List of ECU Mentors for Summer 2025:

1. Dr. James Clifford; Public Health
   Cigarette smoking is a known risk factor for a variety of negative health outcomes including cardiovascular disease and various types of cancers. Nearly $200 billion in annual healthcare costs are directly attributable to cigarette use in the United States. New products, such as electronic cigarettes (ECIG), have recently entered the market and are often touted as a safer alternative to conventional cigarette (CIG) smoking due to the lack of combustion and reduction of exposure to harmful constituents found in cigarettes (such as tar). It is unclear how CIG-exclusive users transition to ECIG-exclusive use and if they completely abandon CIGs or become dual users of both products. These analyses will have two aims: (1) we will describe the patterns of transition (e.g., CIG-exclusive user to ECIG-exclusive user); and (2) we will use multinomial regression to calculate predictive probabilities of switching on the basis of demographic factors. These secondary analyses will utilize the sixth wave of data from the Population Assessment of Tobacco and Health (PATH) a large nationally representative sample of tobacco users in the United States (N = 30,516). Students interested in assisting with these analyses will gain an understanding of the R programming language as well as descriptive (e.g., Chi-square, ANOVA) and regression statistical models (i.e., multinomial regression). Students should be prepared to conduct literature searches, write introduction and results sections, as well as conduct data analysis and data management (i.e., entirely in the office, no field work is expected).

2. Dr. Sinan Sousan; Public Health
   Climate change has exacerbated heat-related illnesses (HRIs) among outdoor workers, with North Carolina (NC) being particularly vulnerable due to rising temperatures and its reliance on agriculture, which contributes 17% to the state's economy. Agricultural workers face hazardous conditions, prolonged labor hours, and barriers like inadequate training and insufficient hydration. HRIs, ranging from heat rash to fatal heat stroke, are worsened by high wet-bulb temperatures and can cause dehydration, kidney damage, and cardiovascular stress. Studies in NC indicate agricultural workers represent a significant portion of heat-related fatalities. To mitigate HRI risks, we propose using wearable sensors to monitor real-time physiological and environmental conditions, enhancing heat stress risk assessments. These low-cost sensors will measure factors like core body temperature, hydration, heart rate, respiratory rate, and environmental metrics. Data from the sensors will integrate with artificial intelligence to predict individual heat risks, enabling preemptive interventions. A pilot study, scheduled for July 2025, will recruit 30 farmworkers from NC. Participants will wear non-invasive sensors on their chest, wrist, shoulder, and belt during one workday, with devices transmitting data to Android phones. The study will involve health screenings, informed consent in English and Spanish, and compensation for participants. This approach aims to advance occupational safety by linking personal exposure data with innovative tools, addressing HRIs and improving farmworker health outcomes.

3. Dr. Guy Iverson; Environmental Health; co-mentor Dr. Charles Humphrey
   Shallow groundwater impacts sewer infrastructure in North Carolina's Coastal Plain, often leading to ineffective stormwater management due to rising groundwater or

inadequate siting. Communities often lack sufficient groundwater data to guide stormwater management, thus more groundwater data is needed to improve stormwater management. This project integrates soil science, hydrogeology, and geospatial information systems to characterize the depth to water in Greenville, NC. Results from this project will be used to evaluate the relationship between shallow groundwater and stormwater infrastructure, identify systems that are currently stressed by shallow groundwater, and identify zones where stormwater retrofit activities are appropriate. Your role in this project will be to assist with monitoring groundwater levels in Greenville, NC. More specifically, you will be expected to: 1) assist in developing and upkeeping a groundwater monitoring network; 2) assist in evaluating soil characteristics; 3) routinely monitor depth to water in piezometers; 4) maintain water level loggers in selected piezometers; 5) evaluate water levels in stormwater control measures; and 6) organize and analyze water level data. Participation in this project requires a driver's license and a personal vehicle to support project-related travel. Your mileage will be reimbursed through project funds.

4. Dr. Avian White; Health Education and Promotion; co-mentor Dr. Carmen Cuthbertson
   While global maternal morbidity and mortality rates have declined over the past two decades, the United States has experienced an increase in this area of adverse health outcomes (Saluja and Bryant, 2021). Indeed, recent data show the US maternal mortality rate has increased from 20.1 deaths per 100,00 live births in 2019 to 32.9 in 2021 (Hoyert 2023). Maternal mortality rates for non-Hispanic black women were significantly higher than those of non-Hispanic white women, 69.9 deaths per 100,000 versus 26.6 per 100,000, respectively (Hoyert 2023). Thus, maternal health is a significant concern in healthcare. A multitude of factors may contribute to this phenomenon of increasing morbidity and mortality rates (i.e., maternal age, pre-existing conditions, prior cesarean delivery, BMI, etc.,). One factor of increasing importance is the development of cardiovascular issues. Thus, it important to understand knowledge and perception of cardiovascular disease pre-and postnatal. Our research aims to characterize and evaluate this knowledge by using quantitative surveys to measure awareness, knowledge, and perception of CVD risk related to adverse pregnancy outcomes. Additionally, we will perform in-depth interviews to explore acceptability of educational interventions to increase knowledge of CVD risk related to pregnancy.

5. Dr. Eric Anderson; Biology
   Our lab is studying the ability of artificially synthesized antimicrobial peptides to disrupt bacterial biofilms and control the infectivity of *Pseudomonas aeruginosa* in patients with cystic fibrosis. We will be testing a new group of engineered peptides using bacterial culturing techniques, as well as evaluating their effect on bacterial stress responses using primarily real-time PCR and SDS PAGE analysis.

6. Dr. Rebecca Asch; Biology; co-mentor Naomi Jainarine
   Climate change is leading to seasonal changes in the timing of many ecological processes, including reproduction, migration, and population dynamics. This can disrupt food webs if organisms that previously co-occurred and interacted with each other through predator-prey relationships no longer occur at the same time of year. In North

Carolina coastal ecosystems, we know that fish larvae have been entering nursery habitats earlier in the year than in past decades, but it is unknown if their key prey items have experienced similar responses to a changing climate. Understanding the dynamics of fish larvae is essential for monitoring the productivity of adult fish populations that are relied on by coastal communities as a source of food and for commercial fishing livelihoods. We plan to address this issue using a time series of five years of weekly samples on zooplankton (the principal prey for fish larvae) collected from Beaufort Inlet, North Carolina. Samples will be imaged with a Zooscan instrument and then a computer vision-based machine learning technique will be used to identify taxa in these samples. Students will gain experience processing plankton samples, operating the Zooscan, identifying species, and analyzing data outputted from machine learning.

7. Dr. April Blakeslee; Biology; co-mentor Meghan Nadzam
   Seagrass beds are vital but endangered marine ecosystem, making up at least 160,000 km2 worldwide while playing pivotal roles in sediment accumulation and stabilization and habitat for biodiverse fauna. Seagrass beds of North Carolina are unique, as they reside in a biogeographic transition zone between temperate and tropical bioregions; this means changing climactic patterns could more readily alter seagrass abundance and ecosystem structure and biodiversity along NC coasts. Seagrass species in this region are dominated by *Zostera marina* (winter/spring-dominant) and *Halodule wrightii* (summer/early fall-dominant), with temperatures >28-30°C causing heat stress *Z. marina*, but increased biomass for *H. wrightii*. However, both seagrass species are often dominated by the growth of epiphytic microalgae, bacteria, microfauna, and detritus (otherwise known as "epibionts"). Epibionts foul seagrass blades, sometimes outcompeting them for light and limiting nutrient uptake from the water column. Multiple studies have addressed the direct influence of epibiont biomass on seagrass productivity through grazer activity. However, little research addresses how parasitic infection of these grazers could impact consumption behaviors, indirectly affecting seagrass productivity and health. Our summer work will determine the influence of parasites on the ecosystem function of seagrass systems by integrating observational surveys, behavioral assays, lab microscopy, and field experimentation.

8. Dr. Rachel Gittman; Biology; co-mentor Mary-Margaret McKinney
   Marsh planting stress amelioration through microbial inoculation and salinity pre-treatment Marsh restoration is key aspect of coastal resilience, but survival of planted plugs is often poor and unpredictable. Previously researched methods to improve success often focus on methods that are difficult or costly to implement at scale. This spring and summer we will be pre-treating, planting, monitoring, and measuring 5,000 *Sporobolus alterniflorus* seedings in Carteret County to determine if pre-treatment with saline water and/or marsh microbial communities can improve the growth and/or survival of marsh grass plugs planted on restoration sites. By performing low-cost treatments at a commercial nursery prior to plant delivery, we hope to develop actionable ways to improve *S. alterniflorus* growth and survival that could be easily implemented on large-scale restoration projects.

9. Dr. Xiaomei He; Biology

RNA G-quadruplexes (rG4s) are RNA secondary structures that play vital roles in RNA metabolism, including RNA splicing, transport, and stability. More importantly, rG4s are associated with various human diseases, with their functions often mediated by rG4-binding proteins. Understanding these proteins can provide deeper insights into the roles of rG4s in RNA metabolism and diseases. Our prior bioinformatic analysis identified several rG4-binding protein candidates, among which U2AF1, a key splicing factor, was one of the top candidates. To investigate the interaction between U2AF1 and rG4, we purified recombinant U2AF1 protein and conducted fluorescence anisotropy assays to measure its binding affinity for rG4 and a mutated probe (rM4). The results demonstrated that U2AF1 binds strongly and selectively to the rG4 probe, suggesting that U2AF1 is a novel rG4-binding protein. To further assess whether U2AF1 binding induces structural changes in rG4, we performed circular dichroism (CD) spectroscopy, which revealed that rG4 was unfolded upon U2AF1 binding. This suggests a novel role for U2AF1 in rG4 unfolding. In future studies, we aim to confirm U2AF1's role in rG4 unfolding both in vitro and in cells using fluorescence resonance energy transfer (FRET) assays and fluorescence microscopy. We will also determine which U2AF1 domains are responsible for interacting with rG4 and for its unwinding activity. Additionally, we will explore the biological function of this interaction in RNA metabolism. Collectively, our research will uncover U2AF1 as a novel rG4-binding protein and unveil a new function of U2AF1 in rG4 biology.

10. Dr. Fadi Issa; Biology
    My lab examines the neurobiology of social aggression and how social stress affects brain function using zebrafish as a model organism. The student will join an ongoing project to examine the effects of social dominance and subordination on the thalamic parathyroid hormone neurons (PTH2). PTH2 is a hormone typically associated with calcium release, but it also promote prosocial behavior and serves as anxiolytic molecule to relieve stress. The student will be testing the hypothesis that PTH2 neuronal expression, activity and structural morphology will differ in animals of different social rank.

11. Dr. Ariane Peralta; Biology
    We study how climate and human-induced environmental changes influence microbial community structure and functions associated with regulating water quality. Specifically, we examine wetland microbiomes that provide beneficial ecosystem functions such as improving water quality and facilitating carbon storage. But changes to environmental conditions cause unpredictable microbial responses leading to increased greenhouse gas production and contaminant loads. For example, the addition of nutrients and changes to the water cycle from human enterprises cause dramatic shifts in terrestrial and aquatic microbial communities, ultimately influencing flows of carbon and nutrients through land, water, and the atmosphere. We now have the molecular tools to study the diversity of microorganisms that have been challenging to culture in lab settings. The goal of this project is to examine how environmental changes influence microbial traits using genomic sequencing approaches and microbial functions using lab-based assays of samples from urban, agricultural, and coastal wetland ecosystems. Undergraduate researchers will collaborate with graduate students, staff, and faculty researchers. Our lab

conducts microbiology research that is interdisciplinary and involves collaborations with community and ecosystem ecologists, sociologists, economists, engineers, anthropologists, geologists, and microbiologists. This work focused on understanding how environmental changes influence microbial communities will inform wetland and water management efforts that result in predictably enhancing beneficial ecosystem functions.

12. Dr. Morgan Milton; Biochemistry and Molecular Biology
    Biofilms are complex bacterial communities that adhere to surfaces. Bacteria use biofilms as a physical barrier to protect themselves from unfavorable conditions and persist in the environment. In this biofilm state, bacteria can be a major problem for humans. The biofilm allows bacteria to be up to 1,000-fold more resistant to antibiotics and the host immune response. My lab's goal is to understand how biofilms are formed in the model organism *Vibrio fischeri* so we can develop therapeutic interventions. We study biofilms through a biochemical structure-function approach. By understanding the 3D structure and basic biochemical properties of a protein, we can address important questions about the protein's function within the cell. We are studying proteins that control the production of the protective biofilm matrix to better understand how bacteria make biofilms. The summer student will work alongside a PhD student to learn how to express and purify recombinant protein for use in biochemical and structural experiments. Experiments include SDS-PAGE and Native PAGE analysis, analytical ultracentrifugation, differential scanning fluorimetry, enzymatic assays, and X-ray crystallography. The student will gain an understanding of how to perform each experiment, how to analyze the resulting data, and the limitations of each method. From this research experience, the student will gain hands-on experience with essential techniques typically employed by biochemistry labs.