire biosynthesis pathways can be introduced through plasmids to E. coli to produce bacterial glycans. Using E. coli as cell factories of biomolecules allows us to bypass many steps that would be needed to chemically synthesize them. The purpose of my work is to design plasmids to create a library of E. coli that will produce intermediate building blocks (uridine-diphosphate-linked sugars) that can be assembled into any fully functional bacterial glycan. By doing this, we shift the burden of chemical synthesis to a bacterial host system requiring us to simply isolate these materials from the organism after it is produced.

Title: Design and Test an Obstacle Avoidance Algorithm on a Semi-Automated Vehicle

Program: OUR Summer Research Scholar

Student Author (s): Marcus Neacsu

Faculty Mentor (s): Dr. Amirhossein Ghasemi

College: Engineering

Obstacle Avoidance algorithms are used to automate today's self-driving cars and tomorrow's unmanned ground vehicles. The algorithms must be able to detect the presence of a collision threatening obstacle and create a new trajectory to avoid an incoming crash and return to its original road path. An obstacle avoidance algorithm will be designed to operate a motorized steering axle of a golf cart using Arduino, Raspberry Pi, DC Motor and Motor Driver, Encoder, radio module, Lidar, and a Camera. A live obstacle detection program was coded in Python and used with the Camera and the Lidar sensor data. The data is generated from the detection of the object of interest and used to determine the distance from the vehicle, in which the cart would steer left or right according to the object's relative position to the car. When the experiment was simulated in MATLAB and tested in real life, it was determined that video camera-based obstacle avoidance algorithm is proven to be a suitable obstacle avoidance algorithm. Due to the mounting position, the Lidar sensor is better for longer distance and wide range detection, although it has a few blind spots near the car since the sensor can't detect objects fifteen degrees below the sensor. The camera on the other hand, can more accurately identify the obstacle, but only when the object is closer to the camera lens. The data from both the Lidar and the camera will be used simultaneously to have a more robust and reliable obstacle detection and avoidance algorithm.

Title: Synthesis, Characterization, and Self-Assembly of POSS-Porphyrin Derivatives

Program: OUR Summer Research Scholar

Student Author (s): Anh Nguyen

Faculty Mentor (s): Dr. Juan Vivero-Escoto

College: Liberal Arts and Sciences

Photodynamic therapy (PDT) is a photochemistry-base technique that uses photosensitizers (PSs) to induce apoptosis or necrosis in cancer cells via the production of reactive oxygen species. PSs such as porphyrins, are highly hydrophobic molecules, which usually form aggregates in aqueous solutions. These aggregates exhibit a self-quenching effect that reduces their phototherapeutic capabilities. Therefore, new alternatives are needed to improve the solubility of PSs. Our group has created adaptable scaffolds to functionalize PSs with a wide range of functional groups using polyhedral oligomeric silsesquioxane (POSS) molecules. In this work, we are using the POSS-porphyrin compounds to fabricate nanoparticles for PDT. A foreseeable advantage of this approach, is that due to the steric hindrance associated to POSS structure, the self-quenching effect between PSs could be reduced resulting in a higher phototherapeutic outcome from the nanoparticles. The isobutyl POSS will be used in this study to carry out the synthesis and characterization of POSS-Porphyrin molecule that is the precursor for the nanoparticles. The POSS-Porphyrin compound will be characterized using a variety of analytical methods including infrared (FT-IR), nuclear magnetic resonance spectroscopy, and UV-vis spectroscopy; and matrix-assisted laser desorption/ionization (MALDI)-mass spectrometry (MS). The precipitation approach will be used to fabricate the nanoparticles through self-assembly of the POSS-porphyrin molecule. Dynamic light scattering (DLS), transmission electron microscopy (TEM), UV-vis, and fluorescence spectroscopy will be used to characterize the nanoparticles. The phototherapeutic ability of the nanoparticles will be tested in cancer cells.

Title: Autonomous 3D Mapping using Line Coverage with a Husky UGV

Program: OUR Summer Research Scholar

Student Author (s): Ninh Nguyen

Faculty Mentor (s): Dr. Srinivas Akella

College: Computing and Informatics

To help autonomous vehicles work with high accuracy and efficiency, researchers have developed several algorithms to achieve simultaneous localization and mapping (SLAM). SLAM is implemented with multiple sensors (e.g., LiDAR, wheel odometry) to scan nearby objects, map the environment, and update the vehicle's location. For autonomous ground vehicles equipped with LiDAR sensors, we use the lightweight and ground-optimized LiDAR odometry and mapping (LeGO-LOAM) library to address the SLAM problem. Using the line coverage library developed at UNC Charlotte recently (Agarwal and Akella 2020), we can create a vehicle plan to inspect road networks with a minimum cost, such as travel time. In this study, we integrate the LeGO-LOAM and the line coverage libraries to develop a semi-autonomous program to control a Husky ground vehicle and build a 3D map of selected portions of the UNC Charlotte campus road network. We will compare the localization accuracy of the vehicle with GPS sensor data and assess the feasibility of using the LeGO-LOAM and the line coverage libraries to create 3D maps of environments.

Title: The Influence of Focus of Attention Training on Sagittal Plane Biomechanics in Patients with Chronic Ankle Instability

Program: OUR Summer Research Scholar

Student Author (s): Ashley Norton

Faculty Mentor (s): Dr. Abbey Thomas Fenwick

College: Health and Human Services

Lateral ankle sprains are among the most common musculoskeletal injuries. Approximately 40-70% of these patients will repeatedly sprain their ankle and develop chronic ankle instability (CAI). An ankle sprain is the result of excessive inversion in which the lateral ligaments of the ankle complex are stretched or torn. Once injured, these ligaments do not provide adequate stability to the ankle. Thus, individuals with CAI experience altered movement and gait, decreased range of motion, and decreased strength that current rehabilitation does not adequately refine long-term, necessitating the development of novel rehabilitation strategies. This study seeks to determine if external (ExFOCUS) or internal (InFOCUS) focus of attention feedback can improve gait biomechanics in patients with CAI, specifically of movements in the sagittal plane. InFOCUS forces the individual to watch their segment of interest during movement while ExFOCUS forces the individual to focus on the result of their movement within the environment. Up to 75 patients with CAI will complete pre-intervention 3D walking trials to assess lower extremity walking biomechanics. Patients will then complete a 4-week (12 session) rehabilitation program consisting of ExFOCUS or InFOCUS training aimed at improving walking biomechanics. Patients will be reassessed immediately, and again at 1 and 3 months post-intervention. For this project, I will be using data specifically from pre- and immediate-post intervention 3D walking trials. Repeated measures ANOVA will detect changes between and within groups following biofeedback training. Results will allow me to determine if ExFocus or InFocus training can improve sagittal plane biomechanics for patients with CAI.

Title: CXCL12 CXCL4 Chemokine Heterodimerization and Breast Cancer Progression

Program: OUR Summer Research Scholar

Student Author (s): Aiza Noyal

Faculty Mentor (s): Dr. Didier Dréau

College: Liberal Arts and Sciences

Breast cancer is by far the most recurrent cancer among women. While patients with early-stage non-metastatic breast cancer is highly treatable, advanced disease, i.e., metastatic breast cancer, remains incurable and accounts for over 90% of breast cancer related deaths. Establishment of metastatic breast cancer encompasses multiple key steps including tumor cell migration from the primary tumor mass. The tumor cell migration is largely governed by the CXCL12-CXCR4 chemokine signaling pathway. Previous we provided evidence of the heterodimerization of CXCL12-CXCL4 in platelets. The present research seeks to further demonstrate the formation of CXCL12-CXCL4 heterodimers. Here, using previously produced and purified CXCL12 and CXCL4 in co-immunoprecipitation studies, we aim to provide further evidence of the formation of CXCL12-CXCL4 complexes. Briefly, after combining proteins, CXCL12-CXCL4 chemokine heterodimers were co-immuno-precipitated with specific antibodies to CXCL12 and then detected on WB using antibodies to CXCL4. CXCL12-CXCL4 chemokine heterodimers were also co-immuno-precipitated with specific antibodies to CXCL4 and then detected on WB using antibodies to CXCL12. The presence of either CXCL4 and CXCL12 following co-immuno-precipitation further supported the presence and generation of CXCL12-CXCL4 chemokine heterodimers. Whether CXCL12-CXCL4 heterodimers and their potential modulations of the CXCL12-CXCR4 signaling promoting breast cancer progression is a relevant therapeutic target to prevent breast cancer progression warrant further investigation.

Title: Analyzing Accessibility of Early Childhood Health and Educational Resources for Families With Young Children (PN-3)

Program: OUR Summer Research Scholar

Student Author (s): Mariana Nunez

Faculty Mentor (s): Dr. Stephanie Potochnick

College: Liberal Arts and Sciences

Early childhood education and health resources are vital for healthy development. A supportive community that offers accessible health, economic, and educational resources is critical in cultivating equitable systems of care for all. In Mecklenburg County there is a gap in available health services, specifically for members of racial/ethnic minority groups and for families of low income with children from prenatal to age 3 (PN-3). Families of underrepresented groups face more barriers to utilizing available services. Given that Mecklenburg County has a rapidly growing diverse population, it is important to incorporate systems of care that address the needs, strengths, and opportunities for growth within a diverse sociocultural context. The purpose of this landscape study is to examine (1) what services are available and accessible in Mecklenburg County for PN-3 families, and (2) what needs are evident for underrepresented families at a geographical and socioeconomic disadvantage. This research utilized a mixed-method approach including collecting and mapping PN-3 services through the use of community stakeholder sources, focus group interviews to gain the parent/provider perspective, and qualitative coding analysis to identify different PN-3 systems and areas for improvement. For this research project, I will be analyzing the qualitative interviews with direct service providers and parent focus groups. I will use the qualitative software NVIVO to analyze qualitative transcripts and identify main roadblocks in access to childcare including affordability, cultural sensitivity, and responsiveness. I expect to find that Mecklenburg County needs more equitable ECE and health resources available for parents with young children.

Title: RNA-based Nanoparticles for Various Biomedical Applications

Program: NC LSAMP

Student Author (s): Celine Angelica Ortiz

Faculty Mentor (s): Dr. Banita Brown

College: Liberal Arts and Sciences

The basic unit of all living organisms is a cell. There are many different types of cells that contain different types of structures and functions but have some similarities like the nucleus. The nucleus contains nucleic acids which encode the instructions for cell life and the segments of these nucleic acids are called genes (Petsche, 2015). Nucleic acids like deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) were originally known for their role in genetics and genomics; however, due to the discovery of Watson-Crick base pairings (i.e., A-T or -U and C-G) in 1953, these biomolecules can now be used as the building blocks of nanostructures. Incredibly intricate multi-stranded assemblies known as nucleic acid nanoparticles (NANPs) are able to take advantage of the base-pairing rules and can be designed in silico (computer modeling) to assemble into a predicted three-dimensional structure (Afonin et al., 2011). NANPs are made of multiple strands of RNA or DNA (either purchased or synthesized in-house) and are made using a one-pot assembly. Assembled NANPs can be programmed to any shape, size, and functionality, which allows them to have a wide range of applications within the field of nanotechnology. The potential use for NANPs is in therapeutics. The NANP as a therapeutic uses a naturally occurring process called RNA interference (RNAi) (Alnylam Pharmaceuticals, 2020). RNA interference is a naturally occurring silencing of genes that is highly specific and occurs in response to double-stranded RNA in a cell (Mocellin & Provenzano, 2004). This route received an extreme amount of attention to use as a potential treatment for cancer, viral infections, or genetic diseases (uncsop, 2017). The NANP switch uses therapeutic nucleic acids (TNAs) to suppress a specific gene after being “turned on”. The conditionally activated NANP switch’s ability to release a specific target RNA that attaches to the biomarker will then allow the cell to go through programmed cell death or apoptosis. Two different cell lines will be used to see the effectiveness of the NANP switch and quantify the cell viability. If the switch is effective, there will be an increase in programmed cell death.

Title: Insights Gained from Student Feedback Forms for Professors

Program: OUR Summer Research Scholar

Student Author (s): Jack Pamukci

Faculty Mentor (s): Dr. Mohsen Dorodchi

College: Computing and Informatics

Professors can gain essential information about their courses through the feedback given to them by their students. This feedback contains subjective opinions of students about the course progress and their learning experience. Our study aims to analyze the students' reflection data on a concrete level, examining emotional trends and the correlations with their performance and academic progress throughout the course, also highlighting key topics that give trouble to students which can be keyed in on by professors. Our vision is to develop an interface for instructors to access this data meaningfully. Streamlining the process of raw data to clean and presentable visualizations is the first priority, with data cleaning and preprocessing being handled algorithmically so that data can be efficiently used. Specifically, for our data set, we prompted students to describe what emotions they experienced during the course. This method of analysis, although insightful, posed problems because of student subjectivity. To avoid bias, students also submitted written responses that were coded for sentiment analysis, where pre-trained NLP models evaluate sentiment scores of students' opinions. We graphed these scores against students' grades, providing possible insights to instructors, such as showing which students are at risk and need more attention. Our next goal for the sentiment analysis is to measure and track sentiments over a period of time which can give an understanding of where and when students encounter trouble. As the data analysis provides insight, instructors can utilize it to enhance the students' learning experience.

Title: An Examination of Linguistic Alignment to Understand the Impact of Task Goals

Program: OUR Summer Research Scholar

Student Author (s): Victoria Post

Faculty Mentor (s): Dr. Alexia Galati

College: Liberal Arts and Sciences

Language plays a large role in how humans, as social beings, communicate and coordinate with one another. Some studies suggest that when language users align or match their behavior, communication is supported (Pickering & Garrod, 2004). However, other studies suggest that the benefits of alignment are selective and depend on task affordances (Fusaroli et al., 2012). The extent to which alignment is observed and beneficial across tasks remains under explored. The purpose of this study is to determine how task goals regulate interpersonal alignment. I hypothesize that alignment between partners will increase when the task requires participants to track a shared perspective. In 36 dyads, participants worked on 10 different city maps: five involved visual search (participants had to find specific landmarks on the map), and five involved route planning (participants had to plan the most efficient route from an origin to a destination). Eye movements were tracked and conversations between partners were transcribed. I focus on alignment in word use, which was established by applying cross-recurrence quantification analysis (cRQA) to the time series of eye fixations and words used by partners. I predict that there will be higher levels of alignment (i.e., higher recurrence rate) in route planning tasks rather than visual search tasks due to the perspective-taking demands of the route planning task. This work will inform how alignment and complementarity can each support performance in different tasks. These findings could be beneficial in navigating high-stake situations that require interpersonal coordination (e.g., medical situations, emergencies, military settings).

Title: Thiazolothiazoles Photocatalysts for Organic Photoredox Catalysis

Program: OUR Summer Research Scholar

Student Author (s): Gabriela Martinez Ramirez

Faculty Mentor (s): Dr. Michael Walter

College: Liberal Arts and Sciences

Thiazolothiazoles (TTzs) are new catalysts that are being studied for photoelectrochemical, organic synthetic processes.Organic photocatalyst are advantageous due to their low toxicity and wide structural diversity. The advantages of TTzs as photocatalysts are their inexpensive synthesis requiring a single reaction step and its photochemically stable heterocyclic core. Also, TTzs can engage in a reversible one electron reduction and form stable radical cation which make them great photocatalyst. We studied their reactivity in alkylation of imines with potassium alkyltrifluoroborates (alkyl-BF3K) with excellent yields of ~ 80-90% and turn over numbers of 400-700 using very low mol% (0.05-0.1) photocatalyst. The photoredox catalysis reaction includes a stirred reaction with either 420 nm or 450 nm LED lights under anaerobic conditions in dichloromethane (DCM) for 48h.Interestingly, many of the TTz catalysts have limited solubility in the reaction solvent, which potentially could slow down the overall reaction rate. To further improve the TTz photocatalyst solubility, we synthesized a new TTz derivative, pentafluorobenzyl (F5BzTTz2+) that has an improved high solubility in DCM. The TTz pentafluorobenzyl has a lower fluorescence quantum yield than the other derivatives (58%). However, it still has comparable reaction rate yields with driving the imine alkylation reactions. In conclusion TTzs have the potential to increase the number of available organic photoredox catalyst tools due to their high efficiency and desirable photophysical properties.

Title: Quantifying the Binding Affinity of PsDef2 to the Receptor-Binding Domain of the SARS-CoV-2 Spike Protein Using Microscale Thermophoresis

Program: OUR Summer Research Scholar

Student Author (s): Patrick van Ravesteyn

Faculty Mentor (s): Dr. Irina Nesmelova

College: Liberal Arts and Sciences

Severe acute respiratory syndrome coronavirus 2, also known as SARS-CoV-2, is a deadly virus that attacks human cells via binding between the receptor-binding domain (RBD) of the virus' spike protein and the angiotensin-converting enzyme 2 (ACE2) receptor of the human cell. After binding, the virus will inject its DNA into the cell and commandeer it to produce more viruses which then break out (killing the cell in the process) and infect surrounding cells, continuing the cycle. Computational modeling has shown that plant defensin from Scots pine, PsDef1, may interfere with the binding between the RBD of the spike protein and the ACE2 receptor of the human cell, potentially making Scots pine defensins a viable antiviral product. Preliminary experimental data show that PsDef1 binds the RBD with strong, micromolar affinity. The purpose of this project is to quantify the binding affinity of PsDef2 to the RBD and compare the results to PsDef1. To accomplish this, I will be using microscale thermophoresis (MST) to determine the dissociation constant (Kd), the entity used to quantify the binding affinity of two biomolecules. This includes a fluorescent labeling of the RBD and adding varying amounts of PsDef2 to it. Microscale Thermophoresis analysis will then be done on these samples to yield a Kd. I expect the Kd of PsDef2 to be similar to that of PsDef1. The results will show the feasibility of using Scots pine defensins to disrupt the RBD-ACE2 complex.

Title: Determining the Features that Contribute to Eye Tracking Biometrics

Program: OUR Summer Research Scholar

Student Author (s): Andrew Redinbo

Faculty Mentor (s): Dr. Liyue Fan

College: Computing and Informatics

Eye tracking technology is becoming increasingly prevalent, especially with the rising popularity of virtual/mixed reality devices. This enables new functionality for many applications, but also introduces some amount of privacy risk. Previous research has shown several methods for biometric identification based on eye tracking data, primarily utilizing various machine learning techniques. Research has also shown privacy mechanisms to mitigate this authentication, such as introducing Gaussian noise and spatial/temporal down sampling. We plan to expand upon previous methods and present novel methods of anonymizing eye tracking data while still maintaining a reasonable level of usability for non-authentication focused applications. To this end, this project aims to answer two research questions: (1) which features within the eye tracking data contribute the most to the current state of the art neural network authentication methods? Specifically, we adopt explainable AI tools for recently proposed authentication classifiers. (2) Can we slightly perturb the data in ways to mainly affect those important features? We study current privacy-protecting methods and identify opportunities for developing smart perturbation techniques. The results show that preprocessing the data to obfuscate identifiable features will lower the accuracy of biometric techniques, while minimally impacting the usability of the data for other applications.

Title: Prenyl Analogues for the Investigation of Glycan Biosynthesis Pathways

Program: NanoSURE REU

Student Author (s): Jared Reeder

Faculty Mentor (s): Dr. Jerry Troutman

College: Liberal Arts and Sciences

The protective surfaces of bacterial cells are made up of sugars that are heavily involved in numerous processes that bacteria undergo, including invasion, colonization, host immune system evasion, and antibiotic resistance. One key roadblock in studying these complex surface sugars in bacteria is the vast diversity found within the composition of these sugars between bacterial species. Bactoprenyl phosphate is an important lipid carrier that is necessary for sugar assembly. The sugar on the surface of the bacteria is linked to this lipid carrier at the inner face of the membrane and is eventually transported toward the periplasm, where it is transferred to the growing polymer of sugars. The project this summer is focused on creating a fluorescent tag for these sugars using nerol. Using a synthesis originally developed for geraniol, the same initial steps will be performed for nerol to reach the product nitrobenzadiazol neryl phosphate (NBD-NP). Research in this field is necessary due to the potential for the discoveries found in these sugar biosynthesis pathways to one day lead to knowledge that leads to antigens for glycoconjugate vaccines or therapeutics for infections. In addition, the more relevant application for academic scientists is to use fluorescent tags to gain an understanding of the specificity of the enzymes that prefer different parts of sugar substrates within biosynthesis.

Title: Automating the Testing and Methodology of PFG Materials

Program: NSF Water Purification REU

Student Author (s): Christopher Reid

Faculty Mentor (s): Dr. Jordan Poler

College: Liberal Arts and Sciences

Water filters on the market today are single-use, they must be thrown out and replaced every six months creating plastic waste and a high cost of ownership. Their technology only removes a variety of harmful chemicals and bacteria but cannot remove other contaminants that our water treatment facilities fail to remove, like heavy metals and pesticides. Our materials, polyelectrolyte-functionalized fluorographite (PFG) can be regenerated, reused, and purify water at its point of use, our homes, sinks, and refrigerators. However, our current method of testing the PFG materials creates a low water flux during the process, which requires students to use a lot of time and man power. Testing requires 5mL of water, sodium fluorescence, and brine to flow through the material and is restricted at flow rate of 2~3mL per minute, limiting how quickly we can test the properties of the materials. Our solution is to automate the process, we are using a conductivity meter, spectronic 20, peristaltic pump, dataq-2108, and the LabView data flow programming language. Each instrument measures properties of the different solutions, and provides voltage measurements which will be recorded and measured to complete each step of the regeneration and reusability test. With our automation, we will test our materials for thousands of cycles in order to learn more about their absorption properties, performance, longevity, and how we can develop better, more efficient films.

Title: A Novel Flexible Endoscope Design using a Liquid Light Guide for Combined Irrigation and Illumination during Laser Lithotripsy

Program: OUR Summer Research Scholar

Student Author (s): Aidan Restelli

Faculty Mentor (s): Dr. Nathaniel Fried

College: Liberal Arts and Sciences

Development of miniature flexible ureteroscopes (< 2-mm-outer-diameter) may enable less expensive, office-based laser lithotripsy with patients under local anesthesia. This study describes a miniature ureteroscope design combining illumination and irrigation channels using a saline liquid light guide (LLG). Teflon AF is a flexible, biocompatible material with lower refractive index (n=1.29) than saline (n=1.33), enabling total internal reflection (TIR) of light. Gravitational and manual irrigation rates were measured through an annulus-shaped LLG sandwiched between concentric inner Teflon tubing (OD=0.74mm/ID=0.61mm) and outer Teflon tubing (OD=1.60mm/ID=1.02mm). A 72/108/120 optical fiber can be placed in the flow area. A flexible plastic fiber bundle (7.4k pixels, OD=0.5mm) was placed within the core of the inner Teflon tubing for imaging. Optical fibers (0.125mm-OD) were placed between Teflon layers, as spacers and steering cables. Computational models (ANSYS) of saline flow were also conducted for design optimization. The numerical aperture (NA) for illumination was also changed by varying salinity (0.9-3%). Gravitational and manual irrigation flow rates measured 0.6±0.1 ml/min and 9±2 ml/min, respectively (n=3). The NA is expected to vary from 0.339 to 0.354 for 0.9% and 3% salinity. Computational models are being generated to find optimal flow rates in concentric inner and outer Teflon AF tubing with variable dimensions. A novel LLG based flexible ureteroscope design utilized concentric Teflon AF tubing for TIR of light through an annulus-shaped irrigation channel, saving valuable cross-sectional space, and resulting in a miniature ureteroscope design less than 2-mm-OD. With further development, miniature ureteroscopes may enable an office-based approach to laser lithotripsy.

Title: The Impacts of Player Load on Performance in Women's Volleyball

Program: NC LSAMP REU

Student Author (s): Jessica Ricks

Faculty Mentor (s): Dr. Doug Hague and John Tobias

College: Computing and Informatics

Volleyball is a high-intensity sport where conditioning and in-game exertion (aka, player load) may impact an individual's performance. The purpose of this study is to measure player load in volleyball athletes and test the impacts it has on performance variables in practices and games during a regular season. To conduct this study, small devices, called VERT, are worn by players to measure the number of jumps, vertical jump displacement, and other player load metrics. The VERT data is blended with volleyball game statistics during a UNC Charlotte's women's team regular season. To conduct statistical analysis, the data was exported into CSV files and read into Python. For the first hypothesis, an increasing player load is expected to decrease performance. Performance in this hypothesis will be measured as hitting percentage and player load will be measured by the number of jumps. A second hypothesis projects that performance will decline after a weekend of 2 games with an intense player load. Performance here will be measured by the average max vertical jump and will be evaluated for each day after a high player load weekend. The preliminary findings conclude that with player load increasing, hitting percentage declines and that with recovery, vertical jumps are close to the max by the next game day. This research study is helpful for volleyball coaches to understand the effects of player load on performance metrics.

Title: Piecing Together the Pathways of Energy Through Macroinvertebrate Food Webs in Saltmarshes

Program: OUR Summer Research Scholar

Student Author (s): Yuleny Gomez Rodriguez

Faculty Mentor (s): Dr. Paola López-Duarte

College: Liberal Arts and Sciences

Macroinvertebrates have key trophic positions in saltmarsh food webs and the creation of saltmarshes is known to increase the biodiversity of new habitats. The effects on food web interactions at the macroinvertebrate level, however, are less understood. The gap in knowledge suggests the need for additional research concerning the trophic differences and similarities between newly-created and natural saltmarshes. Macroinvertebrates (ants, amphipods, midges, springtails, bristle worms, ticks, and crabs) were sampled at two different habitats: two newly-created and one naturally established saltmarsh located in the Lake Hermitage Marsh Creation area in Louisiana. Stable isotope analysis (SIA) of δ13C (energy source) and δ15N (trophic position) was used to trace the trophic pathways throughout each marsh and compare the trophic connectivity to neighboring marshes to determine whether newly-created marshes can sustain similar food webs as naturally established saltmarshes. We hypothesize that newly created saltmarshes do not sustain the same food webs as naturally established saltmarshes. Higher biodiversity is associated with a more complex food web. Therefore, newly-created marshes may sustain simpler food webs before they become well-established. Similarly, those newly-created marshes may contribute less macroinvertebrate organisms to neighboring habitats than natural marshes. Understanding the contributions of macroinvertebrate communities is important because they are at the base of saltmarsh food webs and not as well studied as higher trophic levels. The SIA data can provide valuable information for decision making processes for the creation of future saltmarshes.

Title: Synthesizing Knowledge from Science for Performance Management Decisions

Program: OUR Summer Research Scholar

Student Author (s): Jay Sakarvadia

Faculty Mentor (s): Dr. Reginald Silver

College: Belk College of Business

Humans make decisions every day. Naturally, we as humans often adopt the cause/effect model. Feeling hungry? Eat. Feeling tired? Sleep. Raining outside? Carry an umbrella. Causality, at its core, is that simple. However, when making decisions in an environment with more variables, objectives, parameters, and expectations, say in the business world or in a hospital setting, things can get a little more complex. Making the right or the most effective decision begins to be less intuitive. In an effort to allow hospitals to take more efficient/effective actions, we attempt to formulate decision models encompassing causal insights from literature in the areas of healthcare, business, and social science. Those causal insights are derived through three methods: 1. High Performance machine reading system to extract causal insights (variables) from healthcare literature and then cluster and connect them into a logic network (knowledge graph). 2. Knowledge graph-based reasoning system for enterprise management (specifically to identify hidden causal relationships between variables). 3. Novel statistical causal inference. By synthesizing the causal insights perceived from these three methods into decision models, we are able to construct a synthetic counterfactual and run causal analysis to identify the most effective actions given performance objectives. Specifically, we present the most effective/efficient actions for a hospital given their performance objectives (situation/scenario) we are testing for.

Title: Water Quality Monitoring Instrumentation Platform for Data-Informed Aquaculture

Program: OUR Summer Research Scholar

Student Author (s): Christopher Schultz

Faculty Mentor (s): Dr. Michael Smith

College: Engineering

Oysters are an important component of North Carolina's coastal ecological and economic health. A healthy population of these shellfish provides many natural and economic benefits, such as water filtration, creation of reefs, and a food source for humans. The oyster population along the coastal waters of North Carolina has suffered due to several reasons, including over-farming and inadequate information available to local farmers. Efforts are being made to remedy this, including the addition of more accurate and up-to-date water quality monitoring (WQM) tools and information. While commercial aquaculture WQM tools are available, they remain costly and out-of-reach for many smaller enterprises. The purpose of this research is to continue work started at UNC Charlotte towards the goal of building a low-cost Internet-of-Things (IoT) WQM buoy. This device will utilize independent sensors to monitor specified water quality metrics. Each metric will have both high and low control limits, and through the use of a simple go/no-go interface, the user will be notified when one or more metrics are outside of their respective control limits. This short-term deployment device, which is designed for this focused application, should be able to perform the monitoring actions of a commercial buoy, while costing 10-20 times less. This work includes the construction and testing of the device, as well as the design and implementation of an accessible software monitoring tool for interfacing with and interpreting the live readings from the buoy-based sensors.

Title: Revenge Pornography: An Examination of State Statues

Program: OUR Summer Research Scholar

Student Author (s): Jaden Schutt

Faculty Mentor (s): Dr. Charisse Coston

College: Liberal Arts and Sciences

Revenge Pornography is an umbrella term used to encompass the crime of distributing nonconsensual sexualized images of an individual. This crime became highly popularized during the latter half of the twentieth century and has continued to plague the internet into the twenty-first century. Nonetheless, despite the overwhelming abundance of this issue in the country, there are inconsistencies in regulating revenge porn among the fifty states and the District of Columbia. This study aims to evaluate the relationship between state political party affiliations and their respective stance on revenge porn laws to pinpoint where these inconsistencies lie. To do so, two maps were created; the first cross-examines state political affiliations against the differing statute terminology addressing revenge pornography along with the severity of the criminal punishment that follows. The results yielded that the most commonly associated state statute term among all fifty states regardless of party affiliation is the “Dissemination of Non-Consensual Pornography”. Additionally, the first map demonstrated that Democratic and Republican-associated states treat the crime as a misdemeanor while politically competitive states treat it as a felony. The second map analyzed the connections between state political affiliations in relation to whether criminal and civil liability was provided and if injunctions are allowed by the state to remove revenge pornography. This map illustrated how although most states only provide criminal liability for revenge porn, the states that provide both civil and criminal liability are more like to come from a politically competitive state and additionally support injunctions for said crime.

Title: At the Intersection of Femininity and Cultural Ambiguity: Hedda Grab-Kernmayer in Theresienstadt

Program: OUR Summer Research Scholar

Student Author (s): Emily Sheffield

Faculty Mentor (s): Dr. Jay Grymes

College: Art and Architecture

During the Holocaust, mezzo-soprano Hedda Grab-Kernmayer (1899-1990) was one of the most prominent musicians in the Nazi ghetto of Theresienstadt (Terezín). During the earliest days of the ghetto, she organized and starred in various unaccompanied performances. Because of her professional opera career before the war, she was asked to be a leader in the Freizeitgestaltung (“Free Time Activities” bureau) that oversaw artistic activities in Theresienstadt. As Grab-Kernmayer recalled, she was so in demand with the Freizeitgestaltung that she “sang every day.” Despite Grab-Kernmayer’s leadership and prominence in the Freizeitgestaltung, the existing narratives of music in Theresienstadt portray her role as merely supportive. In addition to being marginalized for being a woman, Grab-Kernmayer was especially neglected in the ghetto due to cultural dissonance between the Czech and German prisoners. Born in Prague but reared in Vienna, Grab-Kernmayer was often overlooked by the predominantly German administration of the Freizeitgestaltung and ostracized by the dominant Czech prisoner population for her inability to speak Czech. Previous music histories in Theresienstadt have focused primarily on men, specifically male composers, to the near exclusion of women who played essential roles in the musical life of the ghetto. Until recently, histories of the ghetto have also underestimated the frictions between the Czech and German prisoners. Drawing on current research and often neglected interviews with Grab-Kernmayer from the U.S. Holocaust Memorial Museum, this project seeks to chronicle Grab-Kernmayer's role as one of the most important yet undervalued musicians in Theresienstadt.

Title: Developing Machine Learning Models to Predict Water Quality based on Land Development and Climate Patterns

Program: OUR Summer Research Scholar

Student Author (s): Nathaniel James Shepherd

Faculty Mentor (s): Dr. Nicole Barclay

College: College of Engineering

In the past twenty years, the population of Mecklenburg County, NC has grown significantly. Due to this, there is increased urban development throughout the county. The objective of this study is to determine whether increased urban development has a positive or negative effect on water quality by mapping growth and predicting water quality indicators based on data from an eighteen-year period from 2001-2019. We used land data from the Multi-Resolution Land Characteristics (MRLC) Consortium that details land development in the county by classes (i.e., urban, forest). This study included climate variables to determine if they are necessary when considering the effect of land use on water quality. The climate variables are air temperature, rainfall, and humidity. The water quality indicators that were considered are total nitrogen (TN), total phosphorus (TP), dissolved oxygen (DO), pH, total suspended solids (TSS), turbidity, water temperature, and fecal coliform bacteria (E. Coli). The analysis was done using a combination of ArcGIS mapping software and machine learning models in Python, specifically multi-linear regression (MLR). With the mapping software, we looked at the spatial increase of urban development in Mecklenburg County over time. Then, with the help of machine learning models, we were able to predict the water quality indicators based on the change in land use. We expect to see a negative correlation between urban development and water quality. We also expect to conclude that climate variables are key factors to include when considering land use and water quality.

Title: The Relationship Between Gentrification, Rising Property Taxes, & Charlotte Residents' Ability to Afford Healthcare

Program: OUR Summer Research Scholar

Student Author (s): Morgan Smithey

Faculty Mentor (s): Dr. Erin Banks, Dr. Nhi Cao, and Boris Henderson

College: Office of Undergraduate Research

Rapidly rising home values often accompany gentrification, leading to increased property taxes for homeowners (Ding & Hwang, 2020). Higher property taxes increase the risk of becoming cost-burdened, "in Mecklenburg County, 75% of homeowners earning under $20,000 are cost-burdened, spending more than 30% of their monthly income on housing-related expenses" (UNCC Urban Institute, 2021). These families may not be able to spend as much money on healthcare, potentially harming their health (Drabo et al., 2021; Shamsuddin & Campbell, 2021). This project will explore income levels and rising housing costs and how they impact access to healthcare. Research has shown there is a correlation between income levels and access to healthcare (Hoffman & Paradise, 2008). I hypothesize that respondents reporting a lower income bracket will be more likely to express a need for access to healthcare in their neighborhood. This study is based on surveys given to Charlotte residents that include Likert scale questions, and open-ended responses. They include questions about respondents' homeownership skills, gentrification, home price appreciation, and services they need in their community. Respondents are asked to participate in focus group discussions that are analyzed for commonly discussed topics and themes. Data collection is still ongoing and preliminary data will be analyzed to identify trends. The impact that rapidly rising property values and taxes has on individuals' ability to meet essential needs should be further examined. This work is important for policy development because an inability to afford basic living essentials can harm a person's health and quality of life.

Title: Development of Battery Safety Database

Program: OUR Summer Research Scholar

Student Author (s): Luigi Stanisa

Faculty Mentor (s): Dr. Jun Xu

College: Engineering

With the increasingly wide application of lithium-ion batteries (LIBs) in our current mobile society, it is necessary to evaluate and understand the safety situation of currently available LIBs in the market. To fill this gap, in this study, we aim to develop a one-of-a-kind battery safety database (BSD). This database aims to store the safety performance of the battery via detailed characterizations, including basic physics and electrochemistry information of batteries, cycling, data, as well as mechanical abusive data for batteries. Particularly, the cycling data can indicate the durability of the cells while the mechanical abusive data can well quantify the safety behaviors of the cells upon mechanical abusive tests, including nail penetration, indentation and compression. Cells in various formats (cylindrical, pouch and prismatic) and various material systems will be measured and characterized. The case information may be used for future statistical analysis for battery safety behaviors and also gain an overview of the safety situations of the commercialized LIBs. This database provides fundamental data for the design, evaluation and improvement of the next-generation safe batteries for the original equipment manufacturers (OEMs), battery providers, consumers, insurance companies, researchers and government agencies.

Title: Alternative Grading Strategies for an Anti-Black Institution of Higher Learning

Program: OUR Summer Research Scholar

Student Author (s): Lawrence Stevens

Faculty Mentor (s): Dr. Elisabeth Paquette

College: Liberal Arts and Sciences

Racist grading practices and policies in higher education have existed to perpetuate white supremacy and privilege while at a disservice to minority students. Minority students in higher education often face discrimination for being of a lower socioeconomic status or skin color; this is shown in academic achievement and student experiences at higher education institutions. This study examines racist grading methods and how said grading methods have negatively impacted minority college students across the United States. This study primarily analyzes sources that have documented detailed accounts of racism and racist policies and alternative grading strategies. I will focus on finding non-traditional and different grading methods in higher education, especially in STEM and Social Sciences. I will use Google Scholar and Atkins Library at UNCC, records, journal articles, books, and essential items through this research. A solution that I came up with to end racist grading methods is contract grading; contract grading is a non-traditional method that is a form of grading which results from cooperation between an instructor and their students. Contract grading emphasizes writing policies and labor much more than final products meaning that professors or instructors make prioritizing process over product more explicit. An example of contract grading is ‘’to obtain x grade; a student must have fewer absences, a student must complete this number of drafts on time, a student must have completed this number of workshops on time.

Title: Using Thiazolo[5,4-d]thiazole Molecules to Create Light-driven Aqueous Organic Redox Flow Batteries

Program: NanoSURE REU

Student Author (s): Sarah Trantham

Faculty Mentor (s): Dr. Michael Walter

College: Liberal Arts and Sciences

Organic aqueous redox flow batteries have the potential to store energy from renewable sources in a clean and sustainable fashion, especially when made from organic materials. Many of these materials are nontoxic to the environment and the abundance of the materials needed for their development make them more cost effective as they are solely based on carbon and hydrogen and contain no heavy metals. One such material that is being used in redox flow batteries is thiazolo[5,4-d]thiazole (TTz). TTz molecules can undergo two reversible electron reductions which make them a good candidate to create organic redox flow batteries, however the photochemical properties are what make it truly interesting. TTz strongly absorbs light and the absorbed light can drive photoredox processes. Our goal is to create a thin film TTz-based energy storage device that can be charged with sunlight. Using a traditional redox flow battery set up, the ability of an aqueous TTz solution to charge and discharge was tested. Preliminary data using a potentiostat shows that charging an aqueous organic redox flow battery is possible. We engineered a thin film device with transparent electrodes to study the photocharging properties exhibited by TTz derivatives. Initial data indicates changes in voltage when the redox battery devices are illuminated by white light. Our goal is to further understand the photocharging properties of the TTz thin film redox batteries and develop efficient devices that can be charged completely using solar power.

Title: Machine Learning Applied to Aquatic Robot Locomotion

Program: OUR Summer Research Scholar

Student Author (s): Connor Trautwein

Faculty Mentor (s): Dr. Scott Kelly

College: Engineering

Machine learning is a subfield of artificial intelligence that endows computers with the ability to learn without explicit instructions. Specifically, reinforcement learning is a machine learning technique whereby an autonomous agent is capable of interacting with its environment and is able to learn an optimal behavior through trial and error. The optimal behavior, or policy, is learned iteratively by the agent through exploration of the states within its environment. As the agent performs an action to transition between states, it receives a prescribed numerical reward. The agent's goal is to maximize the expected cumulative reward it receives, where the reward values of desirable or undesirable behaviors are outlined by the user-defined reward function. This project investigates the development of a Q-Learning algorithm that will determine an ideal policy that yields efficient swimming gaits for a simple fishlike robot. The robot was constructed of a teardrop-shaped buoyant foam material and outfitted with a Hitec HSR-1425CR continuous rotation servo motor, imparting the robot with the ability to mimic oscillatory movement patterns seen in fish locomotion. An Intel RealSense T265 tracking camera, paired to a Raspberry Pi 3B, was used to sense the robot's environment via a combination of fisheye lens cameras and an inertial measurement unit (IMU). Successful implementation of the Q-Learning algorithm could result in further application to more complicated robot geometries or employment of more robust reinforcement learning methods, such as those using deep neural networks as function approximators.

Title: Governmental Policies and Its Impact on Displacement Amongst Low Income Families

Program: OUR Summer Research Scholar

Student Author (s): Tuyen Truong

Faculty Mentor (s): Dr. Erin Banks, Dr. Nhi Cao, and Boris Henderson

College: Office of Undergraduate Research

The lack of adequate federal policies lead to a precarious housing market that generates more displacement amongst low income communities than their wealthier counterparts, leaving local communities and non-profit organizations to amend the situation for themselves. Even local funding and community efforts cannot compete with rising housing costs and the lack of housing supply due to the neoliberal nature of federal policies. In the Charlotte Region, neighborhoods experience a fair share of displacement for low-income families, particularly people of color in neighborhoods such as West Davidson and Optimist Park. The purpose of this study is to evaluate the policies and programs at local levels that impact low income populations. This study will use quantitative and qualitative methods. Quantitative data will be collected through pre and post surveys of community participants on a Likert scale to help provide a better understanding of how residents in Mecklenburg County are affected by the housing crisis. Qualitative data will be collected by analyzing the themes that arise from focus groups to see repeating patterns amongst residents. Preliminary findings indicate that residents of these communities already face gentrification accompanied by rising taxes and lack of resources and protection from the government. It is hypothesized that local state policies and programs assist low-income families better than federal ones. The implication of the study is to illustrate the need for new federal housing policies that complement today's changing demographics and rising costs as well as to assist residents of Mecklenburg County in becoming better educated in homeownership.

Title: The Relationship Between Income and Home Maintenance

Program: OUR Summer Research Scholar

Student Author (s): Jenna Venditti

Faculty Mentor (s): Dr. Erin Banks, Dr. Nhi Cao, and Boris Henderson

College: Office of Undergraduate Research

Within the last year, over thirty thousand people decided to claim residency in Charlotte, North Carolina (Noguera, 2022). This booming area is ranked as one of the top cities in the United States for numeric growth (Lee, Durham, 2021). As beneficial as this is for the economy, residents that call Charlotte home are being kicked out of their houses and displaced. Rising costs bring inflation which makes it difficult for individuals to pay for many amenities, such as home repairs. My project will collect data to explore the relationship between income levels and increasing housing costs. I hypothesize that individuals with lower incomes will be less likely to afford repairs on their homes due to rising housing costs. Home repairs may seem elective, but in some cases, repairs may be considered necessary or urgent when a homeowner's health is at risk. This study will explore the relationship between income and housing costs. It is hoped that this project will help to share programs and resources that will help families maintain their homes and home repairs.

Title: Assembling Fe4S4 Clusters with Janus Biscarbene Linkers

Program: OUR Summer Research Scholar

Student Author (s): My Vuong

Faculty Mentor (s): Dr. Christopher Bejger

College: Liberal Arts and Sciences

Iron-sulfur (Fe-S) cluster assembly is an essential process for all cells. More than 120 types of Fe-S enzymes and proteins have been identified since 1960, and they are found to be involved in redox processes such as electron transfer and CO2 fixation. Thus, Fe-S clusters have become ideal candidates for use as building blocks in electronic materials, due to their stabilities in numerous oxidation states and nuclearities. However, incorporating Fe-S clusters into crystalline polymers remains a challenge. In this study, we explore the assembly of bioinspired Fe4S4 clusters with poly-N-heterocyclic carbenes (NHCs) as a route to new functional main-chain organometallic polymers (MCOPs). Specifically, the phosphine ligated Fe4S4(PiPr3)4 cluster undergoes global ligand substitution in the presence of benzo-bis-imidazolylidene (Janus bis(NHCs)/ Janus biscarbene) bridging linkers under solvothermal conditions in benzene. The blue-colored polymer Fe4S4 - MCOP was characterized by IR spectroscopy, powder X-ray diffraction (PXRD), Brunauer-Emmett-Teller (BET) analysis, and scanning electron microscopy (SEM). The material's surface plays an important role in how the solid interacts with its environment, therefore, the BET analysis, SEM and energy dispersive X-ray spectroscopy (EDX) have been used to measure the surface area and analyze the elemental composition of Fe4S4 - MCOP. Solid state electrochemical analysis, including cyclic voltammetry, of the polymer will also be presented. The polymer is expected to be redox active and is currently being investigated for applications in catalysis and energy storage.

Title: Stereochemical Specificity in C. Jejuni

Program: OUR Summer Research Scholar

Student Author (s): Juliusz Wieckowski

Faculty Mentor (s): Dr. Jerry Troutman

College: Liberal Arts and Sciences

Campylobacter jejuni is a species of bacteria responsible for approximately 1.5 million annual infections in the United States. C. jejuni infection can cause death in individuals with compromised immune systems and is the most commonly identified cause of Guillain-Barré syndrome, a disease that can lead to muscle paralysis. Antibiotics are common remedies for bacterial infections that function by disabling life-essential biological systems in bacteria; however, populations of bacteria may evolve to become immune to the lethal effect of a given antibiotic, as drug-resistant bacteria will survive and reproduce. Antivirulence medications differ from antibiotics in that they neutralize the infectious component of bacteria without killing them, thereby not encouraging evolutionary resistance. C. jejuni possess protein-linked complex sugar molecules that are involved in the bacteria's ability to enter and infect hosts. pglD, or protein glycosylation gene D, encodes PglD, an enzyme required to make 2-4 diacetamidobacillosamine, (diNAcBac), the first sugar required for protein glycosylation in C. jejuni. The purpose of our work is to examine the active site of PglD to determine whether isomers, or molecules with different stereochemical configurations but identical chemical formulas, of the four-amino sugar substrate will be recognized by PglD. Antivirulence drugs containing such an isomer could inhibit the enzyme's function, preventing the sugar from being created while not being fatal to the bacterium. To recreate the protein glycosylation pathway leading up to PglD in vitro, we grew E. coli transformed with plasmids containing pgl genes and extracted the expressed proteins using Ni-NTA- or glutathione-based purification.

Title: Thermal Stabilization of Biologics Using Light-Assisted Drying: Characterizing Drying Inside Lyophilization Vials

Program: OUR Summer Research Scholar

Student Author (s): Jude Yoshino

Faculty Mentor (s): Dr. Susan Trammell

College: Liberal Arts and Sciences

Freeze-drying is the current preservation method for many biologics, but is energy and time intensive, and may cause damage via freezing stresses. Light-assisted drying (LAD), a novel preservation process, can stabilize biologics using less energy and processing time. In LAD, a laser rapidly evaporates water from a trehalose solution, forming an amorphous solid matrix capable of stabilizing imbedded proteins. Previously, droplets of solution were processed on glass coverslips, and thermal imaging could determine processing completion. In this study, samples are also processed inside pharmaceutical-standard lyophilization vials. Thermal imaging cannot monitor LAD inside vials as they are opaque at infrared wavelengths. Thus, a power meter is used to monitor laser power passing through samples. 250uL droplets on coverslips or in vials are dried at <3% relative humidity with a 1064nm laser at 5W for 140 minutes. Two characteristics to monitor the effectiveness of LAD are low end moisture content (EMC), and the absence of crystallization. The mass of the solution before and after processing is taken for calculation of the end moisture content; a polarizer and digital camera image the processed sample to observe crystallization. An infrared camera measures temperature over time; a power meter underneath the sample records the power passing through. Power metrics versus thermal imaging for LAD monitoring are compared. Results show power curves may be an effective way of determining finishing points of processing. This may allow changing substrates to lyophilization vials, which are more applicable to existing healthcare standards and may have beneficial geometry versus coverslips.

Charlotte Teacher's Institute Personal Reflections

Title: Truth be Told

Program: Charlotte Teachers Institute-Wilson Stem Academy

Author (s): LaShonda Alexander

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

Just when I thought I knew it all about slavery and the Civil Rights Movement, I discovered at 45 years of age that I had no idea the suffering that my ancestors truly endured. To know the unwanted sacrifices of some and the courageous strength and sacrifices of others forever changed my perception of my past, present, and future. From the mass lynching site in Monroe, GA (Moore's Ford Bridge) to the current joint efforts in LaGrange, GA formed of community leaders and law enforcement who fought and continue to fight racial injustices and disparities was just the beginning of the feeling of being overwhelmed and distraught that I experienced on this trip. The entire experience, although emotional, was eye-opening and heart-wrenching, including retold stories that vividly described the encounters of what our ancestors experienced, those known through textbooks, as well as those lost to history. From the four African American lives lost in 1946 at Moore's Ford Bridge, to the four angel's lives lost from a bombing in 1963 at 16th Street Baptist church, to assassination of Dr. Martin Luther King in 1968. These voices that were silenced due to racism and pure cruelty will never be forgotten. These stories, whether being read off markers or told from our very knowledgeable and engaging tour guides, I understood in those moments that we have made much progress, however, we are still fighting the battles on various levels that our ancestors fought.

Title: What the Text Doesn't Teach: Honoring the Unsung Heroes and Stories of the Civil Rights Era in the South

Program: Charlotte Teachers Institute-English, Myers Park High School

Author (s): Shundra Allison

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

There are no words. As many times as I have heard people speak of the importance of being present in the moment, this trip was the first time I allowed myself to do that. No matter what you think you know about your people, your history, your identity it's false or only a very tiny sliver. Until you can experience what is not in a textbook you will remain lost, and I hate to use this word but ignorant to the truth. As a woman who places a check in the box next to Black/African American, that is not okay. Textbooks only teach what they want you to know. They teach what makes America look unblemished. The CTI/Racial Equity trip reminded me of just how unequitable things were and still are, while simultaneously teaching me about the many unsung heroes, the truths, the realities and leaving me thirsting for more. Some of the places and people I'd heard of, but many I had not. In either case nothing could have prepared me for the raw emotion that took over my soul. From Monroe and LaGrange, GA to Montgomery, AL to Memphis, TN and Birmingham, AL, the stories were varied but intertwined. These stories need to be heard, shared, and experienced by more people. America must be ready to be honest. We have a generation of children who are aware of injustice and want to see change happen. We are charged with providing them with the necessary knowledge to become aware.

Title: The Right to Navigate High School Without Conflict

Program: Charlotte Teachers Institute History, Independence High School

Author (s): Tamara Babulski

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

High school can be a challenge for students. They are transitioning from an environment in which all decisions were made for them into an environment in which they are expected to begin making their own decisions. Quite often, students enter high school without the academic and interpersonal skills they need to excel in a new environment. Near the end of their eighth-grade year, students attend an assembly in which they are told what they can expect in high school; however, by the time the new school year rolled around, they had forgotten much of the information they were given. To circumvent this issue, Independence High School has instituted the AVID program for all incoming ninth graders. AVID was first created in 1980 to help students recognize their potential and succeed academically in high school and beyond. Currently, there are 18 high schools in Charlotte Mecklenburg Schools. AVID consists of eight domains: character development, communication, writing, inquiry, collaboration, organization, reading, and college preparedness. After examining the NewGen Peacebuilding curriculum, I am convinced that my students' metacognitive and interpersonal skills along with their academic skills will exponentially increase through the incorporation of My Peace Foundation curricula. For my research and poster, I will create a concept map that will serve as a roadmap for my students, and other AVID teachers, in connecting the eight domains of AVID with overarching concepts of the eight pillars of peace, Maslow's Hierarchy of Needs, and the Five Spheres of Peace.

Title: Hidden Histories: The 2022 Civil Rights Trip

Program: Charlotte Teachers Institute-Social Studies teacher, Northwest School of the Arts

Author (s): Andrew Bartkowiak

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

The Civil Rights movement takes on a new significance for this northern transplant. The legacy of the Civil Rights movement can still be seen in the de facto segregation seen in our schools and on a larger scale in our society today. One cannot address these issues without having an awareness and acknowledgement of these wrongs of the past.The disparities over the acknowledgement of lynching, was immediately evident in the contrast of the acknowledgment of the events in Monroe and LaGrange, GA, respectively. Monroe's failure to acknowledge the lynching at Moore's Ford can certainly be linked to more entrenched racist attitudes within the community today. Lagrange's acknowledgement, on the other hand, has helped to build a bridge between the different racial and ethnic grips to move the city further towards greater equity in the community. The Civil Rights Museums in Montgomery and Memphis further illuminated the need to correct racial injustices, through audio, video, and timelines. Stories and sites from Birmingham and Memphis served as a strong reminder of the lengths individuals would go to in order to maintain racial superiority. Bombings and murder were the norm. The National Memorial for Peace and Justice provides a powerful reminder of the many sacrifices made by minorities. One cannot teach US History without teaching the inclusion of these events as equally important to commonly taught Eurocentric topics. By doing so, students will gain empathy and understanding of one another to foster a more peaceful future.

Title: Look Before You Leap: Connecting History with Future Peacebuilding

Program: Charlotte Teachers Institute-History, West Charlotte High School

Author (s): Vita Borjas

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

History involves discussing individual issues that are fragmented along timelines of a nation, region, or the world and can cause students to ponder their potential impact on historic issues. This desire is founded in an interest in the fight for civil rights, workers' rights, women's rights, and more. These topics motivate students to increase their understanding of history as they discuss injustices in the world. Often though, contemplation is where student learning in history stops, preventing students from actualizing the change they want to make. My goal is to create tools for American History by combining curriculum content with peace education content to help students overcome this stopping point by examining timelines that connect current rights to their historical origins within the U.S. This will be expanded upon by utilizing tools within peace education and examining the successes and failures within various movements to unearth methods for furthering rights and preventing the deterioration of current rights. Peace education has led to the creation of tools that help people examine issues and actualize solutions through concepts of positive and negative peace, positive and negative violence, Galtung's Triangle, the 8 Pillars of Peace, and the Five Spheres of Peace. These tools connect issues to government, societal, and cultural factors and enable analysis of these relationships.Through research I will create flowcharts that incorporate these tools alongside historical analysis to examine timelines of different movements while offering questioning frameworks rooted in A.S.A.P. (Awareness, Service, Advocacy, Philanthropy) to help students make implementable plans.

Title: Back on the Civil Rights Trail

Program: Charlotte Teachers Institute-Retired History teacher, East Mecklenburg High School

Author (s): Larry Bosc

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

As a veteran civil rights trip organizer, I eagerly awaited this summer's trip. The first 2 stops were difficult for many as they tell the story of our history of racial terrorism up close and personal. Outside of Monroe, Georgia, at Moore's Ford Bridge, the 1946 lynching of George and Mae Murray Dorsey and Roger and Dorothy Malcolm is memorialized on the first marker of its kind which sits off of US 78. The town's resistance, first to punishing the perpetrators of this horrific crime and then to acknowledging the tragedy, overshadowed the work of the Moore's Ford Memorial Committee. Stopping in LaGrange, Georgia we witnessed a totally different attitude among those who worked with EJI to bring a marker memorializing the lynching of Austin Callaway. This was also true with town officials who, as a group, apologized for the actions of those who in 1940 allowed the tragedy to take place. In Montgomery, visiting the expanded Legacy Museum was also difficult as its exhibits, which draw a clear line from slavery, Jim Crow and mass incarceration, required significant reflection. Equally challenging was our visit in Memphis to the Civil Rights Museum at the Lorraine Motel, the site of the assassination of Martin Luther King, Jr. Thanks to our wonderful tour guides Shirley Cherry, Barry McNealy and Martha Bouyer, teachers were able to learn about the movement in Montgomery, Birmingham and the outsized role played by Rev. Fred Shuttlesworth and Bethel church in ending segregation in the Magic City (Birmingham).

Title: Breaking the Ice with the Universal Declaration of Human Rights: Creating a Global Perspective Through Empathy and Commonality

Program: Charlotte Teachers Institute-Teacher, IBEN Educator, Piedmont Open Middle IB

Author (s): Matt Cramer

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

At the beginning of a sixth-grade magnet school year at Charlotte Mecklenburg Schools, students can filter in from as many fifty different feeder schools. This brings a wide array of ethnic, cultural, and socio-economic diversity to Piedmont Open Middle IB. Over sixty percent of the student population is black with a third of all students coming from low-income backgrounds. Besides countless personal worldviews and experiences, most will have never met their new cohort of classmates until their first day in the classroom. Research shows that using empathy can be critical to connecting with a diverse student population. Teaching at an International Baccalaureate (IB) school also brings the opportunity to intentionally expose and instill a global worldview through its pedagogy. This study will explore The Universal Declaration of Human Rights using The NewGen Peacebuilder Experience and The Human Rights Resource Center (HRRC) with the goal to bring together diverse student populations by creating empathy through human commonality. Incorporating icebreaker activities from NewGen and HRRC will create opportunities for self-reflection, open and safe dialogue, and an introduction to the IB learner profile traits. Students will be able to build a rapport with their fellow classmates through empathy building activities. Using the NewGen and HRRC will serve as a vehicle through which students gain insight into their lives, the lives of others around the world, and finally their fellow classmates. Discovering this fellowship and creating empathy will help foster an inquiry driven global worldview with our students for the upcoming school year.

Title: Inequality and Injustice: Up Close and Personal -- CTI Civil Rights Trip 2022

Program: Charlotte Teachers Institute-4th Grade ELA Teacher, Rea Farms STEAM Academy

Author (s): Toni Cruickshank

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

The 2022 Teacher Civil Rights Trip was simply amazing and powerful! As an African American I have always heard stories about our history and the struggles my ancestors endured, but this trip allowed me to stand in the place where injustice took place. On our first day we visited the Moore's Ford Marker in Monroe, GA memorializing four victims of lynching. It was emotional to hear the story about the last day of their lives and to think about the WHY! It also felt powerful because their names will be forever engraved on that road and their stories will continue to be told. We visited the gravesite of one of the lynching victims which also contained many nameless white crosses that marked a grave for African Americans. We toured Old Alabama Town in Montgomery, AL. and received some personal and detailed accounts of some of the historical buildings, such as the old bail bondsman building and First Baptist Church where the freedom riders came to hide. Visiting the home of Martin Luther King that was bombed in 1956 was the most exciting! Standing on the steps where he had once stood was so inspiring and powerful for me! I hope to share this experience with my students to give them an up-close understanding of the struggles of inequality and injustice of African Americans and to make them more aware of what's happening in the world around them.

Title: A Ripple in the Stream: Sharing the Experience of Racial Reckoning

Program: Charlotte Teachers Institute-Phillip O. Berry Academy of Technology

Author (s): Lori DiCenzo-Carter

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

I have long known our national shortcomings when teaching our authentic history. As a 1979 high school graduate, I vaguely remember learning about the treatment of indigenous peoples and the enslavement of Africans by those who came before me. During this time, white PhDs researched and wrote our history. As a 9th-grade World History teacher today, I can provide students and adults with a narrative that more accurately reflects the truth. To understand the truth of our history of enslavement and its impact, I immersed myself in stories shared by my African American colleagues and students. I visited museums and historic sites. I read books to better inform myself as a student, teacher, ally, and abolitionist. These experiences barely prepared my soul for this road trip. Our first stop was the Moore's Ford Lynching site in Georgia. Reading about the lynchings was gut-wrenching. Words cannot adequately express the experience of walking the area and seeing the location by the stream that held the two couples' bullet-ridden bodies until found. At a loss for words, I picked up a pebble and dropped it into the stream. As the pebble created ripples, I pledged my intention to use my new learning to make ripples in all the streams of my life: personally, professionally, and through my advocacy. Sharing my experience of racial reckoning will look different depending on my audience. Whether in my classroom, with family or in my community, I hope sharing this history will continue to ripple and create change.

Title: The Song of Suffering and Injustice

Program: Charlotte Teachers Institute-Choral Director, Carmel Middle School

Author (s): Matalya Dixon

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

Growing up as a young child in rural North Carolina, I was made aware of the racial injustices experience by people of color such as racial prejudice, discrimination and threats made by White supremacist groups. In school, I was educated on “basic African-American history”, typically highlighting the contributions of Martin Luther King, Jr., Rosa Parks, Harriet Tubman, and the music of the Civil Rights Movement. My public-school education was enriched with stories of our family history and legacy of our influential, well-established Williamson community. The less glamorous realties of the brutality suffered through the institution of slavery and lynching were often never discussed. The Civil Rights tour further emphasized the narratives that African Americans experienced then and still experience today. Our visits at the Moore’s Ford Bridge and in LaGrange, Georgia brought light to differing perspectives from the community as it addressed their indiscretions. In addition, the magnitude of The National Memorial for Peace and Justice lynching exhibit is overwhelming by the knowledge that these memorials are only a fractional representation of the horrific reality. The tour experience left me questioning the amount of progress that has been made for the advancement of people of color. The melodies remain constant, only the lyrics have changed. Legalized slavery is now known as mass incarceration while unjustified police brutality is known as modern day lynching. Perhaps, one day instead of changing the lyrics, the song of suffering and injustice will cease.

Title: Physiology of Peace: Biology and Human Rights

Program: Charlotte Teachers Institute-Science, Cochrane Collegiate Academy

Author (s): Regina Dula

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

With the tragedies of recent local and global events, violence is of great concern for citizens of all ages. In order to create cultures of peace, youth must be equipped with strategies and tools to ensure respectful and productive collaboration. In today's science classroom, peace education is rare. As we prepare our scholars for life beyond high school, educators are compelled to fuse peace education with our core subjects. Science allows us to examine how the stressors of violence affect the ecosystem of all organisms. For example, studies from The COAST lab (Contexts of Adolescent Stress and Thriving) examined the cortisol levels of scholars participating in standardized exams. Cortisol is a hormone secreted during high levels of stress. Access to clean water is a human right that has been violated nationally (Flint, Michigan water crisis) and throughout the world. Science enables the connection between human rights and peace by researching the diseases that thrive in unclean water. Data is a necessary component of peace education. Our scholars recognize various needs in our communities and must be given the opportunity and space to conduct research to bring awareness and possible solutions. At the beginning of the semester assignment, I intend to create a peace project by: (1) Supporting collaboration through icebreakers (2) Examining how humans react to issues such as hunger, thirst, and stress (3) Use the Categories of Peace Projects to create a class community project (4) Create a community night to showcase our peace education journey.

Title: The Battle of Human/Civil Rights in America

Program: Charlotte Teachers Institute-Exceptional Children, Mallard Creek High School

Author (s): Judy Duren

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

Every student needs to experience this journey. The Charlotte Teacher Institute's Civil Rights trip this summer really put history into perspective as an educator. On this journey our first stop was the memorial site of the Moore's Ford Lynching and the gravesite of Mae Murray Dorsey, one of the victims of the Moore's Ford lynching at the Zion Hill Cemetery in Monroe, Ga. Our next stop was at the Warren Temple United Methodist Church in LaGrange, Georgia where we spoke with members of Troup Together. This is a community group committed to collecting stories, building dialogue, healing divisions, and seeking justice. From there we drove to Montgomery, Alabama where Dr. Sherry Cherry gave us a tour of key civil rights sites including the home of Dr. Martin Luther King, Jr. before turning in for the night. On Friday, we set out to the Legacy Museum and the National Memorial for Peace and Justice. After driving to Memphis, Tennessee where we experienced an evening on Beale Street. On Saturday, we visited the Civil Rights Museum at the Lorraine Motel and the Legacy Museum across the street where the fatal shots came from that killed Dr. King. On to Birmingham Alabama to the 16th Street Baptist Church a civil rights historical site and active place of worship. On Sunday morning we attended church service at the historic Bethel Baptist Church where lunch was served before heading back home. Our journey through Georgia, Alabama, and Mississippi was a wonderful learning experience that will be used in the classroom.

Title: A Robbed Past

Program: Charlotte Teachers Institute-8th Grade Social Studies, Marie G. Davis IB K-8

Author (s): Pamela Goines

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

The Civil Rights/Racial Equity trip brought haunting textbook images and descriptions to life. Spending part of my childhood in two racially segregated areas of Tulsa, Oklahoma, visiting the Magnolia Plantation in Charleston, South Carolina, and minoring in African American Studies in my adulthood, I felt that there would be nothing I could encounter that would be new to me or my family history. I questioned whether any piece of historical evidence could weigh on my spirit and dignity more than those factors. The Civil Rights/Racial Equity trip which included a visit to a lynching site at Moore's Ford bridge and a visit to the Legacy Museum angered me. It was very upsetting to see the cemetery markers of unknown black persons across from a probation office in a poor section of town. A frantic search for any lynched relatives at the Legacy Museum in the hot sun prompted me to compare the smallest details in all the museums to what I missed studying the Civil Rights Movement. I remembered my grandmother's history but could not remember my father's family history other than my aunt dating a member of the Black Panther Party. In our discussion with Troup Together and the Equal Justice Initiative, I was reminded of all the organizations who fought for equality and justice to further implement civil right laws but could not seem to overcome the effects of past discrimination, lingering prejudice, and a lost history. These gaps also need to be filled in our current curriculum to promote a sense of identity.

Title: Separate but Equal, and Other Lies to Disrupt the Peace

Program: Charlotte Teachers Institute-6th Grade Social Studies, Albemarle Road Middle IB Magnet School

Author (s): Tam Hawk

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

“Back then, as a teenager, I kept thinking, why don't the adults around here just say something? Say it so they know we don't accept segregation? I knew then and I know now that, when it comes to justice, there's no easy way to get it. You can't sugarcoat it. You have to take a stand and say, 'This is not right.'

Claudette Colvin

“That’s not fair!” say students. There is a long history of structural violence, outlined in the Triangle of Violence, embedded in our institutions, responsible for the creation of unfair laws. Racist doctrines such as “separate but equal”; can be exemplified, by an activity, of dividing groups of students, good candy versus very basic. Both have candy; therefore, it must be equal. Was the intent to be equal or separate? It did not advance the acceptance of the rights of others, as defined in The Pillars of Peace or to receive basic human rights as outlined in the UDHR. What similarities and what is needed for Peace, Justice and Strong Institutions as a goal? Information from the Civil Rights/Trip outlines a horrific narrative of violence, and a struggle for the acceptance of others. Propaganda demonized Black Americans as subhuman, inherently violent and allowed for institutional laws that created violence. The KKK had free reign to terrorize, lynch people for any reason, such as vagrancy. We can connect the relevance of the past to our society today. What laws are created to inhibit certain people from having rights? What laws instigate violence against other groups? Ancient Civilizations had the struggle of human rights. We will evaluate historical documents like Hammurabi’s Code, historical figures, and conflicts about human rights. What has been done for and against human rights and how can we use our historical knowledge and voices to make a difference to ensure the acceptance of the rights of others.

Title: We Have Not Overcome: Comparison of Human Rights Violations in Sudan to Civil Rights Era

Program: Charlotte Teachers Institute-EL Teacher, Ardrey Kelly High School

Author (s): Sara Herrera-Dandridge

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

Many students in CMS schools are from countries that have an unstable government or economy. Every child has the right to feel safe in the country they are in. According to Article 5 of the Universal Declarartion of Human Rights," No one shall be subjected to torture or to cruel, inhuman or degrading treatment or punishment". In an effort not to signal out any native countries, a comparison of Sudan and the Civil Rights Era in the United states will be conducted. The removal of the independent peacemakers in 2021 from Sudan and the violence that ensued is similar to the atrocities that took place in Birmingham, Alabama during the 1960s under the hand of Bull Connor. I will take students on a journey about the social establishment of unacceptable "abuse of power" against populations – starting with Bull Connor - known for his use of police dogs and fire hoses to quell the Civil Rights demonstrations in 1962-1963 – to abuse of power today in Sudan, Venezuela and other countries. The people of Sudan and Venezuela have experienced many human rights violations. Bull Connor created laws in Birmingham to ensure segregation. It is the hope that using the NewGen Peacebuilders Curriculum and focusing on Healing and Heart will foster discussions of race relations, human rights and elicit change. This will coincide with the English 3 curriculum unit of America at War.

Title: No Health Without Mental Health/No Hay Salud sin la Salud Mental

Program: Charlotte Teachers Institute-Spanish, Independence High School

Author (s): Matt Kelly

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

The United Nations recognizes access to mental health care as a fundamental human right. All my students come from populations with challenges in accessing mental health care simply because of the state in which they live. Hispanics are less likely to access mental health services than other groups, but Hispanic women have a higher rate of depression than Black and White women. Black teenagers are more than 50% more likely to attempt suicide than White teens. Asian Americans are the demographic group least likely to seek mental health care. Overall, North Carolina ranks 42 in the U.S. for incidence of youth mental illness and access to mental health care. In my school, 23.1% of students are White, 30.8% are Black and 37.1% are Hispanic. 5.5% of students are Asian. 2.8% of students identify with two or more races. 30.1% of students qualify for free or reduced lunch. My Hispanic students predominantly come from English-dominant homes. I plan to use the thematic units in the Spanish II curriculum dealing with health care as an on-ramp to explore mental health care and well-being. I will use activities from the NewGen curriculum for starting conversations about topics that matter, adapted for language learners in the Spanish classroom. Students will engage in research finding community resources in Spanish around these themes. Students will identify and prioritize community resources and create a campaign to publicize them to the school community.

Title: The Ground Cries Out

Program: Charlotte Teachers Institute-ELL, Garinger High School

Author (s): Brian D. Kennedy

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

“In the soil there is the sweat of the enslaved, In the soil there is the blood of the victims of racial violence and lynching. There are tears in the soil from all those who have labored under the indignation and humiliation of segregation. But it is in the soil there is also the opportunity for new life, a chance to grow something hopeful and healing for the future.”

-Bryan Stephenson

The Memorial for Peace and Justice records the names over 4,400 people who had been lynched in the United States through 1949. At the Legacy Museum and at the Memorial for Peace and Justice there is a display of dirt that has been collected from every known site where a lynching has taken place. The dirt has been preserved from the precise location that it originated as a legacy of those lives lost to racial terror. Scripture also has few, specific causes of the ground crying out to God, which include murder, mistreatment, slavery, and unfair wages. How long will the land itself still cry out in these places where these atrocities have occurred? How can the land begin to heal? While the answers might not be reached, it is worth exploring through an artistic representation. Going forward, I will be working on an original artwork linking the soil project and the spiritual implications of the ground crying out to God. This project has roots in Black Liberation Theology, which states that systems, along with individual people, are in need of and able to be redeemed.

Title: The Civil Rights Trip: The Small Silence for the Fight of Civil Rights

Program: Charlotte Teachers Institute-Phillip O Berry Academy of Technology

Author (s): Debbie B. Kennedy

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

As an African American woman born in North Carolina my observation of racial disparities was transparent. My daily survival consists of staying away from businesses that contain confederate flags, Ku Klux Klan meetings being held downtown, and being chased by white teenagers were part of my life experiences. My perception of this trip I knew would be educational and at times overwhelming, then evolved to life changing memories. This trip gave me the first-time knowledge of what resistance meant. When we traveled to Georgia, Memphis, and Alabama I felt the growing reminiscences of past lives. Nonetheless one stood out slightly more, and that was the schoolchildren at Kelly Ingram Park in Birmingham, Alabama. The dedication to the small silent activists was momentous. I knew about the bombing at 18th street Baptist Church, but to now know these students' bodies provided coverage to save people that were in the church altered my perceptions of historical facts. Plus, learning how other small activists contributed to the civil rights movement. These small silent activists continued to place their little bodies in the wake of attack dogs and water cannons for over four days gave me a sense of overwhelming anger and pride. Listening to the presenter and remembering his description of the water cannons as, "powerful enough it could take the bark off a tree" sent jolts over my body. I understood how everyone could play a significant role in these njustices. These young people receive little media attention, but they forever change the perception that students can transform "Good Trouble" stated by John Lewis to 'Great Trouble.'

Title: Made In America, Greed, Business Finance, and Marketing!

Program: Charlotte Teachers Institute-Educational Facilitator, Harding University HS/ Rocky River HS

Author (s): Thomas Murphy

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

The slave trade was the genesis of the American way of business methods that are present in all aspects of society. Jim Crow laws evolved alongside capitalism to create a business model that was uniquely made in America. On a recent four-day Civil Rights trip to the Equal Justice Initiative's Legacy Museum in Montgomery, AL., the Civil Rights Institute in Birmingham, AL., and historical markers to victims of racial terror lynchings in Georgia, it became clear the oppressive ways that conduct of the Black people in the American culture, including business, were manipulated even today. This systemic structure was legitimized leaving African Americans still struggling in business today. The Black Power Struggle is a critical avenue in seeking equal justice. The Negroe (Black) people who were the wealth generator for the antebellum South have a role in eliminating subservient beliefs held by the power and mindset of the modern-day segregationist movement. High school students in principles of business and finance will study the history of business and marketing by critically reviewing examples of the origin of business practices coined "Made in America". These students will consider the role of e-commerce to amass wealth and to exploit people in today's marketplace leaving a legacy of unnamed contributors that are not fully able to participate in today's economy.

Title: The Youth Will Be the Pillars of Light Out of Darkness: The Question Project

Program: Charlotte Teachers Institute-West Charlotte High School

Author (s): M. Lynn Roach

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

“Darkness cannot drive out darkness, only light can do that. Hate cannot drive out hate, only love can do that.”

-Dr. Martin Luther King Jr., Strength to Love, 1963

This quote by Dr. Martin Luther King Jr. makes me think of the darkness of race relations we struggle with in America today, but it also gives me motivation to prepare the future generation toward peace, respect, and understanding. The last two years in education have been difficult, as an educator with 23 years of experience, I found myself struggling for answers to several questions: How do I teach the future leaders to gain peace within themselves and toward others? How do I create a call to action for human rights? What are the essential tools they will need to be prepared for a better future? How can I be a Drum Major of peace and righteousness? Yes, I can, by passing them the baton through the creation of positive long-lasting relationships based on acknowledgement of the past, common respect and understanding by exposing them to current inequalities around race in education and various policies. This will be accomplished through the Question Bridge Project (QR Code with PowerPoint), training from the Peacebuilders “Right to Rights” lessons, enriching field trip experiences through the Civil Rights (Legacy Museum) and College Tours (Johnson C. Smith University and Queens University) and the Equal Justice Initiative: Racial Justice Essay Contest 2023. Through these relationships, students will not only gain knowledge and understanding of cultural and structural violence, but establish a call-to-action legacy project of social justice of their own.

Title: Disclosing and Declaring the Untold Stories

Program: Charlotte Teachers Institute-Curriculum Resource Teacher (Social Studies), CMS Elementary Learning and Teaching

Author (s): Lecia Shockley

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

The journey that took us through Georgia, Alabama, and Tennessee brought to life the long and somber chronicle of America's infliction of racial violence toward African-Americans. Over four days we wrestled with the bitter history that began over 400 years ago when the first enslaved Africans arrived in Jamestown. Our primary focus was the 'modern era' of the 20th and 21st centuries – seeing the difficult truths confronted in both our past and present. I found myself most rocked by the stories: the justifications given for lynchings, the narratives of those incarcerated, the narration of our tour guides and those we sat beside in church, the community apologies. In his book, How the Word is Passed, Clint Smith writes "So many people, specifically white people, often have understood slavery and those held in its grip, only in abstract terms. They do not see the faces. They cannot picture the hands. They do not hear the fear or the laughter. They do not consider that these were children like their own or that these were people who had birthdays and weddings and funerals, who loved and celebrated one another just as they loved and celebrated their loved ones." I came away from this experience wanting to know more – to see, picture, hear, and consider. In my own life and in my sphere of personal and professional influence I want to explore and know these stories so that this history is remembered and reckoned with.

Title: Traditionally, We Learn a Superficial Truth

Program: Charlotte Teachers Institute-English I, Harding University High School

Author (s): Shannon N. Shore

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

When I consider the amount of information afforded to me and my peers on the Civil Rights Trail, I am disappointed to realize how superficial my depth of knowledge, particularly as an educator and woman of color. I would read every placard and land marker which displayed information I would not ever find in a history book. Not one textbook that my students will read from to learn about how the country they live in today was cultivated, will describe the egregious acts performed by white citizens who felt blacks needed to be kept in their place. From the historical site in Monroe, GA; the only one of its kind marking a mass lynching, to the grave site of those who will never be known for the sacrifice they made with their lives to appease the restless superiority complex most whites outwardly displayed. To white citizens of LaGrange, GA who formed their own chapter of the NAACP because they were not pleased with the injustices their black neighbors had to endure. The most valuable treat of the tour was the personal touch added by our three guides. To have the stories retold, the intimate details of those involved, and passion woven in with their wisdom was so revealing. Each stirring up my desire to research more, for the lost voices of the Civil Rights Movement; before, during, and now.

Title: An Unknown American Story

Program: Charlotte Teachers Institute-8th Grade Social Studies, Northwest School of the Arts

Author (s): Khuanduen Toatley

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

Changing the course of history, by learning from our past. There were 43 classroom teachers who were selected to take a journey back in history. Many of the participants, including myself, did not know what to expect on this Civil Rights trip to Georgia, Alabama, and Tennessee but received a wealth of information from Civil Right Activists. During the townhall meeting in LaGrange, Georgia in Troup County, we were able to hear from citizens on how they are trying to heal their community from years of inequality. They established an organization called Troupe Together, where members in the community have open and honest conversations about how they can make a difference in public schools and neighborhoods. Our next stop was Montgomery, Alabama, where we met Shirley Cherry. She took us on a tour of Montgomery, where she explained the impact the citizens Montgomery had on the Civil Rights Movement. We stood where the bomb hit Dr. Martin Luther King, Jr.'s house in 1956. Mrs. Cherry explained how Dr. King was calm and peaceful after the bombing, impacting the entire African American community. The Peace and Justice Memorial Center allowed individuals to see the loss of life through lynching in 837 counties in America. The Lorraine Motel started from the beginning of forced enslavement of Africans to the assassination of Dr. Martin Luther King, Jr. Although Dr. King did not see the vision of his dream, there was a leader such as Fred Shuttleworth to carry the torch to equality. We must know the truth in order to ensure we do not make the same mistake twice. Equality is a birthright and no one should have to fight for it.

Title: The Roles of a Teacher: Social Justice History Marker and a Peacebuilder.

Program: Charlotte Teachers Institute-Spanish, Olympic High School

Author (s): Milagros Ugueto

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

Are history markers about social justice making history? Some markers were addressed at the beginning of the Civil Rights Trip last week. The first ones told us about the lynching of African American people in Alabama. Every word on them was read vehemently. Nevertheless, it did not take long to know firsthand that this is still a segregated world based on having access to resources. As a teacher, I commit myself to let my community know about the events that changed the world in a peaceful fight for justice that unfortunately led to painful deaths. I started this trip by reading the book Juneteenth, then continue in places where African American people were lynched identified with history markers. Members of Troupe Together in LaGrange let us know that a long road has been traveled regarding Civil Rights, but still poverty determines whether people are being segregated or not. My reflection is that students coming to the United States of America, along with their families should know what happened in the land where they chose to live. I wonder whether I will have the enthusiasm of Shirley Cherry, our first tour guide, to teach the facts, with passion and authority in a peaceful environment guided by my high school students. How am I going to facilitate my students' willingness to learn and promote social justice, conflict resolution, and peacebuilding? Through the 7H framework I intend to help them move from learning concepts to putting them into action.

Title: Peace Language and the Mediation of Adultification Bias

Program: Charlotte Teachers Institute-English, West Charlotte High School

Author (s): Dr. Angela Walker

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

Research has shown how the devastating effects of the adultification of Black youth have both short-term and long-term consequences in schools. Adultification is a bias that perceives youth of color as more mature than they are, resulting in the belief that these students should be held to a higher standard of accountability and receive harsher punishment for behavior that is consistent with white children of the same age. It is structural, institutional, and interpersonal violence that manifests in the belief that students of color (and especially Black female students) are more violent, disruptive, and manipulative. Current racial equity research reveals that Black students in the Charlotte Mecklenburg System were 7.1 times more likely to be suspended when compared to white students, which alludes to the persistence of adultification in the day-to-day interactions between Black students, teachers, and administration. Utilizing Monique Morris's Pushout (2016) and the tools of peacebuilding in My Peacebuilder Foundations, this research explores practical, language-oriented solutions for undermining the devastating effects of adultification. AP English Language students will explore de-escalation strategies, the eight pillars of peace, the language of rights, hope, harm, respect, and dignity. They will use these concepts to lead critical conversations and will ultimately become voices of student mediation. The aim of the research is a student-devised action plan that disrupts adultification bias in school. The implications of the research centers the wellbeing of students, empowering them to identify barriers to and to take agency for the positive future they envision.

Title: The Many Layers of Racism: A Return Journey to Familiar & New Sites - CTI Civil Rights Trip 2022

Program: Charlotte Teachers Institute-Visual Art Teacher, East Mecklenburg High School

Author (s): May Winiarski

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

The trip we took together as educators was amazing as usual. The information was extremely important for us to experience, so that we can share it with our students and community. The last student trip I was on, the key element for them was all the foot soldiers that made the movement. It empowered them knowing that they too could participate. On this trip I focused more on the foot soldiers. The new Legacy Museum in Montgomery was overwhelming, but so rich in information about the history from slavery to mass incarceration. When you proceed into the museum there is an installation of heads in the sand of the ocean representing those slaves that did not make it. It was powerful as was the film about the artist and how he created his work. At the end of the museum there was a gallery of artwork by 20th & 21st century African American artists. Several of my favorites, including Kerry James Marshall, Elizabeth Catlett, Faith Ringgold, and Romare Bearden, as well as new artists' work. Having the artworks as bookends to the history and information presented was poignant. This was my first time at The Lorraine Hotel in Memphis, TN. We watched the movie Martin Luther King in the Wilderness before visiting this site. Knowing all that lead up to the point of the assignation made the whole experience chilling and powerful. Knowledge is powerful. Sharing this information with students helps to empower them.

Title: Environmental Justice for All

Program: Charlotte Teachers Institute-7th Science and Social Studies, Cochrane Collegiate Academy

Author (s): Jessica Young

Faculty Mentor (s): Dr. Scott R. Gartlan

College: Liberal Arts and Sciences

Young people across the globe are worried about their future, and rightfully so. More powerful hurricanes and tsunamis, frequent droughts and forest fires, rising sea-levels, declining air quality, and other effects of climate change displaced an estimated 25 million people in 2019 alone. Nearly half of Americans can expect to experience a decline of environmental quality in their lifetimes, namely less water and more heat. Instead of preventing and preparing for the impacts of climate change, people of the United States continue to rebuild in areas prone to forest fires and flooding. Our legislators allow business and politics to dictate our response, or lack thereof, to climate change. The environmental and structural violence of climate change disproportionately impacts the most vulnerable globally and within the city of Charlotte, where rising temperatures and extreme weather events are likely to increase the divide between residents of high and low socioeconomic status. Everyone, no matter their race, nationality, age, or income level, has a right to a safe environment. Students will investigate the causes and costs of climate change as part of 7th Grade Science Unit 1: Weather and Climate. Students will learn their rights by participating in the My Peacebuilder Foundations course, specifically focusing on the ecological sphere of peace, while building classroom culture during the first two weeks of school. By combining their scientific understanding of climate change with peacebuilding skills, students will be able to advocate for change through peace projects.