

Abstract Book

Friday, August 2, 2024

Popp Martin Student Union

&

Online via Symposium

<https://symposium.foragerone.com/srs-2024>

# Welcome to 2024 OUR Summer Research Symposium!

The Summer Research Symposium celebrates the intellectual exploration and creativity of our students. With over 140 presenters, 2024 represents our largest ever Summer Symposium. The presentations are the result of nearly 30,000 hours of collaborative work between students and mentors in the labs, libraries, studios, field sites, and with community partners. We encourage you to engage broadly with the diverse projects representing 7 colleges from across the University of North Carolina at Charlotte.

The research presented here represents multiple National Science Foundation supported programs, the Charlotte Teachers Institute, the Louis Stokes Alliance for Minority Participation, and the OUR Summer Scholars.

The Summer Research Symposium would not be possible without the commitment of our UNC Charlotte research mentors. A big thank you to all mentors for your service and dedication to undergraduate research, scholarship, and creative activities at UNC Charlotte.

View presentations, ask questions, and continue conversations online at the 2024 Summer Research Symposium site



**2024 Summer Research Symposium**

**Schedule of Sessions**

8:30 AM - On-site Conference Registration Opens (Rm 340)

9:15 AM - 9:30 AM - Welcome

9:30 AM - 10:30 AM - First Session of Poster Presentations (340)

10:00AM - 11:00 AM - First Oral Presentation Session (200 rooms)

10:30 AM - 10:45 AM - Poster Swaps (340)

10:45 AM - 11:45 PM - 2nd Session of Poster Presentation (340)

11:30AM - 12:30 PM - 2nd Oral Presentation Session (200 rooms)

11:45 AM - 12:00 PM - Poster Swaps (340)

12:00 PM - 1:00 PM - Third Session of Poster Presentation (340)

1:00 PM - 2:00 PM - Lunch for Presenters & Mentors (back of 340)

First Oral Presentation Session 10:00-11:00AM

*Room 261*

Abstract #401 - Efficacy of Anterior Heel Wedge at Reducing Knee Flexion Contracture after Total Knee Arthroplasty: A Pilot Investigation by Gracyn Dwyer; Mentor: Abbey Thomas, College of Health and Human Services

Abstract #402 - Mexico's Economic Influence and the Debt Crisis of the 1980s by Ashley Alcivar Conteron; Mentor: Jurgen Buchenau, College of Humanities & Earth and Social Sciences

Abstract #403 - Improving State Space Models using Structured Low Rank Optimization by Brian Mohseni; Mentor: Kümmerle, College of Computing and Informatics

*Room 263*

Abstract #404 - Designing parts as combinations of smaller pieces for sustainable Manufacturing by Gabriel Bonus; Mentor: Mahmoud Dinar, William States Lee College of Engineering

Abstract #405 - Effect of KRAS Inhibitors on Oncolytic Virotherapy by Nathaniel Foret; Mentor: Valery Grdzelishvili, College of Science

Abstract #406 - Measurement of Gas Flow in the Laser Powder Bed Fusion Additive Manufacturing Process by Andrew Thompson; Mentor: Jaime Berez, William States Lee College of Engineering

*Room 265*

Abstract #407 - The Mechanism and Sensitivity of Alcohol Sensing Utilizing Dipyridinium Thiazolo[5,4-d]Thiazole by Aiden Hawkins; Mentor: Michael Walter, College of Science

Abstract #408 - Revisiting the Mission: An Ethnographic Evaluation of Identity Discourse and Advocacy Efforts in Non-Profit Organizations by Eesha Alla; Mentor: Sharon Watson, College of Humanities & Earth and Social Sciences

Abstract #409 - Multisite phosphorylation of the yeast co-chaperone Cdc37 fines-tunes the global yeast stress response by Ashley Choi; Mentor: Andrew Truman, College of Science

Second Oral Presentation Session 11:30AM - 12:30PM

*Room 261*

Abstract #501 - Mrs. E.W. Payne: A Literary Contribution to Science and Religion by Haywood Hayes; Mentor: Alan Rauch, College of Humanities & Earth and Social Sciences

Abstract #502 - Understanding the Kar2 Chaperone Code by Erica Flores; Mentor: Chathura Paththamperuma, and Andrew W. Truman, College of Science

Abstract #503 - The Mechanical Integrity of Mycelium-Hemp Structures by Trenton Brooks; Mentor: Brigid Mullany, William States Lee College of Engineering

*Room 263*

Abstract #504 - Mexico and Global Economic Justice: An analysis on the Carter administration by Sofia Fuentes; Mentor: Jurgen Buchenau, College of Humanities & Earth and Social Sciences

Abstract #506 - Prototyping a Coordinated Multi-Drone Network System using Autonomous Path-finding Algorithms by Chandra Siddhartha Geddam, Mohammad Hasan; Mentor: Ran Zhang, William States Lee College of Engineering

Abstract #507 - What does Wilhelm Reich have to teach us about health today? by Joseph Thompson; Mentor: Shannon Sullivan, College of Humanities & Earth and Social Sciences

*Room 265*

Abstract #508 - Light-Activated Nanoparticles for The Elimination of Bacterial Biofilms by Atqiya Nafisa; Mentor: Juan Vivero-Escoto, College of Science

Abstract #509 - Blood Memory - Resistance by Amaree Ratliff; Mentor: Tamara Williams, College of Arts and Architecture

First Session of Poster Presentations 9:30-10:30AM

Abstract #101 - Discovering the Knowledge, Perspectives, Beliefs and Experiences of Teacher Assistant to Teacher Candidates Learning to Design Instruction Using Universal Design for Learning by Lori Glavan; Mentor: Holly Johnson, Cato College of Education

Abstract #102 - Fuel for ThoughtBiodiesel in the STEM Classroom by Evelyn King Metcalf, Jorden White, Aaron Socha, Kyle McGuff; Mentor: Scott Gartlan, Charlotte Teachers Institute

Abstract #103 - Complimenting Interactive Visualization of High-Performance Scientific Application with Hardware Utilization Dashboard by Jaiden Daya; Mentor: Tyler Allen, College of Computing and Informatics

Abstract #104 - Reliving History: Don’t Fumble the Freedom Struggle; Its Rich in our Legacy of Survival by Thomas Murphy; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences and Charlotte Teachers Institute

Abstract #105 - ROS alters NLRP3 Inflammasome activities in breast tumor associated macrophages by Shely Acosta; Mentor: Didier Dréau, College of Science

Abstract #106 - Forging the Future of Manufacturing Education: Developing Augmented Reality Experiences to Shallow the Learning Curve by Austin Varghese, Arjun Phadke; Mentor: Jose Martins do Outeiro, William States Lee College of Engineering

Abstract #107 - From Science to Civil Rights: Examining teachers’ experiences in three intensive and experiential summer teacher professional development programs by Madelyn Torkelson, Kendall Fording; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences and Charlotte Teachers Institute

Abstract #109 - Explain Your Thinking: What Does this Mean in Math? by Susan Lima-Romano, Amelia Crawford; Mentor: Madelyn Colonnese, Cato College of Education

Abstract #110 - Sankofa: Looking Back to Move Forward by Melanie Creech; Mentor: Scott Gartlan, Charlotte Teachers Institute

Abstract #111 - The Decomposition of Mental Health Barriers within the African American Community by Ayanna Lee; Mentor: Dale-Marie Wilson, College of Computing and Informatics

Abstract #112 - Examining Intersecting Employment & Early Care and Education Sector Opportunities and Barriers for Latina Mothers in Charlotte, NC Abstract by Wendy Castellanos-Olivares, Isabel Almonte-Tavarez; Mentor: Stephanie Potochnick, College of Humanities & Earth and Social Sciences

Abstract #113 - Examining Eye Gaze in Students From the Marshall Islands Through the Lens of Critical Language Awareness; by Clare Grealey; Mentor: Elise Berman, College of Humanities & Earth and Social Sciences

Abstract #114 - Directly measuring Viral Dark Matter within the Terrestrial Biosphere by Sean Madden; Mentor: Richard Allen White III, College of Science

Abstract #115 - 3D Printing of Fully Integrated Flexible Humidity Sensor for Long-Term Health Monitoring by Dylan Burke; Mentor: Erina Joyee, William States Lee College of Engineering

Abstract #116 - The effects of leaf stomatal closure on humidity in a prominent climate model by Joe Wholey; Mentor: Jacob Scheff, College of Humanities & Earth and Social Sciences

Abstract #117 - Overshadowed but Not Forgotten:Surviving in a Nation That Still Feeds on Us by Christopher Lawson; Mentor: Scott Gartlan, Charlotte Teachers Institute

Abstract #118 - Resolving Thymic T-cell Development within Chiroptera by Andra Buchan; Mentor: Richard Allen White III, College of Computing and Informatics

Abstract #119 - The Psychological and Emotional Toll of Food Insecurity, & Resulting Presentation of Survival Mode;An explanatory process model by Rae Hallo-Gordon; Mentor: Nicole Peterson, College of Humanities & Earth and Social Sciences

Abstract #120 - Building an Emotionally Intelligent Writing Center through Mindfulness Training for Tutors by Bree Johnson; Mentor: Katie Garahan, College of Humanities & Earth and Social Sciences

Abstract #121 - Investigating the Role of *S. aureus* Membrane Vesicles in Stimulating Resident Bone Cell Responses During Osteomyelitis by Ishan Patel; Mentor: M. Brittany Johnson, College of Science

Abstract #122 - Design of a Buoyancy Control System for a Miniature Aquatic Robot by Joey Porter; Mentor: Artur Wolek, William States Lee College of Engineering

Abstract #123 - Remembrance Through Art: Examining the Narrative of Slavery and Oppression through Artistic Work by Shannon McFarland; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #124 - Providing Creative Space for Artists & Arts Engagement in the Queen City by Jenna Drew; Mentor: Vaughn Schmutz, College of Humanities & Earth and Social Sciences

Abstract #125 - Freedom Lighters by Rochelle Stanley; Mentor: Scott Gartlan, Charlotte Teachers Institute

Abstract #126 - Designing Introductory Visual Programming Assignments for Computer Science Students by Neil Huntley; Mentor: Kalpathi Subramanian, College of Computing and Informatics

Abstract #127 - The ARC of Racial Justice: Awareness, Relationships, and Commitment by Meagan Lineberger; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #128 - CXCL4 peptide derived from the CXCL12-CXCL4 heterodimer interface alter breast cancer cell CXCL12-CXCR4 signaling by Jenna Venditti; Mentor: Didier Dréau, College of Science

Abstract #129 - Filtration of PFAS through Ion Exchange Resins by Rachel Irving; Mentor: Mei Sun, William States Lee College of Engineering

Abstract #130 - Chicago-Money & Sumner, MS Reflections on Emmett Till and the Mississippi Campaign by Floyd Carroll; Mentor: Scott Gartlan, Charlotte Teachers Institute

Abstract #131 - Morphological Analysis of North American River Otter (*Lontra canadensis*) Diet Across an Urbanization Gradient by Alexandria Lupton; Mentor: Sara Gagne, College of Humanities & Earth and Social Sciences

Abstract #132 - Resolving the virome of marginally farmed *Panicum virgatum* by Ivy Mateos Guevara; Mentor: Richard Allen White III, College of Computing and Informatics

Abstract #133 - Establishing a Connection with the Past to be Better Prepared for the Future by Garland Sweeney Jr.; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #134 - Visualizing the Spatiotemporal Localization of HSFs in Heat-Shocked *Nematostella vectensis*; by Ciela Crane; Mentor: Adam Reitzel, College of Science

Abstract #135 - Reinforcement Learning (RL)-Based Smart Control System for Wastewater Treatment Process Control by Justin Logan; Mentor: Michael Smith & Nicole Roberts, William States Lee College of Engineering

Abstract #136 - An Analysis of General Research Literature on Serial Murder to the Specific Case of Gary Ridgway “The Green River Killer” by Abbey Beam; Mentor: Charisse T. M. Coston, College of Humanities & Earth and Social Sciences

Abstract #137 - Exploring Plasmid Content and Mobility in Endohyphal Mycetohabitans Species by Sara Field; Mentor: Morgan Carter, College of Science

Abstract #138 - Atomistic Simulation of Thermal / Ionic Conduction in YSZ/STO Superlattices by Jan Zavaleta Molina; Mentor: Xiang Chen, William States Lee College of Engineering

Abstract #139 – ‘It was so painful': A qualitative analysis of women’s experiences of pain during reproductive endocrinology and infertility (REI) treatment by Joy Yochem; Mentor: Margaret Quinlan, College of Humanities & Earth and Social Sciences

Abstract #140 - Preparation and characterization of fluorescently labeled APE1 recombinant protein for mechanistic studies in liquid-liquid phase separation by Anthony Malone; Mentor: Shan Yan, College of Science

Abstract #141 - Black Sexual Health in Young Adults Study by Victoria Smith; Mentor: Jasmine Temple and Erika Montanaro, College of Humanities & Earth and Social Sciences

Abstract #142 - Influence of Biofilms on Settlement of *Ectopleura crocea* Larvae in the Gulf of Maine by Christian Klepper; Mentor: Adam Reitzel, College of Science

Abstract #143 - Thermal influence on the development rate of the model sea anemone, *Nematostella vectensis* by Caitlin Kennedy; Mentor: Quinton Krueger, College of Science

Abstract #144 - From Streets to Suits: The Effects of Adolescent Gang Involvement on Adult Employment through Life Course Theory by Isabelle Gochtovtt, Mazie Hill, Maria Holmes, Sonya Ngwafang; Mentor: Michael Turner, College of Humanities & Earth and Social Sciences

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Second Session of Poster Presentations 10:45-11:45AM

Abstract #202 - Studying Usability of Expert Cybersecurity Tools by Toya Okey-Nwamara; Mentor: Cori Faklaris, Prakruthi Reddy, College of Computing and Informatics

Abstract #203 - An Experience of the Heart: Bringing This Experience Home (Literally) by Sandie Spraggins; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #204 - The Effects of Urbanization on Dragonfly (Insecta: Odonata: Anisoptera) Metacommunity Structure and Connectivity by Brody Moran; Mentor: Sandra Clinton, College of Humanities & Earth and Social Sciences

Abstract #205 - Developing a Light-Assisted Drying Technique to Thermally Stabilize Poliovirus Vaccine by Jade Duerr; Mentor: Susan Trammell, College of Science

Abstract #206 - Resources for Firefighter Mental Health by Jordan Dunn; Mentor: Michael Benjamin, William States Lee College of Engineering

Abstract #207 - How 'Universal' is Universal Design for Learning in Teacher Education Programs? by Jordan Rierson; Mentor: Holly Johnson, Cato College of Education

Abstract #208 - On the Civil Rights Trail by Larry Bosc; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #209 - A Journey In History: The Power of Waves, Chains, and Mothers by Regina Graves; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #210 - Engineer Multi-Qubit Hamiltonians through Optical Cavity Design by M. Elijah Wangeman; Mentor: Jay Foley, College of Science

Abstract #211 - Analysis of Hollow Microneedle Efficacy for Painless Interstitial Fluid Extraction by Michelle Abigail De Paz Hernandez; Mentor: Erina Joyee, William States Lee College of Engineering

Abstract #212 - Optimizing the Performance of Computer Vision Application by Caleb Brohman; Mentor: Erik Saule, College of Computing and Informatics

Abstract #213 - The Power of Slave Narratives by Jacqueline Smith; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #214 - A Memory From the Past: Meeting an Original Freedom Rider by Ernisha Ballard; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #215 - Quantifying Silanol Groups on Zeolite to Functionalize it for PFAS Removal by Maren Clark; Mentor: Jordan Poler, College of Science

Abstract #216 - Partitioned Allocation for 3D Memory Performance: Python-Based by Monse Montes-Bocanegra; Mentor: Ron Sass, William States Lee College of Engineering

Abstract #217 - Title: Enabling Advisors to Guide Students: Ensuring Financial Readiness for Graduation by Meelad Doroodchi; Mentor: Elise Demeter, College of Computing and Informatics

Abstract #218 - An Accurate Contextualization of African Diasporic History in Advanced Literature Instruction by Angela Walker, Ph.D.; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #219 - Stemming the Loss of Urban Tree Canopy: GIS Analysis to Locate the Last Plantable Riparian Lands in Charlotte by Natalie Stotz; Mentor: Douglas A. Shoemaker, College of Humanities & Earth and Social Sciences

Abstract #220 - CXCL4 peptides derived from CXCL4-CXCL12 heterodimer interface alter CXCL12-CXCR4 breast cancer cell migration by Najee Tidmore; Mentor: Didier Dreau, College of Science

Abstract #221 - Mental Health Resources for Firefighters. by Mariah Manley; Mentor: Michael Benjamin, William States Lee College of Engineering

Abstract #222 - A Preliminary Assessment of Water Quality in Cove and Main Lake Locations in an Urbanizing North Carolina Piedmont Reservoir by Emma Doherty; Mentor: Craig Allan, College of Humanities & Earth and Social Sciences

Abstract #223 - Characterizing Microplastics in the Restored Floodplains of Charlotte's Urban Streams by Mollie Davis; Mentor: Sandra Clinton, College of Humanities & Earth and Social Sciences

Abstract #224 - International Students’ Interaction with Social Media: How the Pressure of “Double Presence” Impacts Privacy Practices by Nishka Mathew, Jabou Jallow; Mentor: Sarah Tabassum and Cori Faklaris, College of Computing and Informatics

Abstract #225 - Spatial and Temporal Patterns of Water Quality in Charlotte’s Watersheds by Dezzie Niemann; Mentor: Fushcia Hoover, College of Humanities & Earth and Social Sciences

Abstract #226 - Synthesis and characterization of Conjugated Fulleride Dimers Linked by N-Heterocyclic Carbenes (NHCs) by Sebastian Zaatini, Jonathan Gillen; Mentor: Christopher Bejger, College of Science

Abstract #227 - Predicting Nitrogen in the Wastewater Treatment Process by Hannah Zeru; Mentor: Michael Smith and Nicole Roberts, William States Lee College of Engineering

Abstract #228 - Managing the Burden: College Students’ Perceptions of Debt by Maya Barbee; Mentor: Scott Fitzgerald, College of Humanities & Earth and Social Sciences

Abstract #229 - Overexpressing, Purifying, and Assessing Superoxide Dismutase-1 by Payton Roy; Mentor: Eva Ge, College of Science

Abstract #230 - Autonomous Surface Vessel (ASV): Field Testing and Sensor Integration by Ryan Monroe; Mentor: Artur Wolek, William States Lee College of Engineering

Abstract #231 - Enhancing HPC Job Scheduling with Synthetic Data Generation for Reinforcement Learning-Based Schedulers by Monish Soundar Raj; Mentor: Dong Dai, College of Computing and Informatics

Abstract #232 - Learning History: Hearing from a Real Freedom Rider by Genitia Johnson; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #233 - The Effect of Methyl Methanesulfonate (MMS)-Induced DNA Damage on DNA Damage Response Signaling by Jade Lyttle; Mentor: Shan Yan, College of Science

Abstract #234 - Upcycling of Common Household Wastes by Ysabelle Blaine; Mentor: Michael Benjamin, William States Lee College of Engineering

Abstract #235 - Comparison of Fluorescent and Antibacterial Properties of Silver Nanoclusters Templated on Single-Stranded DNAs with Various Number of Cytosines. by Regina Dula, Sarmistha Ghosh, Elizabeth Skelly, Kirill Afonin; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #236 - Bio-characterization of Thiazolothiazoles: Cell Staining, Antibacterial and Bacterial Sensing Applications by Simone Walkowe Borden, Gabriela Chamorro, Elizabeth Skelly-Miles; Mentor: Kirill Afonin, College of Science

Abstract #237 - Walking, Writing Archives in Charlotte by Breonna Tuitt; Mentor: Janaka Lewis, College of Humanities & Earth and Social Sciences

Abstract #238 - A Comparative Study of Differential Privacy Factors in Generative AI Research by Pritika Bugga; Mentor: Liyue Fan, College of Computing and Informatics

Abstract #239 - Ligand Functionalization and Bioapplication of Metallic-Coated Magnetic Nanoparticles Against Antibiotic-Resistant Bacteria by Laura Scala; Mentor: Juan Vivero-Escoto, College of Science

Abstract #240 - Modeling Energy Transition: Simulating the Adoption of Smart Energy Devices in a Neighborhood by Jonathan Machado; Mentor: John Hall, William States Lee College of Engineering

Abstract #241 - Assessing the Permissiveness of Pancreatic Ductal Adenocarcinoma Cell Lines to VSV-ΔM51-GFP by Molly Andrews; Mentor: Valery Grdzelishvili, College of Science

Abstract #242 - A Socio-technical Strategy for Engaging Undergraduate Computer Science Students in Informal Learning. by Jonathan Smith; Mentor: Marlon Mejias, College of Computing and Informatics

Abstract #243 - Correlation between Bully Victimization and Generalized Anxiety Disorder: A Focus on Sex, Race, and Ethnicity by Cici Houser, Ellie Hyde, Alayna Przybys, Anna Tovchigrechko; Mentor: Michael Turner, College of Humanities & Earth and Social Sciences

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Third Session of Poster Presentations 12:00-1:00PM

Abstract #108 - Burnout: Contributing Factors of Nurse Portrayal in Social Media and Public Perception by Allie Theisen; Mentor: Margaret Quinlan, College of Humanities & Earth and Social Sciences

Abstract #301 - Collaborative Interactions and Content Expertise of General Education and Special Education Candidates by Khadija Ouedraogo; Mentor: Shawnee Wakeman and Holly Johnson, Cato College of Education

Abstract #302 - Resolving the Microbiota in Radiation Survival Using Functional Metagenomics by Joshua Hensley; Mentor: Richard Allen White III, Ph.D., College of Computing and Informatics

Abstract #303 - Visualizing Patterns of Environmental Injustice Across Mecklenburg County by Maya Fleagle; Mentor: Michael Ewers, College of Humanities & Earth and Social Sciences

Abstract #304 - The Civil Rights Movement: Our Fight For Freedom and the Historical Interpretation by Shyrese Robinson Johnson; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #305 - Synthesis of Bridged and Sulfone-modified [3]Radialenes for Redox Flow Batteries by Chris Landes; Mentor: Christopher Bejger, College of Science

Abstract #306 - Assessing the Relationships between Green Infrastructure and Health Indicators by Nia Spears; Mentor: Nicole Roberts, William States Lee College of Engineering

Abstract #307 - Evaluation of our BRIDGE for KIDS II by Emilia Olivera; Mentor: Lan Kolano, Cato College of Education

Abstract #308 - Evaluating watermarking techniques in Deep Fake images by Aryaman Kachroo; Mentor: Liyue Fan, College of Computing and Informatics

Abstract #309 - Human emotion and Passion from a difficult time in US History CTI Civil Rights Trip June 2024 by May Winiarski; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #310 - The Effects of Dipyridinium Thiazolo[5,4-d]thiazole on Charge Mobility for OLED and OPV Applications by Ryan Kolaitis; Mentor: Michael Walter, College of Science

Abstract #311 - Evaluating the Influence of Socio-Economic Factors on the Distribution of Green Stormwater Infrastructure and Urban Stream Water Quality within the City of Charlotte, North Carolina by Brandon Vorst; Mentor: Nicole Roberts, William States Lee College of Engineering

Abstract #312 - RL4Sys, a Framework for RL-Based Optimization by Jackson Redman; Mentor: Dong Dai, College of Computing and Informatics

Abstract #313 - The State, Organized Crime, & Jim Crow The Last Gasp of American Apartheid by Julio Campos; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #314 - Measuring Volunteer Participation and Retention in Rural and Urban Areas for Environmental Conservation by Nathan Young; Mentor: Sharon Watson, & Timothy Murtha, College of Humanities & Earth and Social Sciences

Abstract #315 - Investigations of Voltage Sensitive Asymmetric Thiazolo[5,4-d]thiazole Dyes by Lillian Hicks; Mentor: Michael Walter, College of Science

Abstract #316 - Surface Finishing of Metal Additive Manufactured Components: Real-Time Force Acquisition From a Robot-Assisted Abrasive Process by Riley Ferrar; Mentor: Jose C. M. Outeiro, William States Lee College of Engineering

Abstract #317 - Education Through Storytelling in A Visit for a Week by Lucy Peacock by Hollie Rode; Mentor: Alan Rauch, College of Humanities & Earth and Social Sciences

Abstract #318 - Make ML cheaper with this one easy trick: Targeted Rank Regularisation by Ethan Nguyen; Mentor: Christian Kümmerle, College of Computing and Informatics

Abstract #319 - Characterizing *E.Coli* and *Vibrio Cholera* Proteins to determine UDP-MaNAcA Synthesis. by Jennifer Lopez; Mentor: Manoj Dooda, College of Science

Abstract #320 - Evaluating the Adsorption and Fate of Dissolved Osmium onto Clay Minerals During Salinity Transitions Between Riverine, Brackish, and Seawater Environments by Jackson Williams; Mentor: Drew Syverson, College of Humanities & Earth and Social Sciences

Abstract #321 - A Better America?: Reflecting on The 2024 Civil Rights Trip by Andrew Bartkowiak; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #322 - Investigating if Fat-Tissue Specific Hsp90 Overexpression Delays the onset of Neurodegenerative Diseases by Bija Babb; Mentor: Patricija van Oosten-Hawle, College of Science

Abstract #323 - Automating Sustainable Design through Analysis of Scrap Metal by Will Cowan; Mentor: Mahmoud Dinar, William States Lee College of Engineering

Abstract #324 - Environmental scan of UNC Charlotte vending machines by Cheyenne Jennings; Mentor: Alicia Dahl, College of Health and Human Services

Abstract #325 - Influx of Rainwater on BDAs in a Natural Stream by Yaritza Galvez; Mentor: Sandra Clinton, College of Humanities & Earth and Social Sciences

Abstract #326 - Ghosts of the Past: How They Haunt Our Present by Tam Hawk; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #327 - Labeling kinetics of amino acids using 5-carboxyfluorescein succinimidyl ester by Chloe Tan; Mentor: Laura Casto-Boggess, College of Science

Abstract #328 - Battery Failure Mechanisms Analysis by Ryan Guthrey; Mentor: Lin Ma, William States Lee College of Engineering

Abstract #329 - Being the Light: Overcoming Fear and Control in American History by Elizabeth Abel; Mentor: Scott Gartlin, College of Humanities & Earth and Social Sciences

Abstract #330 - Assessing University Food Environments: Healthfulness, Protocols, and Nutritional Impact by Jessica Mathew; Mentor: Alicia Dahl, College of Health and Human Services

Abstract #331 - From Legacy Museum to Living Museum:Taking Lessons from a Civil Rights Trip to the Classroom by Jwantina Williams; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #332 - Determining the Regenerative Potential of Zeolite Nano Resins for Purification of Water by Adrian Rodriguez; Mentor: Jordan Poler, College of Science

Abstract #333 - Synthesis, Growth Mechanism Study, and Property Measurement of Metalloid Tellurium Nano/microstructures by William Franklin; Mentor: HaiTao Zhang, William States Lee College of Engineering

Abstract #334 - Thursday June 13th - Sunday June 16th, 2024 The South Civil Rights Trail: The Journey to Freedom by Le'Quanza Johnson; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #335 - Comparing infection of two human pancreatic cancer cell lines with vesicular stomatitis virus by Irakli Mataradze; Mentor: Valery Grdzelishvili, College of Science

Abstract #336 - Computational Methods in Renewable Energy: Wind Energy Aerodynamics by Ben Janke; Mentor: John Hall, William States Lee College of Engineering

Abstract #337 - Developing a GIS Framework for a Stormwater Pipe System in an Urban Micro-Watershed by Heather Corton; Mentor: Craig Allan, College of Humanities & Earth and Social Sciences

Abstract #338 - Imaging Poliovirus Vaccine With Scanning Electron Microscopy by Sean Campbell; Mentor: Susan Trammell, University College

Abstract #339 - An Analysis of AXI Interconnects by William Miller; Mentor: Ronald Sass, William States Lee College of Engineering

Abstract #340 - Educating an Educator by Jackie Smith; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Abstract #341 - What Was I Made For: The Study of Girlhood through Time Utilizing Materiality of Books by Isabella Di Biasi; Mentor: Randi Beem, University College

Abstract #342 - Optimizing Growth and Storage of Mycetohabitans spp. by Taylor Yonemura; Mentor: Morgan Carter, College of Science

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**Abstracts:**

Abstract: 101

**Discovering the Knowledge, Perspectives, Beliefs and Experiences of Teacher Assistant to Teacher Candidates Learning to Design Instruction Using Universal Design for Learning**

*Lori Glavan*

This evaluative study examined the knowledge, perspectives, beliefs, and professional experiences of UNC Charlotte Teacher Assistant (TA) to Teacher candidates regarding Universal Design for Learning (UDL). While this population of preservice candidates have unique experiences and job training opportunities, prior research suggests TAs often do not receive the necessary training and support in their positions needed to effectively plan and provide instruction to meet the diverse needs of students. One way to address this need is by providing TA to Teacher candidates with explicit instruction in UDL. UDL is an instructional planning framework designed to increase accessibility, equity, and inclusive opportunities for all students. One virtual focus group session with 12 TA to Teacher candidates in elementary education was conducted using a virtual conference platform (i.e., Zoom). Using qualitative analysis, researchers applied a thematic codebook (4 themes and 11 codes) to a verified transcript of the recorded virtual session. Researchers coded all content to draw a consensus on themes, codes, and application of codes. Research findings include the following recurring themes: (a) UDL principles are recognized as beneficial to TAs’ practice, (b) discrepancies may be present between the preparation program expectations and school realities, and (c) TA self-efficacy regarding UDL may impact their implementation as in-service teachers. This pragmatic research can be used to inform programmatic content, providing preservice programs with an accurate narrative of TA experiences in planning for and delivering instruction to meet the diverse needs of students.

Research Mentor: Holly Johnson

Abstract: 102

***Fuel for Thought*Biodiesel in the STEM Classroom**

*Evelyn King Metcalf, Jorden White, Aaron Socha, Kyle McGuff*

This project connects scale-up chemistry and engineering, real-world analysis and application, and community partnerships to provide a unique framework for scientific inquiry. Kyle McGuff, BS Biochemistry, Queens University, Charlotte, designed and engineered a safe and efficient biodiesel reactor system capable of processing 50 gal of used cooking oil per month into biodiesel ethyl esters for use in campus equipment. The unit includes a glycerol recovery and distillation component to repurpose glycerol by-product into potassium glyceroxide catalyst. The process uses a catalyst technology developed at Queens University of Charlotte and aims to increase production scale from 5 to 50 gallons/month. This summer, two CMS teachers, Jorden White and Evelyn King Metcalf, along with three undergraduate students and two CMS high school students, worked under the supervision of Dr. Aaron Socha, Biochemistry Department, Queens University, Charlotte. The team created models of biodiesel reactions, set up reactions, conducted quality control, and analyzed data. All gained insight into scientific research, chemical engineering, and product development. Teachers will incorporate learning in their courses per NC State Standards. By bridging Queens’ biodiesel production to CMS, it is hoped we can raise awareness in CMS Transportation and community. CMS has recently purchased 30 electric buses, three of which will take to the road in the 2024-25 school year. We would like to offer biodiesel as an alternative to regular fossil fuel diesel for the system’s bus safety program, Gus the Bus. It would provide public awareness in addition to clean energy.

Research Mentor: Scott Gartlan

Abstract: 103

**Complimenting Interactive Visualization of High-Performance Scientific Application with Hardware Utilization Dashboard**

*Jaiden Daya*

Active visualization can aid in creating student engagement and developing a more comprehensive understanding of advanced High-Performance Computing (HPC) topics. To accomplish this goal, we have created a real-time dashboard that presents live data collected from a cluster of Jetson Orin Nanos, which are small-scale computing devices, as it completes demonstrative scientific applications like fluid simulations. This dashboard visualizes how the hardware is used and how work is distributed, enabling students to interact with a miniaturized Supercomputing system, while also visually displaying the “under-the-hood” utilization of the computing hardware. Connecting the simulation's performance to the hardware's performance can allow students to better understand what is happening in the hardware as the simulation performs successfully or has some malfunctions. The dashboard was created using a web application framework called Dash, the programming language Python, and its libraries, along with Sockets and WebSockets as modes for transferring data. The process consists of data being sent from the computers to a server that will display a graph with live updates every couple of seconds. It enables students to see how the hardware utilization is synchronized with the performance of the fluid simulation demo. The demo employs multiple common High-Performance Computing concepts, such as scheduling algorithms, that can be reconfigured to demonstrate successful and unsuccessful scheduling policies for a given application. It also demonstrates visually the topics covered in an ordinary parallel computing course. We will evaluate the effectiveness of this prototype in the classroom setting in the near future as it works to promote student engagement and educational outcomes.

Research Mentor: Tyler Allen

Abstract: 104

**Reliving History: Don’t Fumble the Freedom Struggle; Its Rich in our Legacy of Survival**

*Thomas Murphy*

The Legacy Museum in Montgomery, AL was unforgettable. It triggered enigmas of the many atrocities from slavery through segregationist beliefs into Jim Crow. During this time period African American people were referred to as Negros, who were believed to be inferior thus justifying the subhuman treatment they endured. Through enslavement descendants experience the realities of oppression leading to a spectrum of struggles that continue today. On this trip, I experienced a bolt out of the blue and felt a sense of hopelessness that a race of people were labeled as inferior.

An exhibit in the Legacy Museum from an segregationist in The *Richmond Examiner* in 1854, stating, “It’s all a hallucination to suppose that we are ever going to get rid of the African slavery and provide civil rights and citizenship; or that it will ever be desirable to do so. It is a system that we cannot do without, that is righteous, profitable, and permanent, and that belongs to southern society as inherently, intricate, and durably as the white race itself. ”  With this mindset, our society’s norms were birthed, integrated, and maintained into the legacy of African American history. These practices must be broken, first, for students to overcome, then integrated into learning freedom, equality, and due process.

As a teacher in the classroom, I plan to provide students ways to connect enslavement, Jim Crow laws, and business and entrepreneurship through the establishment of capitalism. Furthermore, this freedom struggle cannot be fumbled for it carries the legacy for our students as they search for mental freedom and equality in American society.

Research Mentor: Scott Gartlan

Abstract: 105

**ROS alters NLRP3 Inflammasome activities in breast tumor associated macrophages**

*Shely Acosta*

Triple-negative breast cancers (TNBCs) constitute 15-21% of all breast cancer cases in the US, showing poor response to current therapies with a 65% 5-year survival rate. Standard care involves neoadjuvant chemotherapy, enhancing survival rates. Emerging cancer immunotherapy shows promise in improving treatment for TNBCs. Tumor and stromal cell interactions modulate the tumor microenvironment, driving breast cancer progression. Particularly, tumor-associated macrophages (TAMs) secrete pro-inflammatory cytokines, promoting cancer progression. TAMs are predominantly M2-like, immunosuppressive, and pro-angiogenic, promoting inflammation via inflammasome activation. The NLRP3 inflammasome triggers the secretion of IL-1beta and IL-18. Inhibition of NLRP3 with MCC950 reduces caspase 1 activity and IL-1beta secretion. J774 macrophages express increased NLRP3 components, ASC1 adaptor protein, and active caspase 1 upon inflammasome activation by LPS and ATP. NLRP3 activation leads to IL-1beta and IL-18 secretion. ROS expression is altered following these treatments, and since ROS and NLRP3 activation are intertwined, it is unclear if modulating ROS can prevent NLRP3 activation. ROS expression is regulated by glutathione, and ASC1 deglutathionylation promotes active NLRP3 inflammasome complex formation. Both *in silico* and experimental data addressing our hypothesized that modulation of ROS expression, regulated by glutathione levels, is critical. Reduction in glutathione triggers increased ROS expression, facilitating the release of ASC1, and enhancing NLRP3 inflammasome complex formation. This cascade leads to heightened secretion of pro-inflammatory cytokines and may contribute to apoptosis induction, an aspect currently under investigation.

Research Mentor: Didier Dréau

Abstract: 106

**Forging the Future of Manufacturing Education: Developing Augmented Reality Experiences to Shallow the Learning Curve**

*Austin Varghese, Arjun Phadke*

Learning to operate CNC machine tools for machining is time-intensive due to the complexity and diversity of machines and control systems. Immersive Technologies (IT) narrow the learning curve, enabling rapid skill acquisition through interactive and visual training. There are three types of immersive technologies: Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR). These technologies connect the virtual and real worlds visually and interactively. Additionally, the Internet of Things (IoT) - the network of devices that exchange data on the Internet - can combine with AI/ML algorithms and physics-based models to create a Digital Twin (DT) of the machining process. DT is a digital representation of a real-world physical asset, system, process, or product with bidirectional data communication.

This research project is part of an ongoing PhD thesis focused on developing DT in machining processes. The project’s objective is to create a DT to train users using machine tools in an immersive environment with VR and MR.

The project began with creating animated digital models of the CNC lathe machine, integrated into VR and MR experiences using Vuforia Studio and Simlab Composer software. These experiences can be visualized on tablets, smartphones, and MR/VR headsets such as Microsoft Hololens 2 and Meta Quest 3. Subsequently, real-time data from temperature and force sensors connected to the physical CNC lathe will be integrated into the VR and MR experiences through IoT, storing data on an IoT platform and transferring it to VR and MR experiences.

Research Mentor: José Martins do Outeiro

Abstract: 107

**From Science to Civil Rights: Examining teachers’ experiences in three intensive and experiential summer teacher professional development programs**

*Madelyn Torkelson, Kendall Fording*

Previous research has identified seven features of effective teacher professional development: content focused, incorporates active learning, supports collaboration, uses models of effective practice, provides coaching and expert support, offers feedback and reflection, and is of sustained duration (Darling-Hammond, Hyler, & Gardner, 2017). Less evidence is available for how these core features interact and develop to foster implementation into the classroom. This study aimed to use a grounded theory analytical approach to establish a theory that better understands how these seven features relate and support implementation of learning from professional development into the classroom. Three summer professional development programs for public school classroom teachers were reviewed in this study: (1) one led by a chemist at a large, urban research university for two teachers with a graduate student mentor, (2) another led by a chemist at a small liberal arts institution for two teachers with a graduate student mentor, and (3) another led by a retired history teacher for 35 teachers who visited historical American southern cities and museums. In total, eight participants were interviewed using a semi-structured protocol.

Research Mentor: Scott Gartlan

Abstract: 108

**Burnout: Contributing Factors of Nurse Portrayal in Social Media and Public Perception**

*Allie Theisen*

In 2024, 60% of nurses report succumbing to burnout and 13% contemplate leaving the medical profession altogether. With the prevalence of projected nurse shortages, understaffing, and overcrowding in hospital emergency rooms, nurses have been pressured to work an unsustainable amount of shift hours, pushing nurse's physical and emotional well-being capabilities to the maximum. As nurse burnout rates in hospitals continue to skyrocket, the health outcomes of patients have been reported at alarmingly lower rates due to medical worker burnout, which can produce adverse effects on work performance and the overall welfare of nurses and patients alike. This study aims to explore how the influence of burnout when paired with social media and internet platform use can lead to medical mistakes, impacts on nurses’ mental health and physical well-being, and the quality of patient-care. Moreover, through the analysis of nurse burnout in this study, can help optimize our understanding of the factors that align specifically with nurse health concerns and the promotion of properly established well-being programs in healthcare systems. Healthcare organizations can become encouraged to consider the ways in which they support nurses, helping to highlight what particular health policies should be prioritized to effectively promote the resilience necessary to combat the high demandingness of today’s healthcare environment. Thus, the urgency of this study is evident, as it is crucial in order to effectively establish a better understanding of the phenomenon, contributing risk factors, and effectively discover the extensive consequences of burnout amongst patients, providers, organizations, and the medical community as a whole. By studying burnout, we can understand the gravity of the situation and work towards its lasting and undesirable consequences within medical care.

Research Mentor: Margaret Quinlan

Abstract: 109

**Explain Your Thinking: What Does this Mean in Math?**

*Amelia Crawford, Susan Lima-Romano*

Mathematical writing (MW) is an activity where students write about mathematics concepts and procedures. Explanatory writing is one type of MW. This kind of writing is characterized by a student’s explanation of their mathematical thinking such as how they solved a problem and why they selected a particular strategy. Although MW is something that is not new, it isn’t prioritized in school curriculum. The goal of our research was to focus on explanatory writing with students who just completed the third grade. Many students will write explanations but we do not have clear expectations with elementary grade levels. The purpose of this study was to see if there were changes in students' explanatory writing from a pre to post assessment. We collected samples of explanatory MW from a four week summer intervention camp at a school located in a major city in the southeast. Prior to camp beginning, we gave students a pre-assessment where students responded to an explanatory prompt from a validated mathematics assessment. We administered the same assessment at the conclusion of the four week summer camp. We scored the assessment using an element scoring rubric based on the characteristics of a mathematical explanation, the mathematical content, mathematical vocabulary and writing organization. We anticipate the findings from this study will expand our notion of a mathematical explanation. The significance of this research is to help teachers understand the characteristics of a mathematical explanation so that they can implement it more within the math curriculum where they teach.

Research Mentor: Madelyn Williams Colonnese

Abstract: 110

**Sankofa: Looking Back to Move Forward**

*Melanie Creech*

Sankofa, a Ghanan word that means “to go back and get it” was at the center of my experience as I reflected on the meaning of this trip. Reliving the past so that I can better understand the present was the nexus of my visit during the CTI Civil Rights tour. I am now hopeful for a better future so that I can move forward in a positive direction in life. The CTI tour took me through historical sites in Alabama and Mississippi. I was able to ride down the Alabama River where slaves were once transported. I was also able to visit various sites such as the Freedom Monument Legacy Sculpture Garden, Legacy Museum, National Museum of Peace and Justice, Emmitt Till’s Museum, Edmund Pettus Bridge, Mississippi Civil Rights Museum, and others.

The entire trip elicited both sorrow and excitement. Although I am a Black history connoisseur, visiting locations that I read about was an experience that was very emotional. At some points in my tour, I found the experience to be overwhelming, but it was one that everyone should experience. All of the exhibits were informative but by far my favorites were ones that were located in Montgomery, Alabama. The sculpture garden was absolutely beautiful and befitting of my ancestors. Each sculpture was breathtaking. The Legacy Museum had so much information that I felt like I needed more time to view everything. The Museum of Peace and Justice dedicated to past lynchings was eye-opening.

I plan to display the photos that I took during my trip for my students and colleagues. I also plan to sponsor a Black History Trivia Contest for my students and poster gallery to highlight their history research.

Research Mentor: Scott Gartlan

Abstract: 111

**The Decomposition of Mental Health Barriers within the African American Community**

*Ayanna Lee*

African Americans have one of the highest mortality rates, with depression and anxiety being among the leading causes [1]. The barriers experienced by African Americans when accessing the mental health care systems and receiving effective treatment within these systems, “...include stigma, cost of care, and lack of transportation and childcare”[1]. To address these barriers, we propose an application called Alafia. Alafia, a word from Yoruba culture, is a software designed to improve the management of depression and anxiety. This application combines biometric sensors, data analysis, and a recommender system that implements personalized interventions—providing users with a proactive and tailored approach to improving and maintaining good mental health. Alafia is centered around addressing how technological biases and various forms of oppression continuously disadvantage marginalized populations [2]. The development of Alafia questions if an application can be created that effectively identifies mental health distress and recommends a tailored intervention before it manifests into a crisis. This project aims to lower the mortality rate of marginalized communities traditionally excluded from healthcare research, through providing effective healthcare interventions for depression and anxiety.

Citation:

[1] Yolanda A. Rankin and India Irish. 2020. A Seat at the Table: Black Feminist Thought as a Critical Framework for Inclusive Game Design. Proc. ACM Hum.-Comput. Interact. 4, CSCW2, Article 117 (October 2020), 26 pages. https://doi.org/10.1145/3415188

[2] Kawaii-Boguthe e, Babe, Norissa J. Williams, and Kameron MacNear. 2017. Best Practices in Mental Health. Vol. 13: Mental health care access and treatment utilization in African American communities: An integrative care framework. The Follmer Group Co., Inc.

Research Mentor: Dale-Marie Wilson

Abstract: 112

**Examining Intersecting Employment & Early Care and Education Sector Opportunities and Barriers for Latina Mothers in Charlotte, NC Abstract**

*Wendy Castellanos-Olivares, Isabel Almonte-Tavarez*

Latina mothers face the dilemma of prioritizing being the main caretakers of their children, at the expense of working to provide some financial stability for their family in the United States.With the lack of resources that are available to them, Latina mothers have less participation(62.8%) in the workforce compared to other races(71.2%). This hinders their social mobility, and mental and physical health, and underutilizes their skills and education. So, to understand these barriers, *Camino,* a nonprofit that manages research to provide resources for the Latino community, collaborated with UNC Charlotte researchers to conduct 4 focus groups with 6-8 Latina mothers in each group with various employment backgrounds, asking questions based on their work and childcare experiences in Charlotte, North Carolina. We also provided intake participation forms to expand our information on unemployment and childcare responsibilities. Based on the research, we found that Latina mothers make employment decisions based on familial obligations, notably childcare. They are employed in jobs with inflexible hours that do not align with childcare center hours, which makes it more difficult to find a trustworthy childcare center or caretaker. This highlights not only the racial barriers but also how enforced gender norms create another barrier for Latina immigrants who happen to be mothers in the U.S. This research will help increase childcare resources in the Charlotte area so Latina mothers can increase their presence in the workforce.

Research Mentor: Stephanie Potochnick

Abstract: 113

**Examining Eye Gaze in Students From the Marshall Islands Through the Lens of Critical Language Awareness**

*Clare Grealey*

This research uses previously collected data on Marshallese individuals living in the United States to analyze the contribution analysis of cross-cultural differences in gaze practices could make to the field of critical language awareness (CLA). CLA is the pedagogical practice of teaching students to understand language and their interactions in the context of social, political, and economic power dynamics that shape human interaction. In the past, CLA has covered many different aspects of language and communication, such as verbal, written, artistic, and multilingual. Still, there is virtually no research on eye gaze practices or habits. Marshallese communities are notable for their cultural understanding that direct eye contact is considered rude in certain situations. As a result, Marshallese frequently do not make eye contact when deemed appropriate to Western culture. In the United States, social reciprocity and eye gaze are significant markers of attention and respect, and not following these cues differentiates people. This research uses coded sections of previously collected data in MAXQDA, a qualitative data analysis software, to identify moments and contexts where teachers of Marshallese students in the United States prompt eye contact. The findings show the teachers strongly believe eye contact is a necessary tool to show understanding and attentiveness in students and that a lack of eye gaze with an object for referential purposes or with another person is a sign of distractedness and absentmindedness. This research fills a significant gap in the field of CLA, widening the knowledge and research on non-verbal critical language awareness.

Research Mentor: Elise Berman

Abstract: 114

**Directly measuring Viral Dark Matter within the Terrestrial Biosphere**

*Sean Madden*

Beneath your feet lies a galactic abundance of viruses. The global virome (i.e. the totality of all viruses on the planet) is approximately 1031. As a comparison, this number is eight orders of magnitude larger than a mole of atoms (i.e., 6.022×1023 atoms Avogadro's number) and ten orders of magnitude larger than the stars in the observable universe (1021). Viral abundances are measured as viral-like particles (VLPs),which are free virion particles released by infected viral cells and are often measured by flow cytometry and epifluorescence microscopy. However, terrestrial environments (e.g. soil) have been vastly underestimated due to lack of robust methodologies to count viruses directly. Williamson et al., developed methods during the early 2000s; however, no update has been performed or compared to test the validity of these methods. We directly compared our previously published Bellanger et al. (2023) methods on microbialites against the Williamson method in a diverse soil sample panel. Bellanger et al. (2023) provided clearer images with less debris than the currently published method from Williamson et al. The advanced method here will provide a great estimation and window into the unseen viruses beneath our feet.

Research Mentor: Richard Allen White III

Abstract: 115

***3D Printing of Fully Integrated Flexible Humidity Sensor for Long-Term Health Monitoring***

*Dylan Burke*

Humidity sensing technology for biomedical applications has significantly advanced in recent years, particularly with wearable and implantable devices. With advancements in Additive Manufacturing (AM), especially extrusion-based 3D printing, Direct Ink Writing (DIW) has emerged as a promising technique for creating humidity sensors due to its material versatility and ability to produce complex structures. However, current research emphasizes the performance of various material compositions with established design structures; enhanced functionality can be achieved by optimizing the manufacturing process to achieve specific characteristics. This project aims to enhance understanding by building a biocompatible humidity sensor using DIW and SiC-polymer nanocomposites, focusing on optimizing the manufacturing process for consistency and precision. The project analyzes how different parameters in the manufacturing process (e.g., temperature & line speed) influence the printed structure's geometry and resolution. Experimental tests characterize the relationships between manufacturing and the printed parts. The collected data is then used to develop an optimized manufacturing process. Based on the characterization analysis, the best temperature in printing the PVA substrate and the composite was 25°C and 70°C, respectively. Therefore, the manufacturing process uses 25°C initially to print the PVA substrate and increases to 70°C afterward. Additionally, using an 8 mm/s line speed for the composite produced higher precision. These results yield an efficient manufacturing process for a humidity sensor with enhanced precision and quality of the printed parts. These findings enhance the understanding of applying DIW to create fully integrated humidity sensors, guiding future research toward advanced materials and optimized designs.

Research Mentor: Erina Joyee

Abstract: 116

**The effects of leaf stomatal closure on humidity in a prominent climate model**

*Joe Wholey*

On a broad scale, climate models have shown an overall increase in atmospheric humidity as the planet warms. However, there have been several regions over recent years that show a decrease in humidity. Our study aims to find the basis for these areas of decreasing humidity, by examining plant behavior in the Community Earth System Model, a leading climate model.

As CO2 increases, it causes leaf stomata to close, in addition to warming the planet. We analyze how stomatal closure affects atmospheric variables, such as humidity and temperature, by its effects on latent and sensible heat fluxes. There is a general expectation that decreasing latent heat flux causes humidity to also decrease, however, our analysis shows that it causes an increase. In fact, the combined change in both latent and sensible heat flux tends to increase both humidity and temperature.

Future work will analyze cloud impacts, relative humidity, and radiation changes, to dive deeper into what is causing the increases we have seen. This study will allow us to understand more fully how humidity and temperature will increase in the future.

Research Mentor: Jacob Scheff

Abstract: 117

**Overshadowed but Not Forgotten: Surviving in a Nation That Still Feeds on UsChristopher Lawson, Social Studies, Turning Point Middle School**

*Christopher Lawson*

This trip is a literal walk back in time: Montgomery, Birmingham, Selma, Money, Sumner, Jackson — all prominent locations that embody the start and push for civil rights among African-Americans. You begin this journey with a tour from civil rights activist and educator, Dr. Shirley Cherry, who shares first-hand stories about the era of racial segregation in Montgomery, AL. On this tour, she shows you the truth of a city that has never recovered from its role in the movement — a town stricken with poverty, shotgun houses next to national monuments. Similarly, the decrepit site of Bryant Grocery in Money, MS, is overshadowed by a service station that aims to change the narrative of the atrocities that occurred across the Delta.

This trip is important as it spans past, present, and future, ultimately reminding you that despite innocence, my black skin still screams guilty amidst a modern landscape of slavery, still personified as cattle. This truth cannot be overshadowed by white guilt, museums, or monuments dedicated to the preservation and enlightenment of equal justice. This journey shows that there is much more work to be done in a fight that is passed down through generations.

As a social studies teacher, this trip meant everything to me. It inspired my lesson plan that explores civil rights from Emmitt Till to the present day. I can use Dr. Cherry's stories to teach tolerance to my students and emphasize the importance of education while living as a "free" American.

Research Mentor: Scott Gartlan

Abstract: 118

**Resolving Thymic T-cell Development within Chiroptera**

*Andra Buchan*

Bat are elite suppressors of highly pathogenic RNA viruses (e.g., SARS-like, Ebola, Hendra), that represent >20% of all mammals on the planet, and are an extremely diverse order of mammals having >1,100 known species. Building a mechanistic understanding of adaptive immunity is imperative to addressing why bats can house these pathogens without showing clinical symptoms. For over 100 years, anatomical and histological evidence of a thymus being present within bats has been discussed. The thymus is the primary essential organ for the development of T-cells and adaptive immunity. As mammals age, the thymus is gradually and irreversibly replaced with fatty tissue through the process of involution.

We performed RNAseq on two wild caught bats and an older captive bat (e.g., Michigan zoo) on thymic tissue finding evidence of thymic related T-cell development. Using in-house pipeline TITAN, we assembled an average of 99,660 transcripts between all three bats at average N50 contig length of 1,401. The transcripts within the younger wild-caught bats included adaptive immune cells such as B cells and T-cells, as well as many innate immune-related genes. The older bat had no evidence of TCRs, CD4+ and CD8+, but CD39-related transcripts related to Treg cells which is the first time those have been identified in bats. High expression of a fatty synthase was present, suggesting active involution was present. Therefore, bats could have active involution throughout their lifespan. Chiropterans, like all other mammals, generally use the thymus for T-cell development based on previous data and the RNAseq data presented here, but further analysis and sampling will be conducted to resolve thymic T-cell development in bats.

Research Mentor: Richard Allen White III

Abstract: 119

**“The Psychological and Emotional Toll of Food Insecurity, & Resulting Presentation of Survival Mode; An explanatory process model ”**

*Rae Hallo-Gordon*

There is extensive work that grapples with the economic, political, and health aspects of food insecurity, as well as on the assistance programs working to address this concern. There is, however, a lack of research detailing the lived experiences of those who struggle to maintain their basic dietary needs that integrates these lived experiences with the other aspects. A shift towards fully integrated understanding of the biological processes, social implications and structural factors has begun to gain momentum in recent years, in part due to the contributions of physiological, cognitive, and behavioral explanatory models such as the Stress Process Model and the Biopsychosocial model of health. So far, little research has examined similar processes for food insecurity, including nuances related to embodiment and phenomenology. In this article, I examine how people report the effects and affect of barriers to food on their physical, mental, emotional and social health. Analyzing focus group data, we identify several prevalent themes that highlight many aspects that combine to affect people’s sense of worth both internally (emotionally and psychologically through sentiments of hopelessness, and powerlessness) and externally (socially, politically, and economically through stigma, marginalization, and lack of long term solutions by organizations). These appraisals of social and emotional value influence coping strategies for those struggling with food security by regulating decisions surrounding what to eat and how to attain it, how to afford the time, energy and cost of achieving food access, as well as calculations made on whether or not one is capable, or ‘worth’ achieving healthy, sustainable food access. This mixed methods research illustrates the need and place for an intersectional, interdisciplinary, explanatory model for food insecurity. Through examining the experience of individuals who are food insecure, we are able to then provide understanding into the ‘how’ of how social determinants of health affect health, given the above facets at play.

Research Mentor: Nicole Peterson

Abstract: 120

**Building an Emotionally Intelligent Writing Center through Mindfulness Training for Tutors**

*Bree Johnson*

Emotions impact all aspects of tutoring work, including sessions with clients, tutor responsibilities, and tutoring philosophies. While emotions can make tutoring feel difficult, mindfulness strategies can be taught to tutors so they feel equipped to manage clients’ and their own emotions. While plenty of research on mindfulness theories exists, few studies integrate mindfulness into tutor training and examine the impact of mindfulness on tutoring. My study observes how teaching mindfulness strategies can support the emotional labor of tutoring and build emotional intelligence in tutors over time. I developed an emotional mindfulness training workshop for writing center tutors using mindfulness strategies proposed by scholars in Writing Center Studies. During the Fall 2023 semester, I facilitated my training workshop with UNC Charlotte Writing Resources Center (WRC) tutors during the WRC tutor training course for new tutors and a WRC staff meeting for veteran tutors. Then, I followed the impact of this training on tutoring practices by collecting written journal responses from seven tutors at the beginning, middle, and end of the Spring 2024 semester. In these journal responses, tutors wrote about client emotions, tutor emotions, and mindfulness strategies they used. I predict that mindfulness strategies have been used effectively by tutors to manage their own and their clients’ emotions. As one of the first Writing Center studies that analyzes the impact of mindfulness training, my research offers a reference to writing center administrators and tutors on the positive effects of implementing mindfulness into regular tutoring practices.

Research Mentor: Katie Garahan

Abstract: 121

**Investigating the Role of *S. aureus* Membrane Vesicles in Stimulating Resident Bone Cell Responses During Osteomyelitis**

*Ishan Patel*

Osteomyelitis, a serious infection of the bone and joints, is primarily caused by the bacterial pathogen Staphylococcus aureus. Infection results in swelling of bone tissue, leading to bone loss and degradation. Current treatments of osteomyelitis include the administration of intravenous or oral antibiotics and surgical removal of infected tissue. Resident bone cells including bone-forming osteoblasts, initiate proinflammatory and type I IFN (IFNs) immune responses to S. aureus through recognition of pathogen-associated molecular patterns (PAMPs) by host pattern recognition receptors (PRRs). Interestingly, S. aureus releases membrane vesicles (MVs) containing various immunostimualtory components including nucleic acids, proteins, lipids, and peptidoglycan. As such, MVs may contribute to bone cell innate immune responses. In this study, we will investigate the hypothesis that S. aureus MVs stimulate proinflammatory and type I IFN responses in murine osteoblasts. We demonstrate dose-dependent production of the proinflammatory marker, IL-6, as well as the type I IFN, IFN-B, following treatment with purified S. aureus MVs. We additionally show an increase in the neutrophil recruiting chemokine, CCL4, following S. aureus MV treatment. Taken together, this data indicates that S. aureus MVs contain various immunostimulatory components which contribute to the production of an innate immune response in murine osteoblasts. Future studies will focus on further characterizing components of S. aureus MVs as well as the specific PRRs involved in initiating an immune response.

Research Mentor: M. Brittany Johnson

Abstract: 122

**Design of a Buoyancy Control System for a Miniature Aquatic Robot**

*Joey Porter*

A buoyancy control system (BCS) allows precise buoyancy adjustments of an uncrewed underwater vehicle (UUV), enabling control over its vertical position underwater. BCS units tend to be large and heavy, limiting their integration into smaller submersible systems used for collecting data in shallow or constrained underwater environments. The goal of this research was to design a compact, modular BCS unit that can be incorporated into a larger system of miniature aquatic robots. The design constraints for the BCS were focused on the size and weight of the system but also influenced its complexity, speed, and controllability. SOLIDWORKS was utilized to account for sizing and volume constraints of the system while downselecting between options for onboard controllers, water-tight components, and the buoyancy system itself. Static and fluid analysis was used to select components that would allow for control at the rated depth. The BCS design uses an Arduino Nano to control a compact linear actuator that moves water in/out of a 20ml syringe, adjusting the net buoyancy of the vehicle. Reliability and performance testing was conducted in the 5,000-gallon indoor water tank in the BATT CAVE building at UNC Charlotte. The testing was used to characterize the efficiency of the BCS and proved that it could achieve one cycle of rising and sinking in 18-20 seconds and operate continuously for about 580 cycles before running out of power. The developed BCS design will be utilized in future UUV designs, supporting path planning and multi-robot collective behaviors/swarming research.

Research Mentor: Artur Wolek

Abstract: 123

**Remembrance Through Art: Examining the Narrative of Slavery and Oppression through Artistic Work**

*Shannon McFarland*

One of my favorite sights from the Civil Rights Trip isn’t part of a museum or exhibit. In Montgomery, on the side of a brick building, there is a quote from Maya Angelou painted. It reads, “History, despite its wrenching pain, cannot be unlived, but if faced with courage, need not be lived again.” Walking through the Legacy Museum and Mississippi Civil Rights Museum, I thought frequently of this quote, especially when viewing the artwork. A quilt, hand-sewn to tell of a father’s passing and the effect its maker; portraits of Harriet Tubman, painted in various styles but still capturing her determination; and massive monuments, both to past and present, showing the unprecedented resilience of people who refuse to be forgotten. This is the courage Maya Angelou spoke of. The art we saw in places like EJI’s new Sculpture Garden is a testament to the wrenchingly painful history too many choose to ignore, and a courageous display of resistance. This trip left me both in awe of what people can communicate through artwork, and inspired to find space in my classroom to allow my students to try the same. For this reason, I will be focusing on the analysis of artwork for my 2024 CTI Curriculum Unit. Students will look at images of work that I saw from the Civil Rights Trip and ask themselves, “what story is communicated in this work?” I hope to support them as they find creative ways to communicate their own narratives as well.

Research Mentor: Scott Gartlan

Abstract: 124

**Providing Creative Space for Artists & Arts Engagement in the Queen City**

*Jenna Drew*

A common challenge for artists is finding adequate space to exhibit, perform, and produce their work. Without this space, artists are unable to expose the public to the arts which limits their impact on others. In Charlotte, responding to the challenge of space is acknowledged as the fourth key priority in the city’s Arts & Culture Plan that was adopted in January 2024. My project explores the main problems that artists and key stakeholders in Charlotte have identified related to space as well as the strategies that have been used in other places to address this problem. To explore the first question, I use reports produced by local stakeholders (e.g., Arts & Science Council, Charlotte’s Arts & Culture office), 49 interviews with local arts providers, and reports from 40 artists and arts organizations that received Opportunity Fund grants in 2022-23. In addition, I will use comparative examples from the cities of Asbury Park, NJ and Amsterdam, NL about how to improve access to space and create a more artist-friendly environment. These two cities have created arts and culture plans that allow artists to have the space they need, and the city of Charlotte could benefit from following similar patterns in these other plans. Previous research has shown that having space can increase engagement with artists, and the results of my research can help identify possible solutions to this problem in Charlotte and determine whether current strategies are aligned with the concerns of artists, arts organizations and other local stakeholders.

Research Mentor: Vaughn Schmutz

Abstract: 125

**Freedom Lighters**

*Rochelle Stanley*

Rooted in the red clay of Sampson County, a Northern seed hails from a legacy of Great Migrators with clay-etched footprints and unsung stories. I never dreamt of deep driving the South. On the 60th anniversary of Freedom Summer, I bussed through history on a chartered Rose, unearthing memories buried—some by design, and some by time.

The Legacy Museum baptized me in truths, crafted from sculpted Motherland bones. Unchained voices echo along Atlantic waves of bondage across generations. This space embraces the sacred soil of the lynched, names engraved, never to be forgotten. No postcards, no picnics.

In ‘Ole Mississippi—the stark duality of segregated spaces revealed the illuminated faces of a school founder, a Freedom Rider survivor recounting death row experiences, and a spirit-led Oxford congregation. A heated Mississippi roadside conjured the spirit of humanity blessing us when our chartered rose exhaled its last breath of antifreeze. Oxford's harmonized hands embraced us with cool shelter, water, and Blue Bell. Tree lined shadows of injustices, past and present, transformed into a bone-deep empathy, we could feel.

Freedom is all histories illuminating beyond the limitations of mere knowledge. Riders evolve into Freedom Lighters, carrying the torch of truth for our students. Rooted in red clay, fertile grounds of shared truths, struggles, and hope for new generations flourish.

**K-5 students will engage in book walks for empathy lessons using library picture books, graphic novels, and biographies to respond to a Civil Rights Movement photo gallery.**

Research Mentor: Scott Gartlan

Abstract: 126

**Designing Introductory Visual Programming Assignments for Computer Science Students**

*Neil Huntley*

In recent years, there has been a continuous increase in tech and programming, and as a result, more students in high school and college are going into the field of Computer Science.

However, navigating this expansive field can be intimidating, mainly due to the vast amount of languages and disciplines within Computer Science. Knowing where to start within the space is increasingly challenging. The biggest aim of this research is to improve the accessibility of engaging programming assignments that help people (primarily students) learn early conceptual topics. Over many years, it has been shown that students are very visual learners, and learn best when they can visually see what’s happening with their code. To address this, efforts have been focused on developing approachable programming assignments within an environment called BRIDGES, which is an application that allows users to see visual changes to their code in real-time. There is an assignment for most early or mid-level programming topics within it. With a recognized shortage of very early introductory assignments, recent research has primarily consisted of building extremely approachable assignments that almost anybody can do, with just a small amount of programming experience. While the BRIDGES application and some of the assignments within it are not complete, the overall intention is to help them build stronger connections in their brain regarding the code they write, and what it is actually doing.

Research Mentor: Kalpathi Subramanian

Abstract: 127

**The ARC of Racial Justice: Awareness, Relationships, and Commitment**

*Meagan Lineberger*

"The arc of the moral universe is long, but it bends towards justice." - Dr. Martin Luther King Jr., March 31, 1968

In April, 2024, Dr. Jemar Tisby, author and historian, spoke at my church and described the ARC of racial justice: awareness, relationships, and commitment. The CMS Civil Rights Tour was an opportunity to engage in all three, so I was thrilled to take this journey.

I could share many moments that were impactful along our journey, but one stands out above the rest. In Jackson, Mississippi, history was brought to life by Hezekiah Watkins, the youngest Freedom Rider, who happened to be at the Mississippi Civil Rights Museum that day. He shared his story and answered questions, educating in the most personal way. He posed for photos and signed books and was incredibly still doing the work of civil rights to this day. Since the trip I have read his book that shares his life story and continued to understand the civil rights movement from new perspectives through his words.

Between stops on our tour, reflection questions were given to the teachers to spark conversation. This allowed me to have difficult conversations with teachers who started as strangers and ended as friends, further deepening my understanding and perspective.

As I look to the next school year, I am excited to share with my students about my experience on the CMS Civil Rights Tour. I hope to model for them a life-long love of learning, growing, and truth seeking.

Research Mentor: Scott Gartlan

Abstract: 128

**CXCL4 peptide derived from the CXCL12-CXCL4 heterodimer interface alter breast cancer cell CXCL12-CXCR4 signaling**

*Jenna Venditti*

Chemokine signaling regulates numerous biological activities participating in cell migration in both healthy and pathological conditions. In particular, the chemokine ligand 12 (CXCL12) signaling mainly through the chemokine receptor 4 (CXCR4) promotes cell migration including that of cancer cells to metastatic sites. Our group demonstrated the formation of heterodimers between CXCL4 and CXCL12 and their potential to modulate the monomeric CXCL12-CXCR4 signal that promotes strong cancer cell migration. Moreover, combining peptides mimicking the CXCL4-CXCL12 heterodimer interface (i.e., CXCL4-derived peptides) with CXCL12 decreased the CXCL12-CXCR4 driven cancer cell migration. Here, we assess the CXCL4-peptide CXCL12 binding and the associated calcium signaling. Approach and data collected to support the potential of CXCL4-derived peptides in modulating CXCL12-CXCR4 signaling will be presented.

Support (OUR fellowship to JV; NIH grant to DD)

Research Mentor: Didier Dréau

Abstract: 129

**Filtration of PFAS through Ion Exchange Resins**

*Rachel Irving*

People should be able to trust that their drinking water is clean, but sometimes water filters aren’t enough to keep everything out. Bad chemicals such as per- and polyfluoroalkyl substances (PFAS) require special methods to remove from the water such as running them through special beads called ion exchange resins. These resins catch PFAS compounds as the water flows through and later get washed by a washing solution to be reused. Different resins have different levels of effectiveness of removing PFAS from contaminated waters. The current washing solution being used isn’t strong enough to rinse the PFAS off of the most effective resins, leading to these resins becoming a single use product. This led researchers to ask the question, are there alternative washing solutions to remove PFAS compounds from contaminated resin to reuse the resin? To test this theory, a portion of water was pre-contaminated with six PFAS compounds and added the resin to the mixture for contamination. Then, the spiked resin was separated out into ten portions and five different washing solutions were applied to two portions of resin each. Samples were collected each step of the process in order to analyze the results in a separate machine. From those samples, researchers found that the stronger the metal chloride in the different washing solutions, the more effective the solution was in removing the PFAS from the resin. This means that the resin may be able to be reused more than once, reducing the amount of waste this type of ion exchange resin produces. The more frequently the resin can be reused, the less waste that will be produced during the filtration process. Drinking can be both clean while producing less waste to clean.

Research Mentor: Mei Sun

Abstract: 130

**Chicago-Money & Sumner, MSReflections on Emmett Till and the Mississippi Campaign**

*Floyd Carroll*

As a child of the Civil Rights Movement, growing up in Chicago. Illinois discussions regarding the Chicago, Defender, Ebony and Jet magazines, were often dinner table conversations. Emmett Till was from Chicago, and the Defender and Jet magazine covered the story from the beginning to end

The Chicago Defender, the Tri-State Defender and Jet Magazine were responsible for informing the African American communities in Chicago, and beyond.

This was my first trip to Mississippi in ten years. In 2012, I was a fashion photographer, and I had a show in Greenwood. As we made our way to Money, we passed through Greenwood, not much had changed.

Bryant’s Grocery Store was overrun with trees and weeds. However, the vibe, the spirits of what happened that day. The courthouse gave the same aura. My visual captured everything. Uncle Mo, the Defender reporters, the jury, and Mamie Till. All a crucial part of American history.

After the visit to Money and Sumner, I took a trip to Chicago, and paid a visit to McCosh Elementary school (now named for Till), the school Emmett attended at the time of his murder. I then drove to the home his mother moved to in 1956 and remained until her death in 2000. The home is now occupied by Linda Brown, the fifth African American woman to graduate from the FBI Academy in Quantico, VA.

Research Mentor: Scott Gartlan

Abstract: 131

**Morphological Analysis of North American River Otter (*Lontra canadensis*) Diet Across an Urbanization Gradient**

*Alexandria Lupton*

As cities expand globally, increasing urbanization has a substantial negative impact on surrounding wildlife. Many predators, such as the North American river otter (*Lontra canadensis*), adapt their behavior in response to the environmental pressures associated with urbanization. Many studies address how otters can adapt well to their environment, however; there are few studies on how river otter diet is affected by urbanization. We compared *Lontra canadensis’* diet across an urbanization gradient in Mecklenburg County, North Carolina. Due to the behavioral plasticity of the species, we hypothesized that otter diet was less varied in more urbanized areas due to the negative impacts of urbanization on prey diversity. We collected 154 spraints between February 2020 and June 2024 at six stream-side latrine sites at various levels of percent urbanization: 9 at Coffey Creek (78), 13 at Catawba River Tributary (26), 13 at McAlpine Creek (88), 19 at Little Sugar Creek (96), 18 at Paw Creek (71), and 82 at Sugar Creek (78). We dissected eight randomly selected spraints from each site to identify prey composition. Prey types (fish, amphibians, crayfish) were identified through multiple different methods (osteological reports, scale compendiums, and color/characteristics) and recorded as presence/absence. We will compare the presence of different prey types across sites using non-metric multidimensional scaling and linear regression. Our research is important for understanding how ecological processes are affected by urbanization, contributing to future management and conservation strategies for wildlife.

Research Mentor: Sara Gagne

Abstract: 132

**Resolving the virome of marginally farmed *Panicum virgatum***

*Ivy Mateos Guevara*

Switchgrass (*Panicum virgatum* L.) remains the preeminent American perennial (C4) bioenergy crop for cellulosic ethanol, that could help displace over a quarter of the US current petroleum consumption. Intriguingly, there is often little response to nitrogen fertilizer once stands are established. We used high-throughput metagenomic sequencing to characterize the switchgrass rhizosphere viral community (e.g., virome) before and after a nitrogen fertilization event for established stands on marginal land. We resolved 29 Metagenomic Assembled Genomes (MAGs) as individual bacteria genomes via metagenomic *de novo* assembly. The identity of metadata will provide additional information about the rhizosphere microbiome in the Lux Arbor reserve, by providing insight on viruses niche. Furthermore, emphasizing how viruses affect overall plant-microbial associations contributes to soil virology. The study focuses on previously experimented Switchgrass, *Panicum virgatum L*. located in the Lux Arbor reserve (Great Lake Bioenergy Research Center) and the rhizosphere microbiome surrounding it. Based on the composition of the soil, greater implications can be made of biogeochemical processes in the area while continuing to optimize the switchgrass virome.

Research Mentor: Richard Allen White III

Abstract: 133

**Establishing a Connection with the Past to be Better Prepared for the Future**

*Garland Sweeney*

Inspiring, encouraging, moving and heartbreaking, are just a few things that can be said about the Civil rights trip that I had the pleasure to attend. Words cannot begin to describe the emotions that I felt walking across the Edmund Pettus Bridge, or visiting the site where the whistle of a young man prompted a nation to pay attention.

Walking through the Levine Museum and witnessing a holographic depiction of a slave woman pleading for her child not to be sold was so profound that my despair would not allow my thoughts to be reflected upon until later that day. Taking a boat ride down a river to the Sculpture Park, where many slaves had previously been transported, brought about a feeling of apprehension, despite the beauty of the day.

The hottest day of the trip was when we visited Money, Mississippi, the exact spot where a naive Emmett Till whistled at a Caucasian woman. As a middle aged African American male, I felt intimidated and suddenly filled with fear, imagining what could happen to any of us, at any time.

This sudden realization and fear will keep me motivated to continue to influence and assist the students that I teach. It is important for our students to understand that we must continue to search for the truth in order to become better scholars and leaders of this world. We must move forward, with our past behind us and our ideals by our side.

Research Mentor: Scott Gartlan

Abstract: 134

**Visualizing the Spatiotemporal Localization of HSFs in Heat-Shocked *Nematostella vectensis***

*Ciela Crane*

Heat shock factors (HSF) are transcription factors that bind to DNA sequences called heat shock elements (HSE) to regulate the expression of other genes. HSFs are involved in stress response and development, including reproduction and embryogenesis. In the model cnidarian, *Nematostella vectensis,* little is known about HSFs. *N. vectensis* is a species of marine invertebrates that are easily cultured in the lab. In nature they inhabit estuarine environments where conditions like salinity and temperature fluctuate daily, exposing them to variable stress conditions throughout development. A high stress tolerance and complex conserved genome makes them ideal for studying HSF and its roles in development and heat shock response. *N.* *vectensis* has a transparent body and simple morphology allowing for ease of visualization of HSF. Understanding the spatial localization of HSFs under different temperature and developmental contexts in *N.* *vectensis* can further our knowledge of how HSF simultaneously regulates complex processes. Developmental stages of *Nematostella* were collected and exposed at two different temperatures, room temperature (20°C) and 38°C, for 15 minutes. Previously published chromogenic in-situ hybridization protocol was used to visualize the spatial localization of three HSFs in temperature-treated anemones. The NvFork transcript was used as a control because of its characteristic spatial localization pattern in *Nematostella*. HSF localization is expected to differ between different temperatures and within different stages of development. Evaluation of observed differences will help to understand how HSF governs stress response and development in *N.* *vectensis.*

Research Mentor: Adam Reitzel

Abstract: 135

**Reinforcement Learning (RL)-Based Smart Control System for Wastewater Treatment Process Control**

*Justin Logan*

Wastewater treatment requires precise control of processes which are difficult to accurately predict and model. In particular, aeration control, a process that typically accounts for 50% or more of a typical wastewater plant’s energy consumption, has been identified as a target area for improvement. Therefore, process improvements that lead to increased efficiency in the aeration phase of treatment will lead to significant energy savings for the entire treatment process. In this study, a reinforcement learning (RL)-based control technique is developed and tested in comparison with a conventional Proportional-Integral-Derivative (PID) type controller. To facilitate development and testing of the proposed control architecture, a simulated environment, Benchmark Simulation Model 1 (BSM1) developed for wastewater treatment studies, is used. Two approaches to RL-based aeration control are tested: (1) using an RL agent to set the control parameters of a PID controller, and (2) using an actor-critic type RL agent to make control actions directly. In either case, the controller’s manipulated variable is the aeration rate (KLa) in Tank 5 of the simulated BSM1 plant. The goal for the controller is to maintain effluent total nitrogen below permitted limits, while minimizing energy consumption. It is expected that this study will lead to a better understanding of which RL-based control configurations can be successfully adapted for wastewater treatment process control, and ideally lead to improvements in treatment quality and energy-efficiency.

Research Mentor: Michael Smith, Nicole Roberts

Abstract: 136

**An Analysis of General Research Literature on Serial Murder to the Specific Case of Gary Ridgway “The Green River Killer”**

*Abbey Beam*

Serial murder is defined by the FBI as a series of two or more killings by the same perpetrator (s). Criminologists have long sought to understand the intricate interplay of psychological, sociological, and biological factors that motivate individuals to commit such rare and horrendous acts of human behavior. The portrayal and glorification of serial murder in mass media can distort public perception and contribute to misconceptions about the phenomenon. This author delves into the scope of serial murder and the common characteristics defined by

general literature on the subject. Additionally, the research examines the case of Gary Ridgway, also known as the Green River Killer, and compares it to established research literature on serial murder. Ridgway's case is examined through a detailed review of his background, criminal activities, methods of committing his crime, and the responses of both law enforcement and the judicial system. His case exemplifies similarities with other serial murderers, accentuating common traits and proposing strategies for intervention before such crimes occur. This

comparison highlights both similarities and differences in serial murder profiles, providing valuable insights into the application and limitations of general research findings in understanding specific cases. By comparing

common characteristics of serial murderers found in general literature to a specific serial murderer, this research contributes to a deeper comprehension of serial murder phenomena and underscores the importance of case-specific studies in advancing criminological knowledge and investigative practices related to serial murder.

Research Mentor: Charisse T. M. Coston

Abstract: 137

**Exploring Plasmid Content and Mobility in Endohyphal *Mycetohabitans* Species**

*Sara Field*

Bacteria live in close relationships with fungi, sometimes living intracellularly in their hyphae. Microbes living within other organisms offer an evolutionary snapshot of how complex cells and ancient symbioses evolved, even shedding light on the origin of life. For example, *Mycetohabitans* bacteria are endohyphal bacteria (EHB) found within pathogenic *Rhizopus* species that help their host fungi reproduce by sporulation. As expected for a close symbiosis, *Mycetohabitans* genomes are reduced in size.We have recently found that only 8 out of 20 strains of *Mycetohabitans* have DNA stored in a smaller plasmid in addition to the core chromosome and megaplasmid present across strains. This discovery provides an opportunity to explore how plasmids are affecting the coevolution of *Rhizopus* and *Mycetohabitans* as plasmids often contain genes related to symbiosis establishment and maintenance. Very little is known about *Mycetohabitans* plasmids, though they contain putative conjugation machinery that may allow for bacteria in contact with each other to exchange the plasmids. We are conducting bioinformatic analyses that compare similarities in genetic sequences and evolutionary relationships. We are also predicting what genes are contained in the plasmids to inform future experiments about their role in fungal colonization. Furthermore, we will validate our findings in the lab by performing conjugations with *Mycetohabitans* to transfer plasmids between strains, requiring selection methods and tests to verify conjugations. The findings from this investigation will give us insight into how endosymbiotic organisms reduce their genomes and coevolve in intimate relationships.

Research Mentor: Morgan Carter

Abstract: 138

**Atomistic Simulation of Thermal / Ionic Conduction in YSZ/STO Superlattices**

*Jan Zavaleta Molina*

The purpose of this research is to investigate the effect of superlattice structures (alternating material interfaces) on materials ionic and thermal conductivities. The Large-Scale Atomic/Molecular Massively Parallel Simulator (LAMMPS) program is used to conduct molecular dynamics (MD) simulations on the Yttria-stabilized Zirconia (YSZ)/Strontium Titanate (STO) superlattice system. A [110] (001) ZrO2|| [100] (001) STO coherent interface with lowest interfacial energy is studied. To achieve a perfectly coherent YSZ/STO interface, the YSZ structure was first strained at 7%, and then rotated by 45° before it was stacked on STO. The system is then simulated using the direct method, which involves heat source and sink to induce energy transport. After the system reaches a steady state, the temperature gradient can be used to calculate the thermal conductivity. The ionic conductivity is quantified by the Nernst-Einstein's Mean Squared Displacement (MSD) parameter, which can be used to calculate the diffusion coefficient. A single phase YSZ is also studied for the purpose of methodology validation and comparison. Results show that in comparison to the YSZ bulk thermal conductivity (2.317 W/(m\*k)) and diffusion coefficient (1.907 Å^2/ns), the YSZ/STO superlattice has a lower diffusion coefficient (0.709 Å^2/ns) and thermal conductivity (1.418 W/(m\*k)). Note that the thermal conductivity and diffusion coefficient of YSZ bulk correspond well with the simulation and experimental results found in literature. The thermal conductivity and diffusion coefficient of YSZ/STO are reported for the first time.

Research Mentor: Xiang Chen

Abstract: 139

**“It was so painful": A qualitative analysis of women’s experiences of pain during reproductive endocrinology and infertility (REI) treatment**

*Joy Yochem*

Infertility affects 186 million individuals worldwide, including 9% and 11% of American men and women, respectively. The physical and mental impact of infertility treatments has been studied extensively, but often separately. Infertility treatments are frequently physically painful, emotionally distressing, and financially taxing, all of which can lead to long-lasting mental health consequences for patients. Infertility patients are at higher risk for anxiety, depression, and suicidality than their counterparts. The potential risks to infertility patients’ mental health and impact on perceived quality of life suggest that it is crucial to understand how patients perceive the physical and mental impact of their treatment experiences. This study aims to explore further the types of emotional and physical pain experienced by infertility patients before, during, and after treatment processes. Using a qualitative thematic analysis of nineteen interview transcripts, the research team explored participant perceptions of infertility diagnosis and treatment. We examine various aspects related to the physical and mental impact of treatment on participants, all of which fall into three major themes: emotional distress, physical pain, and mistreatment. These individuals’ stories provide insight into the psychological and physical challenges of treatment. Results indicate that both social attitudes about infertility and the medical practices at different infertility practices directly affect patient well-being. This study suggests that healthcare systems and practitioners must develop policies and create resources to assess and account for patient well-being to help patients cope with the emotional and physical duress of treatment. Our data will be reexamined alongside data from “The Retrievals,” a podcast about former patients of the Yale Fertility Center who underwent IVF without pain management because fentanyl meant for treatment was stolen and replaced with saline, to understand how infertility patients describe their experiences of pain.

Research Mentor: Margaret Quinlan

Abstract: 140

**Preparation and characterization of fluorescently labeled APE1 recombinant protein for mechanistic studies in liquid-liquid phase separation**

*Anthony Malone*

Apurinic/apyrimidinic endonuclease 1 (APE1) is a multifunctional enzyme playing a major role in endonuclease and exonuclease activity essential in DNA damage response (DDR) and genome integrity. These roles include the repair of AP lesions through multiple nuclease activity. While the various DNA repair pathways APE1 is involved in are known, very little is understood regarding the role and mechanism of APE1 in liquid-liquid phase separation (LLPS) for DDR. The lack of understanding leads to a knowledge gap, which could lead to targeted cancer therapy and treatment if filled. Using fluorescently traceable APE1 proteins we aimed to study the dynamics of APE1 in various DDR pathways and the formation of biomolecular condensates via LLPS. To prepare the expression construct, APE1 was fused with a Histidine (His) tag and a fluorescent tag (eGFP or Halo) through molecular cloning procedures, and recombinant APE1 was amplified and duplicated using DH5 Alpha E. Coli. The recombinant plasmid was then transformed into Rosetta (DE3) Component Cells to produce recombinant proteins (IPTG induction) which were then purified using Affinity chromatography via His tag. The recombinant proteins were confirmed and identified using Western Blotting and Coomassie Blue staining. Future plans for this study are to set up and optimize *in vitro* LLPS systems to characterize the dynamics of APE1 in biomolecular condensate formation and its role in various DDR events. Taken together, this research aims to address the current knowledge deficiencies of the dynamic nature APE1 plays in LLPS and DDR events through fluorescent tagging and tracking.

Research Mentor: Shan Yan

Abstract: 141

**Black Sexual Health in Young Adults Study**

*Victoria Smith*

When research is conducted on the sexual health of Black populations, it usually takes a deficit-based perspective such as exploring STD/STI statuses. Focusing on potential negative outcomes of sexual activity misses the broad spectrum of sexual experiences in Black communities. Thus, the current study seeks to understand how Black young adult couples conceptualize their sexual health and engage in sexual health communication and practices within their relationships. A total of 15 young adult Black couples between the ages of 18-25, in an ongoing relationship, and who all identified within  heterosexual and queer relationships, were recruited for the current study. Participants consented to a 60-minute Zoom interview call in which they were asked questions such as, “When you hear the words ‘sexual health’, what comes to mind for the both of you?” alongside, “What are other ways you promote your own sexual health and well-being based on the way that you define and view sexual health?”. Most couples (*n* = 13)  were interviewed, together while 2 participants interviewed without their partners cas they were unable to attend (*n* = 2). The research team is currently engaging in thematic analysis. Four interviews have been transcribed and coded (percentage agreement = 95%). We are seeing current themes of a primarily binary gendered sexual health education, and how physical sexual health has been the foundation of their educational experiences while emotional sexual health has not been promoted. Based on our findings, we have seen a trend that couples have had to depend on their partners to learn about the emotional aspect of sexual health. Through these experiences they have gained a deeper understanding around the importance of emotional awareness in regards to their sexual health experiences; through active communication, consent exploration, boundary setting, and expressing needs and desires.  In order to promote sexual health and wellbeing in Black communities, it is imperative that health professionals use strengths-based approaches to examine sexual health communication and practices in their relationships, despite the vast data that shows Black individuals are most at risk. By highlighting the ways in which sexual health is promoted and prioritized within Black relationships, we are able to better understand the ways in which health professionals can provide culturally competent and accessible tools and support to Black communities to live a life that is to their healthiest potential.

Research Mentor: Jasmine Temple and Erika Montanaro

Abstract: 142

**Influence of Biofilms on Settlement of *Ectopleura crocea* Larvae in the Gulf of Maine**

*Christian Klepper*

The biofouling species *Ectopleura crocea* causes costly infrastructure damage and maintenance every year. Preventing *E. crocea* settlement on marine infrastructure is critical to the ongoing effort to preserve and protect these structures. These typically stationary creatures choose their settlement locale as larvae, relying on a complex hierarchy of chemosensory, photosensory, and mechanosensory cues to guide this behavior. The chemical signals produced by local biofilms are believed to be at the top of this hierarchy and a key component in predicting *E. crocea* settlement behavior. Furthermore, evidence suggests *E. crocea* are locally adapted to the biofilm in their environment, as larvae settle at lower rates on foreign biofilms. My research is focused on characterizing the bacterial species that compose biofilms at multiple locations in the Gulf of Maine and evaluating the effects different biofilm populations have on *E*. *crocea* larval settlement. Sequencing and analysis of 16S rRNA from biofilms will be used to identify and categorize the bacterial species from each location. These data will be used alongside settlement observations to draw inferences about local biofilms' role in settlement behavior. By understanding these interactions, we hope to develop strategies to mitigate the economic impact of *E*. *crocea* biofouling on marine infrastructure while preserving the role *E.crocea* plays in local ecosystems.

Research Mentor: Adam Reitzel

Abstract: 143

**Thermal influence on the development rate of the model sea anemone, *Nematostella vectensis***

*Caitlin Kennedy*

The sea anemone *Nematostella vectensis* is an ectothermic organism, which means they cannot regulate their internal body temperature. The external temperature of an ectotherm’s environment plays an important role in their activity, development and overall survival. As ectotherms reach temperatures near the freezing point (-1.6°C in seawater), development may be hindered, or cease altogether. I hypothesize that temperature is inversely correlated to the development rate of *N. vectensis*. For this experiment, embryos were kept at six different temperatures (30°C, 25°C, 20°C, 16°C, 10°C, 4°C), and were checked daily for 20 days. There were 6 replicates per temperature each with 20 embryos. Development was tracked based on four stages: Embryo, Active, Settlement, Tentacle. After 20 days, it has been observed that the embryos kept at the lowest temperature (4°C) have displayed different behaviors, aggregating in the center of the plate and showing no noticeable movement, displaying signs of death. The embryos at 16°C showed a lag in development, compared with the embryos kept at higher temperatures of 30°C and 25°C, who fully developed to the tentacle stage within 9 days. The embryos at 10°C have not currently shown any developments. After 30 days, animals that did not develop (e.g., 10°C, 4°C) will be moved up to 20°C to differentiate whether *N. vectensis* is stopped or hindered from development at lower temperatures. Based on these results it can be concluded that the environmental temperature of *Nematostella vectensis* has an effect on their rate of development through several critical life stages.

Research Mentor: Quinton Krueger

Abstract: 201

**Explain Your Thinking: What Does this Mean in Math?**

*Susan Lima-Romano, Amelia Crawford*

Mathematical writing (MW) is an activity where students write about mathematical concepts and procedures. Explanatory writing is one type of MW. This kind of writing is characterized by a student’s sharing of their conceptual and/or procedural knowledge about a mathematics concept. MW is important because it challenges students to explain their thinking – strengthening students’ ability to communicate and understand the mathematical content. For example, curriculum resources and summative assessments include questions where students are asked to explain their thinking in writing however; expectations for both teachers and students as to what this writing should look like remain unclear. The goal of our research was to focus on understanding how rising fourth grade students compose a mathematical explanation before and after participating in MW instruction. We administered the same validated writing assessment at the beginning and end of a four week summer camp located in a major city in the southeast that emphasized written mathematical explanations. We scored the students’ explanations using an element scoring rubric that included the characteristics of a mathematical explanation, the mathematical content, mathematical vocabulary and writing organization. Findings revealed that 4 of the 5 students had an improved overall score from pre-to post-assessment and one student maintained the same score. This research is significant because it 1) helps teachers understand the characteristics of a mathematical explanation and 2) demonstrates that students' explanations improve when provided with MW instruction. We saw the most growth with students writing in the rubric categories of mathematical explanation and mathematical content.

Research Mentor: Madelyn Colonnese

Abstract: 202

**Studying Usability of Expert Cybersecurity Tools**

*Toya Okey-Nwamara*

According to the Verizon Data Breach Investigation Report, 68% of data breaches involved a person falling victim to a social engineering attack (What Is Social Engineering? | Definition, n.d.). According to the Cambridge Dictionary, a social engineering attack is an attempt to trick people into giving secret or personal information, especially on the internet, and using it for harmful purposes. These harmful purposes include phishing, scamming, hacking, information stealing, etc. Security experts need tools to easily analyze these attacks, known as digital forensics and incident response (DFIR). However, past research has shown that many such tools are unusable by novices and difficult for experts to use. This affects the productivity of DFIR professionals ranging from security analysts to law enforcement officers. Our research addresses this situation by gathering insights into the challenges faced by DFIR professionals and the requirements for improving their usability. In this first study, we interview DFIR professionals and review the current literature. Work to date includes compiling and analyzing prior works, recruiting and talking with twenty-five DFIR professionals on Zoom, and cleaning up and analyzing the resulting transcripts. The insights gained from our literature grid and interviews will inform a research agenda that aims to improve the usability of DFIR tools. This will aid in developing better heuristics for the design of these tools, ultimately enhancing the efficiency and effectiveness of DFIR professionals in analyzing cybersecurity attacks.

Research Mentor: Cori Faklaris, Prakruthi Reddy

Abstract: 203

**An Experience of the Heart: Bringing This Experience Home (Literally)**

*Sandie Spraggins*

This experience changed my life. Not in the sense that I learned more (which I did) but through deep feelings that were brought to the surface. No one could prepare me for what this trip would mean educationally and personally.

Each place we went was an immersive lesson in what people, whose skin was black, experienced just because of that one fact. Throughout the entire trip, the thought that went through my head was, “How can people do that to other people?”

Can humanity really be affected by the greed of money and the need to feel superior?

The place that impacted me the most was Freedom Monument Sculpture Park. The bigger-than-life sculptures were so thought-provoking, but nothing prepared me for what I would experience.

My husband is black and has educated himself about his heredity. As I stood in front of that monstrous wall with thousands of names, I found “Spraggins” my husband's last name. When I saw it and read it repeatedly, my emotions became uncontrollable. This made what I had seen and what I would see real.

We went to so many important places that my students learn about but don’t “feel about.” I plan to use Google Maps and have students create a Civil Rights trip that stops at many of the places I went to and also, research these places. In groups, they will use Google Tour Builder to create an annotated virtual itinerary. They will design their tour and map out a route for the trip. Finally, they will present their trip to each other.

Research Mentor: Scott Gartlan

Abstract: 204

**The Effects of Urbanization on Dragonfly (Insecta: Odonata: Anisoptera) Metacommunity Structure and Connectivity**

*Brody Moran*

The population of Charlotte, North Carolina is increasing, impacting the chemical and ecological structure of freshwater streams such as destroying riparian environments. Urbanization can alter hydrology, lower biodiversity, and negatively impact macroinvertebrate community structure in a phenomenon called urban stream syndrome. Freshwater macroinvertebrates are aquatic insects visible to the naked eye such as arthropods, worms, and snails. Macroinvertebrates are traditionally used in biomonitoring of freshwater ecosystems due to their diversity, ubiquity, and range of pollution tolerance. Dragonflies (Insecta: Anisoptera) are a vital component of ecosystem food webs as they are both predators and prey for various species. Despite their importance, aquatic macroinvertebrates are underrepresented in genomic research. Our project focused on evaluating the relationship between urbanization and dragonfly diversity using both traditional taxonomy and molecular methods. To establish patterns of urbanization, we used historical monitoring data provided by Charlotte-Mecklenburg County Stormwater Services to map the change in Anisopteran metacommunity structure over time. We analyzed Anisopteran metacommunity structure across increasing stream orders along an urban gradient in various watersheds in Charlotte-Mecklenburg County, NC, by collecting dragonfly nymphs of various instars at each site and identifying each individual to the lowest level possible using dichotomous keys. We evaluated urbanization by percent impervious cover across each watershed. Metacommunity structure was evaluated using traditional diversity metrics and single nucleotide polymorphism (SNP) variation of the COI and ITS2 regions. By analyzing historic records and DNA connectivity, we hope to understand the relationship between Charlotte’s urbanization and dragonfly community, thereby providing groundwork for future macroinvertebrate research.

Research Mentor: Sandra Clinton

Abstract: 205

**Developing a Light-Assisted Drying Technique to Thermally Stabilize Poliovirus Vaccine**

*Jade Duerr*

The majority of vaccines are delivered as liquid formulations that must be stored at or below 4°C. In resource-limited areas, this need for cold storage is the leading cause of undervaccination. Light-assisted drying (LAD) is a new technique to dry vaccines in a sugar matrix so that they can be stored at room temperature. Liquid samples containing biologics are illuminated with a near-IR laser, quickly dehydrating samples and forming a storage matrix. The goal was to determine LAD parameters to process a poliovirus vaccine (IPOL). Sample volumes of 0.50 mL were illuminated with the 1064nm laser inside glass tubes for 170 minutes. Thermal histories were monitored throughout processing to determine optimal laser powers. Polarized light imaging (PLI) was used to determine if samples contained sugar crystals, an indication of uneven drying.Biologics can be damaged above 42°C, but at the same time, samples must be dried quickly to prevent crystallization of the sugar matrix which can damage an embedded biologic. High concentrations of the vaccine antigen in solution can lead to aggregation and uneven drying during processing. Thermal histories revealed that a laser power of 3.75W provided adequate drying, but did not result in sample temperatures above 42°C. PLI showed that crystallization depended on the concentration of vaccine antigen. To prevent crystallization, the vaccine was diluted by a factor of 20 compared to the commercially available vaccine. A LAD process to stabilize polio vaccine in a sugar matrix was successfully developed.

Research Mentor: Susan Trammell

Abstract: 206

**Resources for Firefighter Mental Health**

*Jordan Dunn*

The mental health and well-being of firefighters are critical for maintaining an effective and responsive emergency services infrastructure. Recent research has indicated a lack in resources across departments nationwide and an overall need for greater research on what resources are most effective. However, firefighter mental health can be injured by traumatic experiences during their work as well as stressors less job-related such as substance abuse, relationship issues, financial problems, and anxiety/depression. Despite recent studies highlighting the need for firefighter-specific resources, improvement appears to be slow, and there are few studies in the United States showing which resources are being used in each geographic area, let alone ask firefighters which resources they would actually use. Therefore, this study will fill this research gap by examining the availability, accessibility, and efficacy of mental health resources for firefighters in North Carolina and South Carolina. Utilizing a quantitative approach, we have prepared digital surveys for paid and volunteer firefighters and fire chiefs. We anticipate that our findings will reveal a significant disparity in mental health resources across different regions in both North Carolina and South Carolina, with urban areas such as Charlotte generally providing more comprehensive resources compared to their rural counterparts. We also expect that while a majority of firefighters acknowledge the importance of mental health services, stigma and a lack of awareness about available resources continue to hinder their utilization. Future implications include the development of consistent mental health training, peer support programs, and increased funding for mental health programs.

Research Mentor: Michael Benjamin

Abstract: 207

**How "Universal" is Universal Design for Learning in Teacher Education Programs?**

*Jordan Rierson*

Effective and responsive education means meeting the diverse needs of learners. The Universal Design for Learning (UDL; CAST, 2024) framework allows for intentional instruction for all students to meet their specific needs. This framework can only be implemented if all teachers- general and special education- are knowledgeable and confident with its material, beginning in their preservice programs. The purpose of this study is to determine the inclusion of UDL principles in teacher education preservice programs in institutions of higher education in one state. This study is a systematic replication of Vitelli (2015). A survey was distributed using Qualtrics to institutions with both special and elementary general preservice education programs. It was sent to department chairs and program coordinators at 26 institutions to distribute to faculty who teach a methods or curriculum course. Participants are asked to report demographic information as well as their understanding and implementation of UDL principles and guidelines, the depth and complexity of such implementation. Data were collected over a two-week period and 11 responses were received, 6 of which were completed beyond 98% and therefore included in data analysis. The majority of the responses were from Special Education faculty, as hypothesized. The responses and comments of participants confirmed the hypothesis that there is a direct correlation between UDL instruction in educator preparation programs and the preparedness of teachers in the classroom. Overall, all respondents included in data analysis demonstrated a strong understanding of UDL and had at least an average understanding of UDL when teaching it.

Research Mentor: Holly Johnson

Abstract: 208

**On the Civil Rights Trail**

*Larry Bosc*

Our first stop was in Montgomery, Alabama where we took a boat down the Alabama River to the newly opened Freedom Monument Sculpture Park - much like the enslaved and indigenous persons did hundreds of years ago. The sculptures were incredible as was the wall of tens of thousands of names of individuals who were trafficked there. We had a brilliant tour of key Civil Rights sites by the charismatic Shirley Cherry.

The next day was filled with visits to the Legacy Museum and National Memorial for Peace and Justice and another lengthy trip to Jackson, Mississippi.

I was really looking forward to our visit to the Mississippi Civil Rights museum on Saturday and was not disappointed. Besides the incredible exhibits we were lucky to hear stories from Hezekiah Watkins-the youngest Freedom Rider. He was gracious as teachers took pictures with him and he signed his book Pushing Forward.

A trip to the Emmett Till Interpretive Center is always an emotional visit - particularly in the Sumner Courthouse where the trial of Till’s murderers took place. Prior to that we were in Money, Mississippi and saw the store location that was at the center of false accusations made by Carolyn Bryant.

Despite an unexpected bus breakdown, we arrived in Birmingham late evening, attended a church service in the 16th Street Baptist Church (site of 1963 bombing) Sunday morning, followed by a great lunch in the church basement, and another long bus ride back to Charlotte.

Research Mentor: Scott Gartlan

Abstract: 209

**A Journey In History: The Power of Waves, Chains, and Mothers**

*Regina Graves*

This trip was much needed because it gave me an experience that was unknown, it educated me on the history of my ancestors. I had so many amazing experiences and mixed emotions at the same time. I was left heartbroken because I just couldn’t wrap my hands around the  fact that people could be so cruel and hateful.

The Legacy Museum in Montgomery, AL stood out  for me because it set the tone for what I would soon experience. I was placed smack dab in the heart of the transatlantic slave trade.  I stayed in that room longer than expected because I was glued to the floor and the horror cries of my ancestors would not let me move.  The sounds of the drenching waves had me paralyzed.  As I looked around the room at the many faces, chained and shackled bodies an image that still can not be erased caught my attention, the statue of a woman bound to her children while holding a baby at the bosom of her breast  trying to survive. That image showed me the resilience and the courage that the mom had in the midst of all the madness, she  fought for her children’s safety. This was empowering.  I learned so much from this experience but I chose this story to share. I plan to share this information with my students so that they will have a clearer understanding of what happened in history to inspire them to be advocates for justice for themselves.

Research Mentor: Scott Gartlan

Abstract: 210

**Engineer Multi-Qubit Hamiltonians through Optical Cavity Design**

*M. Elijah Wangeman*

Molecular polaritons have unique potential as quantum simulators, and their tunability through the altering of their coupled optical cavity makes them an appealing alternative to more difficult to address quantum systems. In order for these molecular polaritons to be used for quantum simulation, their native gates, coherence, and quantum behavior must be accurately modeled. In this research, a Jaynes-Cummings model (JCM) is investigated and optimized as a more performant model than Lindblad for coupled molecule-optical cavity systems at resonance. *Ab initio* cavity quantum electrodynamics configuration interaction theory (QED-CI) is used to ascertain the parameters (notably the coupling energy) of a Lithium Hydride (LiH) polariton with very high accuracy. The JCM is run with these parameters and contrasted with the Lindblad approach; capturing the dynamics of the interaction Hamiltonian while being significantly faster.

Research Mentor: Jay Foley

Abstract: 211

**Analysis of Hollow Microneedle Efficacy for Painless Interstitial Fluid Extraction**

*Michelle Abigail De Paz Hernandez*

Interstitial fluid is located in the epidermis and contains markers similar to those found in blood. Typical needles used to draw blood samples can leave marks and be very painful, especially for patients with thin veins, blood disorders, or tremors. However, for many tests, interstitial fluid can be painlessly extracted using microneedle patches. In this study, we designed a microneedle patch using Solidworks CAD software and printed it with a stereolithography (SLA) printer using biocompatible material. These materials exhibit hydrophilic properties, enabling liquid extraction through capillary pressure. This characteristic eliminates the need for external suction mechanisms. To ensure the functionality of microneedle patches, the design must precisely target the correct skin layer without causing pain ensuring effective penetration and user comfort. It is essential to conduct tests on a material with mechanical properties similar to human skin. In this study, eight stacked sheets of Parafilm®M will be utilized for these tests. Testing on Parafilm®M sheets will help refine the microneedle design, optimizing performance and achieving a pain-free application. The microneedles penetration depth will be evaluated by applying a range of forces from 3N to 30N. The results were analyzed by meticulously examining each layer individually to determine the force required for skin penetration. The results indicate an almost linear relationship: as the applied force increases, a greater number of layers are either pierced or marked by the needles. A deviation occurs at 25N. This anomaly may be due to needle deformation from prior tests or inconsistent force application.

Research Mentor: Erina Joyee

Abstract: 212

**Optimizing the Performance of Computer Vision Application**

*Caleb Brohman*

Computer vision applications are essential for demonstrating practical applications and capabilities of advanced algorithms for real-world use. These demonstrations must run smoothly to effectively demonstrate tasks like position estimation, image segmentation, and object detection. If a demonstration runs smoothly and efficiently, it makes the technology look reliable and will attract people to use and implement it.

We have used a combination of advanced techniques and tools to optimize computer vision applications for performance. Profilers are used to identify and address any bottlenecks in the code, ensuring maximum performance. Leveraging hardware accelerators like GPUs, we are able to handle more complex calculations faster. Additionally, we optimize our code by using efficient libraries and frameworks like OpenCV and PyTorch. By optimizing the input data and pre-trained model, we have improved the performance of our application without losing key features.

In this project, we have implemented these optimization strategies and tools to great effect. By integrating profiling tools, hardware acceleration, and code optimization, we have significantly improved the application's reliability and performance. Our results show reduced latency and increased framerate on the scale of over 10 times its previous values, providing a clear and smooth user experience. These improvements to our demonstration show that our computer vision technology is effective and ready to provide users with an accurate representation of what computer vision offers.

Research Mentor: Erik Saule

Abstract: 213

**The Power of Slave Narratives**

*Jacqueline Smith*

 What I saw and heard in the Civil Rights Museums put my emotions in turmoil-seared my soul. Thankfully there were courageous acts and hard-won triumphs that inspired and filled me with pride. The museums shared the history of the pain and suffering that was created by slavery, lynching, segregation and injustices that took place in America.

Visiting **The Freedom Monument Sculpture Park, The** **National Memorial for Peace and Justice** and **The Legacy Museum** in Montgomery Alabama breaks my heart. I remembered my heart filling up. I didn’t cry but I wanted to.   Its exhibits, told in first-person narratives and historical displays, track the links between slavery, lynching, segregation, mass incarceration, and police violence which was very disturbing yet powerful. To hear a Freedom Rider, Hezekiah Walker at the **Mississippi Civil Rights Museum** tell his story of being part of the movement that brought History to life and made an enormous impact on me.  The highlight which brought me to tears, was walking over the **Edmund Pettus Bridge**, the site of Bloody Sunday on March 7, 1965.

To make sure students understand what life was like for slaves, my students will read first person narratives from the **Freedom Monument Sculpture Park**. Afterwards, we will discuss the common themes of the different slaves’ narratives and connect them to other literary texts. By connecting slave narratives in English Language Arts, a deeper understanding of history is fostered.

Research Mentor: Scott Gartlan

Abstract: 214

**A Memory From the Past: Meeting an Original Freedom Rider Ernisha BallardSocial Studies, Whitewater Middle School**

*Ernisha Ballard*

The very first stop of the Civil Rights Trip was to The Freedom Memorial Sculpture Park in Montgomery, AL. The park honored the lives of enslaved people indigenous peoples with sculptures, monuments, etc. The sculptures allowed me to gain more knowledge on the African Slave Trade. The Legacy Museum was another site that really allowed me to gain a deeper knowledge and understanding of enslaved people.  The drive to Selma and being able to walk across the Edmund Pettus Bridge was surreal to me. At that moment, I felt empowered as if I was a part of the Civil Rights movement.

The Mississippi Civil Rights Museum was my favorite part of the trip. This museum  was very illustrative. I enjoyed being able to see the visuals such as the church and school that African Americans attended. What I enjoyed most about the Mississippi Civil Rights Museum was being able to meet a person who was part of the Freedom Riders, Hezekiah Watkins. The overall experience on this trip was great. It allowed me to reflect and to put things into perspective on how slavery began to present day mass incarnation. The knowledge that I’ve gained from this trip will allow me the ability to give my students a deeper understanding of African American history and to allow them to be able to connect and critique various forms of inequality in our society today.

Research Mentor: Scott Gartlan

Abstract: 215

**Quantifying Silanol Groups on Zeolite to Functionalize it for PFAS Removal**

*Maren Clark*

This study focuses on removing per- and polyfluoroalkyl substances (PFAS) from water without using environmentally harmful solvents. We zeolite, a natural, gravel-like material commonly used in pool filtration systems to improve water clarity. Clinoptilolite, a type of zeolite, was chosen for its adsorbent properties due to its high surface area and porous structure. On the surface of these materials are compounds called silanols, which are functional groups with Si-O-H connectivity. These silanol groups' presence, quantity, and nature are critical to their adsorption capabilities. Clinoptilolite is a natural cation exchanger, meaning it selectively adsorbs ions with a positive charge. PFAS are anions (negative charge), so the clinoptilolite was modified with polycations to function as an anion exchanger. The silanol groups on clinoptilolite needed to be quantified, which was accomplished via conductometric titration. This is a titration where strong acid is added to a solution, followed by small amounts of base, and the conductance is recorded throughout. Conductance is essentially a measure of ions through a solution. That information is input into a graph and with linear regression the number of silanol groups can be determined. The grains undergo three treatments—dried, silanized, and polymerized—each requiring titration to evaluate the effectiveness of silanol modification. The titration process remains consistent across different grains (KMI and Zeosand) and treatments. Data analysis using linear regression helps determine the volume change at constant conductance, correlating with the number of silanol groups. Findings reveal higher silanol content in dried zeolites compared to silanized counterparts, suggesting partially successful but non-uniform silanization. We will quantitatively report the number of moles of silanol per gram of zeolite. Further refinement of silanization processes is necessary before reliable data can be obtained for polymerized zeolites. This research underscores the importance of precise silanol quantification in enhancing zeolite efficacy for PFAS removal, laying the groundwork for sustainable water purification methods.

Written with the help of ChatGPT: <https://chatgpt.com/share/fb4e4265-327a-49d5-992b-bd3a52bef548>

Research Mentor: Jordan Poler

Abstract: 216

**Partitioned Allocation for 3D Memory Performance: Python-Based**

*Monse Montes-Bocanegra*

This research explores the potential of partitioning to enhance the processing of large datasets. By dividing matrices into smaller segments, the study aimed to improve computational efficiency and reduce memory usage. Partitioning, which involves breaking down data into more manageable pieces, was applied to matrices to address the challenges posed by large data sizes. Various partitioning methods in Python were evaluated, with a focus on their impact on memory consumption and execution time. Performance measurements were obtained using the timeit function, which accurately times code execution. The findings revealed that the NumPy array method was the most efficient, significantly decreasing computation time and memory overhead. To illustrate the concept, consider the analogy of moving house: having several people carry smaller boxes is faster and less strenuous than having one person carry a large box. Similarly, partitioning large matrices into smaller segments allows for more efficient processing and easier data management. The results confirmed that partitioning can substantially enhance the performance of large data processing tasks. Future research will focus on leveraging 3D memory and developing advanced partitioning techniques. This will involve building a MicroBlaze processor and memory on an FPGA to run the code in MicroPython, exploring multiple memory banks, and integrating additional algorithms to further optimize performance.

Research Mentor: Ron Sass

Abstract: 217

**Title: Enabling Advisors to Guide Students: Ensuring Financial Readiness for Graduation**

*Meelad Doroodchi*

Financial aid planning based on academic goals and plans is a critical component of higher education, presenting a significant concern for students navigating their academic paths. Timely completion of education and fostering financial literacy skills are important objectives in this context. Academic advisors play a pivotal role in guiding students through various academic aspects such as course registration and degree requirements. However, their ability to provide personalized advice may be hampered by a lack of insight into students' financial constraints. Advisors typically lack access to detailed student financial aid information, creating a gap in their capacity to offer comprehensive support.

To address this gap, our research is focused on developing a web/mobile tool aimed at aligning students' financial aid resources with their degree plans shared and guided by the academic advisor. By integrating financial aid information into academic advising processes, we aim to empower advisors to provide more tailored guidance and support to students. This tool seeks to facilitate better decision-making regarding financial aid options, course selection, and degree progression, ultimately enhancing students' academic experiences and success while utilizing their financial resources the best.

Additionally, our research involves conducting qualitative interviews with advisors at UNC Charlotte to review the tool’s dashboard for advisors and ensure it meets their specific needs. My part of the project involves enhancing the advisor dashboard to help advisors understand their own specific students’ needs financially and academically. Alongside our work, several other research endeavors have explored similar themes and solutions. These include studies on the impact of financial aid counseling programs, strategies for integrating financial literacy education into academic advising, and the effectiveness of technology-based tools in supporting financial aid planning. Our project aims to build upon existing research and leverage technological innovations to enhance financial aid support in higher education, thereby contributing to efforts to improve student success and retention rates.

Research Mentor: Elise Demeter

Abstract: 218

**An Accurate Contextualization of African Diasporic History in Advanced Literature Instruction**

*Angela Walker, Ph.D.*

In the contemporary educational landscape, teaching content that represents an accurate account of historical atrocities imposed on Black people is often rejected in favor of an innocuous, watered-down version of historical happenings. Therefore, there is a dire need to develop a thoughtful and effective strategy for teaching all students about the harsh realities and present day implications of hard history with special care afforded to those students whose traumatic history is on display. As a high school teacher who teaches at a historically and predominantly Black high school, I approached the CTI civil rights trip with this goal in mind: how to incorporate African Diasporic history into the study of literature—from the harrowing experiences of the Middle Passage to the enduring struggles and achievements of the present day. The Legacy Museum, the Freedom Monument Sculpture Park, and the National Memorial for Peace and Justice were most useful in answering the pedagogical, historical, and social questions that I had in mind. They each stand as poignant reminders of every facet of African Diasporic history, ultimately urging me to incorporate David Walker’s 1829 revolutionary *Appeal to the Colored Citizens of the World* and the personal narratives of the enslaved into advanced literature lessons that are multimodal and multidisciplinary. I walked away from the trip with a plan to host a similar trip for students at my school, one that would include preparation for what students might feel, tools for reflection and self-care, and intentional connection with the experiences of all students.

Research Mentor: Scott Gartlan

Abstract: 219

**Stemming the Loss of Urban Tree Canopy: GIS Analysis to Locate the Last Plantable Riparian Lands in Charlotte**

*Natalie Stotz*

Growing cities such as Charlotte, NC have lost trees to development faster than can be replaced, resulting in an 8% net loss of urban canopy since 2012. Nonprofits such as Creek ReLeaf have replanted around 7,000 trees annually, falling short of the 300,000-trees needed for restoration. Locating increasingly scarce parcels with public access and suitability limits efforts as nonprofits typically plant on public land, and ideal areas must contain arable land outside of planting-restricted floodways.

To find public parcels that were vacant and contained plantable areas within community floodplains, we applied overlayed analyses within a geographic information system (GIS) using parcel data, land cover data identifying potential plantable areas (PPA), our proxy for suitability, and floodplain data. We then ranked parcels by the amount of PPA, community floodplain, and cooccurrence with parkland.We found Mecklenburg County had 1,328 vacant public parcels with PPA and community floodplain. These ranged from 666 ac to less than an acre, with a mean of 10.63 ac and a mode of 5.21 ac. PPA within ranged from 93 ac to less than 1/10th of an acre and averaged 1.5 ac with a mode of 3.38 acres irrespective of floodplain. We then mapped the 25 parcels with the most PPA, community floodplain, and, in anticipation of restrictions, parcels outside of parklands. These analyses were then shared with partners for visualization using a [webapp](https://unccharlotte.maps.arcgis.com/apps/instant/basic/index.html?appid=77dce995ee114a9faf91f289f468d632) developed for this project. As we solicit feedback from our community partners, we anticipate refining the ranking scenarios to inform final decision making.

Research Mentor: Douglas A. Shoemaker

Abstract: 220

**CXCL4 peptides derived from CXCL4-CXCL12 heterodimer interface alter CXCL12-CXCR4 breast cancer cell migration**

*Najee Tidmore*

Besides skin cancer, breast cancer remains as the most prevalent type of cancer in women in the United States today. It is the second leading cancer and accounts for nearly 30% of all new female cancers diagnosed each year. This has led to a wide array of research on the topic, including this study. For cancer to spread from the breast to other parts of the body, CXC4 needs to interact with chemokine called CXCL12. The chemokine ligand 12 (CXCL12) signals mainly through the chemokine receptor 4 (CXCR4), which promotes cell migration including that of breast cancer cells to metastatic sites. The present study examines the effects of numerous CXCL12 peptides on blocking the migration of MCF-10A through the use of transwell essays. A total of 11 different CXCL12 peptides were used during the experiment to see which ones are the best at blocking the CXCL12 and CXCR4 interaction. This study was conducted by first taking pictures of two transwell plates with a digital microscope. Each well had a CXCL12 peptide that was being tested. Digital imaging was performed on each individual well as well as a cell count to quantify how many cells stayed on the insert and how many migrated to the bottom of the well. The results gathered from the experiment will provide information on blocking CXCL12 – CXCR4 from metastasizing to surrounding tissue and organs, resulting in a better outlook for patients with breast cancer.

Research Mentor: Didier Dréau

Abstract: 221

**Mental Health Resources for Firefighters.**

*Mariah Manley*

The availability of mental health resources for firefighters at individual fire departments around the country is a research topic lacking data. While the need for mental health resources has been highlighted in multiple studies in the past decade due to stressors both inside and outside the job, local jurisdictions have been slow to respond to that need. This research study focuses on quantifying the mental health resources that firefighters have access to in communities across North Carolina and South Carolina and gathers information to determine how to distribute the resources better and create new resources that will have better accessibility, progress, and availability. Two surveys were developed to acquire this information: one for fire chiefs who may be best aware of the resources in their department and one for firefighters who can provide feedback on which resources they feel are best for certain stressors. Once we collect data, we expect several differences may arise, such as urban areas have more resources and support than their rural counterparts, but rural areas may rely on neighboring departments for some resources. We also hope to gain information about various stressors in this workforce. For male and female firefighters, the increase in harassment, hardship of creating families, and drinking is with the female firefighters, also since male firefighters are the majority many female firefighters leave the profession earlier than their male counterparts. Future implications include creating better mental health training, funding, and hiring more mental health professionals. This research emphasizes the need to highlight mental health resources for firefighters and what can be done in the future to lessen the impact of mental health symptoms.

Research Mentor: Michael Benjamin

Abstract: 222

**A Preliminary Assessment of Water Quality in Cove and Main Lake Locations in an Urbanizing North Carolina Piedmont Reservoir**

*Emma Doherty*

Lake Wylie is a reservoir located on the Catawba River, along the border between North and South Carolina. The reservoir serves as a water supply to several communities, as well as being used for power generation and recreation. The area surrounding the reservoir has seen extensive development and population growth in the last 25 years, coinciding with reports of noxious algal blooms and increased sedimentation in cove areas. Charlotte-Mecklenburg Storm Water Services has collected water quality data for the main lake for several decades and more recently from specific lake coves under the Cove Monitoring Program. We analyzed nitrate/nitrite, total Kjeldahl nitrogen (TKN), total phosphorus, turbidity, fecal coliform, and chlorophyll-a data collected during 2021-2023 from three coves (Paw Creek Cove, Brown’s Cove, and Lower Withers Cove) and a main lake monitoring station. Preliminary results indicate considerable differences in mean nitrate/nitrate (27.3%) and TKN (37.0%) concentrations between coves. Ongoing statistical analysis will include testing the dataset for normality, an analysis of variance (ANOVA) to determine if there are significant differences in water quality between the coves and the main lake, and conducting a post-hoc analysis if significant differences are identified. We hypothesize that there will be a significant difference in water quality between the main lake and its coves, largely due to differences in hydraulic residence time and active development around the coves. These findings may inform future management strategies implemented in the Lake Wylie region.

Research Mentor: Craig Allan

Abstract: 223

**Characterizing Microplastics in the Restored Floodplains of Charlotte's Urban Streams**

*Mollie Davis*

Plastics are ubiquitously used worldwide due to their low manufacturing cost, diverse material properties, and resistance to degradation. Prolific production however, has led to mass accumulation of plastic waste, which can take up to hundreds to thousands of years to break down. Plastic pollution undergoes physical, chemical, and biological processes that degrade them into microplastic pieces ranging 1 nm to 5 mm in size. The prevalence of this pollution has led to further investigation of marine and freshwater microplastics; however, freshwater ecosystems remain understudied, especially research focused on streamside soils. To address this research gap, we quantified microplastics in Charlotte’s clay-rich floodplain soils in three watersheds varying in litter pollution (Toby River, Little Sugar Creek, and Reedy Creek). At each site, a transect was established perpendicular to the stream and a soil core was collected at a close point (1m ), midpoint, and at the edge of the floodplain from each side of the river (total of 6 cores per stream). We will quantify and summarize the distribution of microplastics using multiple methods including drying, sieving, sediment microplastic isolation and digestion processes. This study highlights the need for a standard soil method and development of a rapid soil microplastic protocol across a variety of soil types. Understanding riparian soil microplastics is important due to the many ecosystem services and molecular pathways in which floodplains and soil affect the earth systems.

Research Mentor: Sandra Clinton

Abstract: 224

**International Students’ Interaction with Social Media: How the Pressure of ‘Double Presence’ Impacts Privacy Practices**

*Nishka Mathew, Jabou Jallow*

Of the 18 million U.S. students in higher education, almost 2 million are *first-generation educational migrants* - meaning they were born abroad and are the first in their families to move to the U.S. for college degrees. These students typically feel connected to people in both their country of origin and destination country, a phenomenon known as “double presence.” However, this makes their security practices more complex, because it doubles their methods of communication (principally social media) and risk of data breaches and cyber-attacks. Yet, limited research exists on how educational migrants deal with these threats. To address this gap, we conducted semi-structured interviews to gain a better understanding of how the concept of “double presence” may affect their privacy practices on social media. We ran multiple qualitative analyses using NVivo to find common themes in the data. Results to date include that, despite these students having strong personal security practices, they often feel forced to sacrifice these measures to connect with their family and friends in their origin country (who may not have the infrastructure or education to follow the same practices). Further, many participants were unaware of the types of social media scams common in the U.S., leaving them vulnerable. Future work can build on these insights to create applications or features on social media that address these vulnerabilities. Our study is crucial for advancing privacy awareness and for developing policies to safeguard the online data and accounts of the students – before, during, and after migration.

Research Mentor: Sarah Tabassum and Cori Faklaris

Abstract: 225

**Spatial and Temporal Patterns of Water Quality in Charlotte’s Watersheds**

*Dezzie Niemann*

Charlotte is one of the fastest-growing cities in the United States. To guide and manage this growth, Charlotte’s City Council developed the 2040 Future Comprehensive Plan, detailing the City’s plans for growth over the next two decades. Research has documented that urbanization–in particular, change in land use from vegetated to impervious cover–has lasting impacts on stream health by increasing runoff and pollution influx. This study examines the complex temporal and spatial drivers of water quality along socio demographic patterns, investigating the ways in which racial and economic injustices manifest in access to healthy streams by asking: Are minoritized communities more likely to live in watersheds with poorer water quality? To calculate change in land use and water quality in Charlotte from 2001 to present, data from the National Landcover Database (NCLD) and water quality parameters (nitrate/nitrites, total suspended solids, fecal coliform, and turbidity) from Charlotte-Mecklenburg’s data portal will be combined in ArcGIS and analyzed using statistical methods. Next, the strength of association between demographic variables obtained from the American Community Survey and water quality parameters will be assessed on a watershed level. Outcomes from this preliminary analysis aim to provide context for anticipated urbanization under the 2040 Plan, with recommendations on where areas might experience water quality impairments due to urbanization. Ultimately, it is vital to situate current urbanization plans with consideration for past land use patterns and systemic injustices to responsibly plan for sustainable and equitable cities in the future.

Research Mentor: Fushcia Hoover

Abstract: 226

**Synthesis and characterization of Conjugated Fulleride Dimers Linked by *N*-Heterocyclic Carbenes (NHCs)**

*Sebastian Zaatini, Jonathan Gillen*

The vast applications and properties of C60 and its derivatives has remained an active and fruitful area of research for decades. Here we describe the synthesis of a series of symmetric C60 dimers comprising two C60 units covalently bridged by Janus benzo bis *N*-heterocyclic carbenes (NHCs). We refer to these compounds as difulleride dumbbells. The NHC linkers were formed by tetra methylation of 1,5-dihydrobenzo[1,2-d:4,5-d′] diimidazole. The C60 units form Lewis acid-base adducts to free carbenes following *in-situ* deprotonation of the benzobisimidazolium. Early attempts resulted in materials with poor solubility. Thus, variation of the N-alkyl groups was explored. Specifically, we prepared ethyl, isopropyl, benzyl, phenyl, and hexyl substituted bis(NHCs). The dumbbells were characterized using nuclear magnetic resonance (NMR), UV-vis-NIR, and infrared (IR) spectroscopies. We also used cyclic voltammetry (CV) and thermogravimetric analysis (TGA) to investigate the influence of the alkyl groups. Finally, the electrical conductivity of all new compounds was investigated using a two-point probe method.

Research Mentor: Christopher Bejger

Abstract: 227

**Predicting Nitrogen in the Wastewater Treatment Process**

*Hannah Zeru*

Wastewater treatment processes are keeping up with regulations, but some of these processes can be updated to better treat influent (incoming wastewater). Currently, we have high levels of nitrogen and phosphorus being released with the effluent (treated wastewater). These levels are varied, with some treatment plants being within regulatory compliance and others exceeding it. This extra nitrogen enters groundwater and leads to algae blooms, as well as an increase in several health conditions like asthma. In this study, we attempt to predict and model the amount of nitrogen released in effluent since there is an excess in influent. To address this, we are using machine learning models to predict nitrogen levels in the middle of the wastewater treatment process. By creating prediction models, we can better understand the behavior of this excess nutrient. If we can predict how much nitrogen is produced during treatment, it may be possible for operators to remove excess amounts sooner and mitigate any effects on the local ecosystem. This also helps determine how much power to use when treating this excess, a subject that can be explored in future research. By utilizing machine learning methods, we hope to predict nitrogen levels ahead of time and develop a functioning model for operators to use with monitoring and managing excess nitrogen levels. As of right now, we have been observing the correlation between nitrogen and other materials, and we plan to develop a testable prediction model using the Benchmark Simulation Model v. 2 (BSM2) as a baseline and data source.

Research Mentor: Michael Smith and Nicole Roberts

Abstract: 228

**Managing the Burden: College Students’ Perceptions of Debt**

*Maya Barbee*

This study is part of a broader project investigating the effects of financial anxiety and debt on the educational experiences and career aspirations of college students. The significant increase in student loan debt for recent generations has occurred at disproportionate rates and is not evenly distributed across groups. In order to explore how college students view debt and what factors account for the presence or absence of debt related stress, we conducted semi-structured interviews and short exit surveys with enrolled college students (n = 40). We asked students about their choice of major, financial stressors, backgrounds, and career aspirations. Our thematic coding of these data revealed multiple ways that students manage and respond to debt. Specifically, we identified different levels of stress and found that non-White students, female students, and students from immigrant families were more likely to experience debt related stress when compared to their counterparts. Identifying the range of experiences with debt and stress for different groups of students is an important first step in developing effective support, financial literacy and policies for diverse future generations.

Research Mentor: Scott Fitzgerald

Abstract: 229

**Overexpressing, Purifying, and Assessing Superoxide Dismutase-1**

*Payton Roy*

Copper’s chemical properties have a dichotomous affect on intracellular homeostasis— when properly regulated, copper facilitates essential cellular functions, yet in its excess can lead to the development of disease states. Cellular copper regulation is dependent upon the performance of metalloproteins, a specific class of proteins characterized by their binding and utilization of metal ion cofactors. In addition to their use and integration of metal ions, many metalloproteins also require post-translational modifications (PTMs) to fold and function. Though recent studies have contributed to immense developments in our understanding of copper’s role in both cell proliferation and death, the explicit details of the crosstalk between metalloproteins’ covalent PTMs and the metal ions with which they interact have yet to be fully realized. In this project, we aim to optimize the overexpression and purification of the antioxidant metalloenzyme superoxide dismutase-1 (SOD1) for future use in biochemical assays that will pinpoint the molecular intricacies of its copper chaperone (CCS). Preparing purified SOD1 is necessary to understand how CCS’s PTMs contribute to its successful copper delivery to its target protein. Ultimately, this research will offer valuable proteomic insights that can be utilized to create novel therapeutic copper delivery strategies that prevent or treat the development of cancer and neurodegeneration.

Research Mentor: Eva Ge

Abstract: 230

**Autonomous Surface Vessel (ASV): Field Testing and Sensor Integration**

*Ryan Monroe*

Autonomous Surface Vessels (ASVs) are remotely controlled watercraft that can be used for applications such as mapping underwater bathymetry, inspecting water-based infrastructure, detecting objects in the water, search and rescue, or surveillance. This project investigates the use of ASVs to enable more efficient water quality monitoring in lakes and rivers. An existing ASV at UNC Charlotte (the Hydrone ASV by Seafloor Systems) was outfitted with a YSI EXO1 Multiparameter Sonde to monitor turbidity, conductivity/salinity, algae quality, and dissolved oxygen (DO). A mounting mechanism was designed and 3D printed for the sonde to attach to the vehicle and electrical/software integration was performed to access and record the sonde’s GPS-tagged data stream. The project aims to evaluate the capability of the Hydrone ASV, with the YSI sonde, to conduct surveys of small sections of lakes and rivers and create interpolated maps describing the spatial distribution of the water quality parameters. The research also supported a North Carolina Department of Transportation (NCDOT) project to field test the Hydrone in diverse environments and evaluate its capability to collect bathymetric data with a single beam echosounder. Lastly, a MATLAB/Simulink model of the Hydrone ASV was developed as a tool to predict the mission time required for the ASV to follow a waypoint mission path in the presence of water currents.

Research Mentor: Artur Wolek

Abstract: 231

**Enhancing HPC Job Scheduling with Synthetic Data Generation for Reinforcement Learning-Based Schedulers**

*Monish Soundar Raj*

In the realm of high-performance computing (HPC), the efficient scheduling of jobs is essential for improving the performance of the system and making the best use of its resources. Conventional scheduling methods, which depend on heuristic priority rules, often find it challenging to adjust to changing job loads, objectives, and configurations. To overcome these obstacles, reinforcement learning (RL)-based schedulers have been proposed. However, training and evaluating these schedulers require extensive job traces, which are often unavailable due to privacy concerns. To bridge this gap, we employ advanced synthetic data generation techniques, including Tabular Variational Autoencoder (TVAE), Conditional GAN (CTGAN), and Copula GAN, to generate high-fidelity synthetic job traces. These models produce diverse and realistic synthetic data that accurately capture various job patterns and system states. We evaluate the synthetic data's quality and applicability through various methods, including cumulative distribution functions (CDFs), correlation heatmaps, statistical analysis, and scheduling simulations. Our findings show that the synthetic data, created with minimal human intervention, closely resembles actual real-world scenarios, which is beneficial for training and assessing RL-based scheduling methods in dynamic HPC settings. Our method addresses the lack of available real-world job traces. Integrating advanced synthetic data generation with RL-based scheduling represents a significant step forward in optimizing HPC job scheduling.

Research Mentor: Dong Dai

Abstract: 232

**Learning History: Hearing from a Real Freedom Rider**

*Genitia Johnson*

**2024 Civil Rights Trip**

This was an amazing experience. The movie, “Slavery and Making of America,” helped me gain a better understanding of slavery. In my classroom I will introduce the lesson by showing students a world map. The lesson will explain the start of slavery and how they travel across the Atlantic Ocean. I will also include information about Freedom park and The Legacy Museum to help students gain a better understanding of slavery.

The tour of Civil Rights with Dr. Cherry provided detailed information about the city of Montgomery, AL. She showed and explained historical sites throughout the city. In my classroom students will make connections by listening to read alouds about historical events from Montgomery.

The walked across the Edmund Pettus Bridge. It made me feel empowered. Students will view pictures of the bridge. I will explain the importance of the bridge. They will listen to children’s stories to learn about the bridge.

The Mississippi Civil Rights Museum had amazing artifacts, videos, and hands-on activities. The best part of this museum was meeting Hezekiah Watkins, a real Freedom Rider who lives in Jackson, MS. He participated in the Greyhound bus sit in. My students will view pictures from the museum. They will also listen to Mr. Watkins’ book.

I am very grateful for the opportunity to attend this Civil Rights Tour. It is one thing to see pictures or watch movies but to see events in person creates memories for life time.

Research Mentor: Scott Gartlan

Abstract: 233

**The Effect of Methyl Methanesulfonate (MMS)-Induced DNA Damage on DNA Damage Response Signaling**

*Jade Lyttle*

DNA damage challenges the fidelity of genetic code through mutations that drive cancer, neurodegeneration, and other disease phenotypes. DNA damage comes from endogenous sources such as cell division and exogenous sources such as UV light, ionizing radiation, and genotoxic chemicals. DNA damage response (DDR) is a crucial cellular mechanism that maintains genome integrity by detecting and repairing DNA lesions or by directing cells to controlled cell death (apoptosis). In response to DSBs, the ATR/Chk1 and DNA-PKcs kinases coordinate the DDR pathways to prevent inappropriate cell cycle progression and facilitate DNA repair. In this study DNA alkylating agent methyl methanesulfonate (MMS) is used as a chemical mimic of radiation to introduce methyl adducts such as N7-methyl guanine (N7meG) and N3-methyladenine (N3meA) into DNA, leading to replication stress and double-strand breaks (DSBs). Our study investigates the effect of MMS-induced DNA damage on DDR signaling pathways. Because of this, studies elucidating MMS-induced DNA damage and repair are directly relevant to clinical applications of radiation therapy in the context of cancer. Interestingly, our investigation shows that ATR and DNA-PKcs activities are preclusive, revealing for the first time a crosstalk between these two “master regulator” kinases of the DDR pathways. These findings reveal novel signaling networks of MMS-induced genotoxic stress and have clinical potential for targeting DNA repair pathways in cancer treatment. Additional studies will focus on precision medicine targeting key components of DDR pathways such as ATR and DNA-PKcs.

Research Mentor: Shan Yan

Abstract: 234

**Upcycling of Common Household Wastes**

*Ysabelle Blaine*

In the waste management hierarchy, the highest to lowest preferences include elimination, reduction, reuse, recycling, or finally disposal in a landfill. Recycling has limitations for products considered assemblies, made of 2 or more fundamentally different materials, each with different properties. Mylar film packaging used in chip bags is one such product that cannot be recycled and is currently part of waste streams sent to landfills. To help combat this problem, we constructed DIY sunshades with the Mylar film used in chip bags.

To conduct this research, we first measured the dimensions of the windows of university golf carts. We then created one sunshade using cardboard backing and potato chip bags, and another using coffee bags. To test the capabilities of these sunshades, we conducted an experiment involving five conditions: the two DIY sunshades, a control cart without a sunshade in the sun, a negative control of a cart in the shade, and a cart with a commercial sunshade. We measured the interior temperatures to test the effectiveness of the sunshades compared to control groups.

This study will evaluate the feasibility and efficiency of upcycled materials for practical uses, focusing on chip bag sunshades' ability to reduce heat absorption. Successful results could promote the adoption of upcycled materials in everyday products, offering eco-friendly alternatives to commercial solutions and highlighting sustainability in design and innovation.

Research Mentor: Michael Benjamin

Abstract: 235

**Comparison of Fluorescent and Antibacterial Properties of Silver Nanoclusters Templated on Single-Stranded DNAs with Various Number of Cytosines.**

*Regina Dula, Sarmistha Ghosh, Elizabeth Skelly,*

The antibacterial properties of silver nanoclusters (AgNCs) produced on single-stranded DNA (ssDNA) templates were investigated against *Escherichia coli* (*E. coli*). Eleven ssDNAs, each differing in the number of cytosines in their hairpin loops (C5 to C15), were buffered and treated with AgNO₃. The samples were then heated at 95°C for two minutes, snap cooled on ice bath for 2 minutes, and silver ions were reduced by NaBH₄. All samples were wrapped in aluminum foil and stored overnight in a cold room. Under UV radiation, the DNA-AgNCs samples exhibited distinct fluorescent colors correlated with the number of cytosines. Primary colors identified were C7 (blue), C11 (yellow), and C15 (red). Interestingly, the mixing of primary colors did not yield the expected secondary colors, with red predominantly overpowering others. However, secondary colors could be produced using other ssDNAs: C8 (purple), C9 (green), and C12 (orange). Subsequent experiments focused on the antibacterial efficacy of the DNA-AgNCs where *E. coli* grown on LB agar plates were treated with combinations of the primary and secondary color DNA samples and incubated at 37 °C. The antibacterial assays revealed inconsistent effects on bacterial growth. While ssDNA-AgNCs show promise as antibacterial agents, further investigation is needed to understand the mechanisms behind color dominance and its impact on antibacterial properties. The investigation can be applied to activities associated with AP Biology’s Big Idea 3: Information: Living systems store, retrieve, transmit and respond to information essential to life processes.

Research Mentor: Kirill Afonin

Abstract: 236

**Bio-characterization of Thiazolothiazoles: Cell Staining, Antibacterial and Bacterial Sensing Applications**

*Simone Walkowe Borden, Gabriela Chamorro, Elizabeth Skelly-Miles*

Thiazolo[5,4-d]thiazole (TTz) viologens are known in chemistry due to their high fluorescence quantum yields (0.8-0.96) and their multifunctional chromogenic properties such as electrochromism, electrofluorochromism, and photochromism, which make them useful in various advanced applications. TTz viologens are a recently developed chromogenic compound and fluorophore that possess a reduction process that allows for the gain of two electrons, which causes a yellow to purple to blue color change. As the TTz viologens are excited by light, they take electrons from surrounding molecules to undergo the reduction process. TTz compounds have recently been explored as bacteria killers, and with varying fluorescence under blue light, there is room to wonder how they interact with mammalian cells. The toxicities of NPr2TTz4+ 4Br- , (NPrIsoQ8)2TTz4+ 4Br-, BA2TTz2+ 2Br-, and Bz2TTz2+ 2Br- on mammalian cells were studied with three biological repeats, as they have differing solubilizing functional group side chains that were used in varying concentrations and treated in light and dark environments. The mammalian cells utilized were HEK-293FT (a human embryonic kidney cell line), MDA-MB-231 (a breast cancer cell line), PANC-1 (a pancreatic cancer cell line), and HeLa (a cervical cancer cell line). These cell studies indicate that TTz viologens are toxic at high concentrations. After finding the toxicity levels of TTz viologens on mammalian cells, fluorescence microscopy was conducted to evaluate the cell staining ability of TTz viologens. Furthermore, it was determined whether the TTz viologens can be used for antibacterial or bacteria sensing applications.

Research Mentor: Kirill Afonin

Abstract: 237

**Walking, Writing Archives in Charlotte**

*Breonna Tuitt*

Progress in Charlotte has been characterized as destruction of the old and construction of the new. The lack of historical Black buildings as a result of urban renewal during the 1960s and 1970s reflects the city’s undervalue of Black spaces. The goal of our research is to create a walkable curriculum of Black Charlotte history that connects stories to physical spaces. There are few resources available to the public that connect them with the history seen and covered in the urban landscape. I identified primary sources such as the Negro Motorist Green Books, institutions’ history books, interviews of residents from historical Black neighborhoods, the Charlotte Mecklenburg Library, UNC Charlotte’s History Charlotte Neighborhoods research, and peer reviewed articles were used to map and tie stories to physical spaces. The locations were divided into five categories: plantations and locations related to slavery, neighborhoods/communities, education, religious institutes, and culture/arts. The map includes Charlotte Mecklenburg as a whole, with many of the locations found in the four wards of the City of Charlotte. Black Charlotte history reflects a time of community being a need for Black people tofunction, survive, and thrive. Some of the spaces are experienced passivelywhile others’ history have a huge impact on how you treat the space**.** In a city with a diverse cultural, racial, and ethnic demographic, I learned that diverse architecture creates a sense of belonging and identity in the city for residents. Knowing the history and stories of the spaces we occupy can create a sense of identity within the city and knowledge for community building.

Research Mentor: Janaka Lewis

Abstract: 238

**A Comparative Study of Differential Privacy Factors in Generative AI Research**

*Pritika Bugga*

The study examines recent research on factors influencing differential privacy in generative AI models, emphasizing its role in balancing individual privacy protection with the extraction of meaningful insights from large datasets. Differential privacy is crucial in this context, facing unique challenges due to its application in generative AI. Studies highlight that dataset size and composition significantly affect privacy guarantees, with larger and more diverse datasets generally offering stronger privacy while maintaining model utility, contrasting with scenarios where smaller, curated datasets achieve comparable privacy-utility trade-offs. Model architecture also plays a critical role, as certain design choices like attention mechanisms and normalization techniques can influence the delicate balance between privacy and utility in generative models. Training algorithms are another crucial factor, with advancements in differentially private optimization methods such as adaptive clipping techniques showing promise in enhancing model performance. Additionally, the integration of differential privacy with other privacy-preserving techniques like federated learning and secure multi-party computation is explored, demonstrating synergies that further enhance privacy protections in generative AI applications. Ultimately, the research synthesizes these findings to provide insights into the complex landscape of differential privacy in generative AI and suggests avenues for future research in this evolving field.

Research Mentor: Liyue Fan

Abstract: 239

**Ligand Functionalization and Bioapplication of Metallic-Coated Magnetic Nanoparticles Against Antibiotic-Resistant Bacteria**

*Laura Scala*

As antibiotics are often life-saving medical tools, the spread of antibiotic-resistant bacteria (ARB) is a critical global health threat. Within nanomedicine, iron-oxide nanoparticles (IONPs) present several advantages as a viable method to combat ARB. Apart from producing reactive oxygen species, which are deadly to bacteria when unmitigated, IONPs are also strongly magnetic. Conveniently, this means they can be guided to and removed from sites of infection within the body by an external magnet, potentially lowering the risk of off-target effects. Therefore, to better understand the biomedical potential of iron-oxide nanoparticles against ARB, this project aims to investigate the antibacterial effect of silica-capped, gold- or silver-coated IONPs functionalized with either amine or thiol ligands. Characterization of the IONPs includes several methods: a colorimetric assay to quantify the concentration of each ligand type; Fourier-transform infrared spectroscopy to confirm expected functional groups; dynamic light scattering and *zeta* potential to measure nanoparticle size, dispersity, and stability; transmission electron microscopy and dark field scattering to compare morphology and coating; and inductively coupled plasma/optical emission spectroscopy to analyze the ligand influence and loading efficiency of the metallic coating. Lastly, the best-performing IONPs will be bioapplied to *Escherichia coli*; colony counts will be compared before and after application to determine treatment efficacy and retrieval of the nanoparticles. Overall, this study will help contribute to understanding of the antibacterial mechanisms of IONPs by investigating both the interaction of the chosen ligands with the silver and gold ions and the physical properties of the metallic coating itself.

Research Mentor: Juan Vivero-Escoto

Abstract: 240

**Modeling Energy Transition: Simulating the Adoption of Smart Energy Devices in a Neighborhood**

*Jonathan Machado*

Energy transition for cleaner and more efficient power distribution and consumption is crucial in today’s society. Installing and utilizing smart technology in households is an example of a step in the right direction. This investment will improve sustainability, quality of living, and personal expenditures. However, factors such as income levels, access to information, governmental policies, incentive programs, etc., affect the likelihood of owning such products. A Monte Carlo method is developed to use repeated random sampling given population income data from households in North Carolina and additional socio-technical assumptions to predict the likelihood of smart appliance installations in a neighborhood. Given our assumptions, our model predicts an average 29% increase in smart device installations over 10 years. In our model, government incentives to motivate purchases on smart energy devices is observed to be the dominant factor for quick and large scale energy transition. Our results therefore show that coordinated efforts from governments to break down social and economical barriers through spreading awareness and implementing policies and programs is critical to effectively transition to a more sustainable energy system.

Research Mentor: John Hall

Abstract: 241

**Assessing the Permissiveness of Pancreatic Ductal Adenocarcinoma Cell Lines to VSV-ΔM51-GFP**

*Molly Andrews*

**Abstract**

Pancreatic cancer is one of the most challenging diseases to manage, with its notoriously aggressive nature and low survival rates. Oncolytic viruses (OVs) have emerged as potential treatments of this type of cancer. Our previous studies demonstrated that pancreatic cancer cell lines are highly variable in terms of their permissiveness to OV therapy. In this study, we focused on vesicular stomatitis virus (VSV), a promising OV against pancreatic cancer and other malignancies. Specifically, we examined the permissiveness of various pancreatic ductal adenocarcinoma (PDAC) cell lines to a genetically modified variant of VSV, VSV-ΔM51-GFP, which lacks normal replication efficiency. We used plaque assays to compare the ability of the virus to start infection, spread and induce cell death in two PDAC different cell lines: Suit-2 and MIA Paca-2. We found that susceptibility of PDAC cell lines varied greatly, with some cell lines demonstrating increased cancer cell destruction (bigger plaques). In addition, we have conducted further research into virus induced apoptosis to improve our design and strategies for combining OVs with other modes of treatment. Based on these results it can be concluded that therapeutic protocols targeting specific profiles of pancreatic cancer cells should be adapted to ensure efficient application of OV treatment in different cell lines. This knowledge can kickstart development of safer and more efficient OV-based therapies.

Research Mentor: Valery Grdzelishvili

Abstract: 242

**A sociotechnical strategy for engaging undergraduate computer science students in informal learning.**

*Joanthan Smith*

To support the holistic development of students in CS departments, a socio-technical system that promotes community interaction and encourages self-regulation and co-regulation of their technical and professional growth is being explored. This system employs gamification as a persuasive technology to motivate students towards holistic development through enhanced informal learning and community engagement. Ongoing research aims to understand and incorporate the perceptions of both students and CS community stakeholders regarding holistic CS development. Additionally, the research examines the impact of this socio-technical approach on students' CS identity, self-efficacy, sense of community belonging, motivation, and self-regulation.

Research Mentor: Marlon Mejias

Abstract: 301

**Collaborative Interactions and Content Expertise of General Education and Special Education Candidates**

*Khadija Ouedraogo*

In all professions, collaboration is a critical component of effective communication and teamwork. This is crucial in general education settings where co-teaching is the predominant service delivery model for students with disabilities. Co-teaching is an educational practice involving collaboration between multiple professional disciplines, with the intent to provide students with disabilities with access to high-quality, grade-level instruction. The capacity of preservice candidates to recognize co-teaching and collaborative behaviors in action is a critical skill that should be learned prior to their implementation in classroom environments. This study examined the degree to which preservice interdisciplinary groups of undergraduate education candidates recognized co-teaching skills and behaviors in practice. Quantitative data were collected from a joint assignment where candidates were asked to use a verified checklist to identify best practices in co-teaching. Consensus scores from a total of 8 candidate groups on 34 possible items resulted in a “pass/fail” (i.e., above or below 60%) designation. Key findings indicate candidates were successful in identifying 23 of the 34 items (67.6%), scoring 100% on eight of those items, but were unsuccessful in identifying the remaining 11 items (32.4%). Data suggests candidates lacked the general knowledge needed to learn corresponding educator techniques, key recognition habits, and experience from real-life applications. Findings from the study may influence policies and procedures across educational preparation programs, highlighting the need for explicit instruction in co-teaching competencies to build candidates’ knowledge, acquisition, and fluency in these practices, ultimately increasing positive outcomes for students with disabilities.

Research Mentor: Shawnee Wakeman and Holly Johnson

Abstract: 302

**Resolving the Microbiota in Radiation Survival Using Functional Metagenomics**

*Joshua Hensley*

Primate microbiotas are a thriving, diverse, and numerous ecosystem present within and upon us that have abundant roles in health, homeostasis, and potentially survival. Prior work suggests the microbiome's role in protection against lethal doses of alcohol, viral susceptibility, and its role as the training wheels of immunity during development. An intense stressor that is unstudied is the role of the microbiome under large doses of radiation, seen in sporadic exposures since the 1920s. In this study, we analyzed the shotgun metagenomic sequences of gut microbiome samples, taken in two other studies, from rhesus macaques before they were exposed to a lethal dose of gamma radiation. The average nonsurvivors lived 28.6 days and survivors lived 127 days – 180+ days. We applied k-mer profiling, metagenomic de novo assembly, and functional annotation, then utilized differential negative binomial models to access differential abundance organisms (e.g., bacteria or phages), pathways, and functional genes related to survival within the cohorts. Survivors and nonsurvivors varied on k-mer based profiling which coincided with differential abundances in organismal abundances and pathways relating to stress response. Such implications of the microbiome's protective impact on radiation survival could provide knowledge to promote faster radiation recovery during cancer therapy, during space flight for astronauts, and those exposed in nuclear accidents.

Research Mentor: Richard Allen White III

Abstract: 303

**Visualizing Patterns of Environmental Injustice Across Mecklenburg County**

*Maya Fleagle*

Increasingly intense environmental hazards are anticipated in a warming climate. Such impacts may exacerbate both socioeconomic inequality and environmental injustice in urban areas. Across the United States, communities of color and low-income populations are the most underserved and overburdened, making them disproportionately susceptible to ecological dangers. The current work aims to visualize the patterns of such disparities across the Charlotte, North Carolina metropolitan area by constructing an interactive web-based Climate Inequality Atlas of Mecklenburg County. This publicly available tool can eventually be used to promote awareness of environmental injustice and explore the role of social capital in strengthening community resilience and economic mobility amidst the climate crisis. Local census tract data are utilized to develop the atlas in ArcGIS Online; featuring data in four categories—socioeconomic, health, environment, and pollution. Collectively, these data help to unveil connections between climate vulnerability and various socioeconomic factors. Information from government and nonprofit resources, scientific journals, and historical archives, is also used to provide additional context for each data indicator. As a part of a broader interdisciplinary project, the atlas will be featured in library exhibits and integrated into the website of the Climate Inequality CLT outreach organization. We plan to measure the project’s success by analyzing the website’s usage metrics, including visitor numbers, engagement rates, and user feedback. Ultimately, we hope Charlotte can employ this tool to enhance the well-being and resilience of all residents through improved scientific communication, ensuring sustainable development in the face of climate change.

Research Mentor: Michael Ewers

Abstract: 304

**The Civil Rights Movement: Our Fight For Freedom and the Historical Interpretation**

*Shyrese Robinson Johnson*

This Civil Right Trip was amazing, interesting, and exciting. Walking through the Freedom Monument Sculpture Park, the sculptures were beautiful. Riding on the boat, down the Alabama River, was awesome. I also passed by Taverns, where the slaves will go and talk about their owners. When I got to the Legacy Museum the next day, I immediately felt all of the different emotions of how my ancestors were treated.

Walking across the Edmund Pettus Bridge in Selma, Alabama, was another highlight of the trip. I felt like I was walking alongside them. They have endured so much, only to get violently attacked by police, state troopers, etc. A visit to the Emmett Till Interpretive Center and Sumer Court House was very interesting and upsetting at the same time. An innocent child was murdered and thrown into the Tallahatchie River.

Attending Church services at the 16th Street Baptist Church in Birmingham, Al was absolutely amazing. The singing and worshiping is what we as African Americans use to keep our Faith. I can bring this back to my classroom by singing songs with the children, writing and drawing pictures of the church, and having the children play different roles. The children will sing songs such as This Little Light of Mine and Jesus Loves Me. The children will be singing songs in reference to the 16th Street Baptist Church in Birmingham, Al, and the children will play the different roles of singing in a choir, and the others will be Praise and Worship Dancers.

Research Mentor: Scott Gartlan

Abstract: 305

**Synthesis of Bridged and Sulfone-modified [3]Radialenes for Redox Flow Batteries**

*Chris Landes*

Redox flow batteries (RFBs) are energy storage devices that rely on the flow of electrons between two chemical species through an ion-selective membrane. RFBs have vast applications from personal energy storage to long-term grid storage. [3]Radialenes and their derivatives have shown potential as effective charge storage species for RFBs due to their stability, electron transfer capabilities, and water solubility. Additionally, their ease of production and purification are important for large-scale usage. As such, we have been investigating the synthetic modification of substituted-[3]radialenes to achieve these aims. This study explores the impact of bridging [3]radialenes, with ethylene glycol, into two-pedal and four-pedal radialenes. We also report the synthesis of new, sulfone-modified [3]radialenes. All derivatives were isolated as disodium salts and converted to dilithium salts using ion-exchange chromatography. The compounds were characterized using X-ray diffraction (XRD), nuclear magnetic resonance (NMR) spectroscopy, and electrochemically analyzed via cyclic voltammetry and differential pulse voltammetry. Crystalline solids with high water solubility and suitable redox potentials were tested in laboratory-scale flow cells. Bridged [3]radialenes are expected to be redox-active and have self-healing properties. Sulfone-modified [3]radialenes are expected to be redox-active and highly water soluble and further modifications on the sulfone substituent are being investigated.

Research Mentor: Christopher Bejger

Abstract: 306

**Assessing the Relationships between Green Infrastructure and Health Indicators**

*Nia Spears*

Green Infrastructure (GI) enhances urban quality of life by integrating nature-based solutions for stormwater management into urban environments. GI implementation often focuses on technical aspects such as stormwater management and economic considerations while neglecting environmental justice (EJ) implications. While EJ may be a component when considering GI implementation, it is often not central to the process. Past studies highlight the exclusion of justice-related criteria in GI siting, showing that historically marginalized communities, especially those with higher proportions of socially vulnerable individuals, have reduced access to both green and gray stormwater infrastructure. We quantified the relationships between GI and selected quality of life indicators in Mecklenburg County, North Carolina, to understand how GI influences urban living conditions and to inform urban planning. To evaluate spatial linkages, Geographic Information Systems (GIS) was used to overlay census tracts with diverse, visually appealing GI types that contribute to green space (e.g., rain gardens, wet ponds, and tree canopies). Independent variables such as household income, race, and physical and mental health were examined in relation to urban stormwater quality indicators. Spatial analysis was used to identify correlations between GI and selected quality of life indicators. The results demonstrate that some quality of life indicators show a stronger correlation than others, including household income, race, impervious surfaces, asthma, and depression. This study underscores the necessity of thoughtfully designing and executing GI to maximize benefits and minimize adverse effects, thereby informing plans for sustainable urban development.

Research Mentor: Nicole Roberts

Abstract: 307

**Evaluation of ourBRIDGE for KIDS II**

*Emilia Olivera*

This project aims to investigate the impact of the ourBRIDGE for KIDS program on the English language acquisition, socio-emotional skills, and cultural pride of immigrant and refugee students in Charlotte. Adjusting to a new country and educational system presents significant challenges for these students, who require both academic and social support. While schools often prioritize academics, programs like ourBRIDGE for KIDS address broader and more complex needs, making it essential to assess their effectiveness. Using a collaborative approach, the researchers worked closely with the ourBRIDGE for KIDS staff to collect data, while providing additional support during daily programming. Data were collected through on-site student surveys and administered by the evaluation team at two points in time (Beginning of Year-BoY) and (End of Year-EoY) with a total of 109 students participating in both points in time. This data collection and analysis aims to look into the program's impact on these critical areas of student development. Early findings suggest that students participating in the ourBRIDGE for KIDS program demonstrate increased language proficiency, improved social skills, and a stronger sense of cultural pride. This research demonstrates the importance of necessary support for immigrant and refugee students and suggests that programs like ourBRIDGE for KIDS can significantly contribute to their successful adaptation and integration. The results will offer valuable recommendations for the program regarding best practices for supporting this student population, ultimately fostering a more inclusive and supportive educational environment.

Research Mentor: Lan Kolano

Abstract: 308

**Evaluating watermarking techniques in Deep Fake images**

*Aryaman Kachroo*

Generative artificial intelligence (AI) models, like large language models, diffusion models, and generative adversarial networks, have been making waves with their ability to learn from data and be applied in fields ranging from medicine to financial services. However, with great power comes great responsibility, and there are real concerns about how these technologies can be misused. For instance, sensitive training data can be extracted, and deepfakes can be created and spread, causing misinformation.

This research project is about understanding and addressing these concerns. Specifically, we study how to detect deep fakes in different types of images, like satellite images, mountain images, and church images, which are generated using GAN (Generative Adversarial Network) models. The process involves generating synthetic images with GANs and then applying deep fake detection algorithms to see how well they can identify which images are fake. Additionally, we apply watermarking techniques to embed watermark into deep fake images, which helps in tracking generated content over the internet.

The expected results of this project include finding out how well existing deep fake detection methods work for different kinds of images and understanding how effective watermarking can be in maintaining the integrity of images. This research is significant because it can help prevent the spread of misinformation by improving our ability to detect fake images. It also has the potential to protect sensitive data and ensure that the images we use are traceable and trustworthy. By contributing to the development of more secure and reliable AI technologies, this project aims to reinforce the integrity of digital media and safeguard against the misuse of generative AI. This experience is not only enhancing my understanding of AI but also equipping me with practical skills in tackling real-world problems.

Research Mentor: Liyue Fan

Abstract: 309

**Human emotion and Passion from a difficult time in US HistoryCTI Civil Rights Trip June 2024**

*May Winiarski*

Again, another amazing and sobering trip through Alabama and Mississippi. The highlight of the trip started with a boat ride down the Alabama River to the Freedom Monument Sculpture Park - The Legacy Sites. The ride is reminiscent of those that did not choose to come to this country. The sculpture park is amazing. Many sculptures evoked feelings of pride of the ancestors that came before this generation. The love and the pain that was endured. My biggest excitement was the art from artists that I am familiar with and one that I met at the Wilmington Cameron Art Museum, South Carolina-based artist Stephen Hayes. He also had an exhibit at the Harvey Gantt Center in 2012. My plan is to share these contemporary artists with my student for inspiration and discussion of what the works evoke to them, describing the works critically, and for inspiration for creating their own art possibly carved sculptures from balsa wood. In the park are newly commissioned works by Charles Gaines, Alison Saar and Kwame Akoto-Bamfo, to name a few. Personally, this work inspires me in my own work in the capacity of emotion and passion in human beings. There were good conversations with my colleagues about their experiences with the work. I will also share my enthusiasm and knowledge with my students and have them do their own research of artists chosen from this collection.

Research Mentor: Scott Gartlan

Abstract: 310

**The Effects of Dipyridinium Thiazolo[5,4-d]thiazole on Charge Mobility for OLED and OPV Applications**

*Ryan Kolaitis*

In the recent years, Organic light emitting diodes (OLEDs) have been added to numerous consumer products such as mobile phone screens due to their unique characteristics such as a resolution, flexibility, and high efficiency. These devices work by engineering multiple layers of various materials onto the device which can act as hole transport layers (h+), electron transport layers (e-), and active (light emitting) layers. These materials, which can be tuned throughout the device utilizing the differences in the HOMO and LUMO between each layer to optimize the device. In this study, the impact of dipyridinium thiazolo[5,4-d]thiazole (TTz) derivatives on the charge carrier mobility for possible future applications in the field of OLEDs and organic photovoltaics (OPVs). TTz compounds are used in this study due to their ability to repeatedly undergo reduction and oxidation when it is interacted with light. The compounds used in the spin coating process include poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS), Poly(3-hexylthiophene) (P3HT), and dipyridinium thiazolo[5,4-d]thiazole (TTz). The PEDOT:PSS acts as the hole transport layer, the P3HT acts as the active layer and the TTz acts as the electron transport layer. The three configurations of devices were used to determine the charge carrier mobility properties of the TTz compounds. TTz materials were spin cast on top of the active layer, incorporated it into the active and hole transport layers, and also implemented as hydrogels to monitor voltage changes under illumination. TTz layers applied as an individual spin coated top layer have shown a positive increase in current density in several of the device configurations suggesting that dipyridinium thiazolo[5,4-d]thiazole does have a positive impact on increasing the overall charge mobility throughout these devices. However, this increase is not shown in the other configurations, such as when it is implemented individually into the active and hole transport layers.

Research Mentor: Michael Walter

Abstract: 311

**Evaluating the Influence of Socio-Economic Factors on the Distribution of Green Stormwater Infrastructure and Urban Stream Water Quality within the City of Charlotte, North Carolina**

*Brandon Vorst*

Stormwater has become a topic of increased interest in recent years due to its role in flooding and its contribution towards increased pollutant concentrations in urban streams. Green Stormwater Infrastructure (GSI) , which encompassess several different methods of stormwater control, has been increasingly implemented across the United States due to its cost effectiveness and environmental benefits. Prior research has been done on a variety of different types of GSI and their site-level impact on pollutant concentrations in stormwater runoff. However, comparatively little work has been done on assessing the impact of large scale implementation of GSI. Additionally, the potential influence of socio-economic factors (e.g., household income, race, percent rental household) on the mitigation of pollution in urban waterways is underexplored. Within this project, we assess the influence of socio-economic factors on the distribution of GSI and urban stream water quality. We used ArcGIS to conduct a spatial analysis of different socio-economic factors such as household income, land use, and GSI density within several individual watersheds. Each watershed had one or more sampling sites to provide information on pollutant concentrations. We also used regression models to understand the relationship between GSI and pollutant concentration. We hypothesize a small, but significant decrease in the concentration of pollutants in urban streams with a higher prevalence of GSI and that are located within predominantly white, affluent areas. The results of this project will help to inform current GSI implementation and increase understanding of factors that may impede pollutant mitigation in urban streams.

Research Mentor: Nicole Roberts

Abstract: 312

**RL4Sys, a Framework for RL-Based Optimization**

*Jackson Redman*

RL4Sys enables developers to easily integrate asynchronous, deep reinforcement learning (DRL) agents into existing system processes. Traditional decision-making methods using static heuristics can lead to suboptimal performance in highly variant environments. RL4Sys addresses this issue by utilizing DRL algorithms to continuously adapt to changing data, improving decision-making flexibility and effectiveness. DRL involves training an agent’s neural network (NN) to make optimal decisions based on environmental observations. By deploying an RL4Sys agent, the agent can learn from inputs and output the best possible actions in real time. RL4Sys focuses on model-free training methodologies, where the agent learns through trial and error without knowing a predefined representation of its environment. Model-free DRL methods encompass Policy Optimization and Q-Learning algorithms. Policy Optimization algorithms directly optimize action-decision probabilities by adjusting the NN’s configuration. Q-Learning first learns the quality value of each action and then exploits the highest-valued action for a given observation. A few of the key DRL algorithms used in RL4Sys include Proximal Policy Optimization (PPO), Trust Region Policy Optimization (TRPO), and Deep Q-Networks (DQN). These algorithms, among others, have been tested within the repository’s maze game and High-Performance Computing (HPC) batch-job scheduling environments. The results reflect an enhancement in adaptability to dynamic conditions when compared with static heuristics. This improvement and RL4Sys’ ease of use carry implications for various applications, including computational optimization, automated decision-making systems, and research experimentation.

Research Mentor: Dong Dai

Abstract: 313

**The State, Organized Crime, & Jim CrowThe Last Gasp of American Apartheid**

*Julio Campos*

The American South holds a significant role in the resistance against social, cultural, economic, and political change in the United States. My journey began in Montgomery, Alabama, At Freedom Monument Sculpture Park, which shed light on the surveillance of civil rights activists known as the freedom riders by the 'Alabama State Sovereignty Commission.' This institution turned out to be a state agency working against desegregation efforts through clandestine means. It became clear that just like clandestine services did against democratic movements in Europe, Africa, Asia, Latin America, this agency aimed to maintain the stronghold of Jim Crow laws through government action. This included local positions such as Sheriff's offices and the police force. The poverty and segregation I witnessed in Birmingham echoed the negative social conditions that persist in the South today.

While museums dedicated to preserving the history of American apartheid are important for the economy of these areas, their impact is limited. Communities in these regions face numerous challenges, including burned-out homes, limited job opportunities, and homelessness. Despite these hardships, I remain hopeful because there have been small steps of progress. These incremental advancements are crucial for the future and demonstrate that positive change is possible, even in the face of prevailing negativity surrounding race issues. It is especially vital for students from low-income families to learn about this history and understand how institutions can act in harmful ways. This knowledge will equip them to navigate an increasingly uncertain and controversial political reality.

Research Mentor: Scott Gartlan

Abstract: 314

**Measuring Volunteer Participation and Retention in Rural and Urban Areas for Environmental Conservation**

*Nathan Young*

Volunteer appreciation is of paramount importance to non profit organizations that utilize volunteers. The retention of volunteers creates an essential work force to actualize the goals of the non profit organizations. However, not a lot has been done academically for these non profits in regards to retaining and creating rural volunteers. Using the Catawba River Keepers(CRK) as a case study with 5,610 square miles of coverage, we’ve implemented a de-centralization intervention to raise the retention and creation of rural volunteers, to come up to par with their amount of urban volunteers. For our methods we conducted an online survey sent out to 1800 volunteers associated with the CRK. In order to discover general information that can explain what and why their level of appreciation is reflected in the survey. We then used the data gathered from the survey to create three separate focus groups of randomly selected people who volunteer with the CRK. We then created an intervention which involved planning ‘chapters’ in rural areas to act as decentralized entities of the CRK. Once implemented this will allow the CRK to spread out into its rural communities and conserve more of its environment. After a year a follow up survey will be conducted and the results will be measured. This will provide not only a basis for what other non profit that rely on volunteers for projects, a way to retain and produce. But also will provide the Catawba River Keepers with more volunteers throughout their four basins.

Research Mentor: Sharon Watson, & Timothy Murtha

Abstract: 315

**Investigations of Voltage Sensitive Asymmetric Thiazolo[5,4-d]thiazole Dyes**

*Lillian Hicks*

Highly fluorescent, asymmetric thiazolo[5,4-d]thiazole(asymm-TTz) dyes are being studied for a variety of optoelectronic applications. Voltage sensitive dyes have the capacity to detect cellular transmembrane voltage due to the changes in fluorescence intensity of the dyes bound in the cell membrane. These dyes have a push-pull electronic nature due being synthesized with both electron donor and electron acceptor substituents. These asymm-TTz compounds are synthesized through reactions involving a dithiooxamide and two different aromatic aldehydes with one containing an electron donor group and the other being an electron acceptor substituent. After these reactions are complete, three products are obtained, one asymmetric and two symmetric TTz compounds. Therefore, separation of the three materials is required through column chromatography. Synthesis of TTz compounds have been examined with a new asymm-TTz compound of interest being formed. The reaction conditions used for forming this new compound was a reaction time of 72 hours in dimethylformamide(DMF). This new compound is positively charged, which is advantageous in cell staining applications, as the positive charges help the compound to adhere and orientate onto the cell membrane. Another advantageous quality of the new TTz is that its absorbance and emission has been shifted further into the red region which is helpful for imaging in thick biological tissues. Properties for the compound including absorption peak, emission peak and fluorescence lifetimes were found and confirmed that the absorption and emission and absorption were shifted further red.

Research Mentor: Michael Walter

Abstract: 316

**Surface Finishing of Metal Additive Manufactured Components: Real-Time Force Acquisition From a Robot-Assisted Abrasive Process**

*Riley Ferrar*

The purpose of this project was to analyze the forces generated during finishing of metal additive manufactured (MAM) parts using a robot-assisted abrasive finishing process. In this finishing process, the material is removed to achieve the final surface condition through relative motion between the part and an abrasive media. MAM is a specific manufacturing process where parts are fabricated through progressively adding material layer by layer following a 3D CAD model. There are many different types of MAM but the focus for this project was Laser Powder Bed Fusion (LPBF) additive process. Then, these parts were finished using an experimental setup composed of a bowl filled with abrasive media and a collaborative robot from Universal Robots (UR) model UR30. The robot was used to hold the part in the media at different orientations and speeds, and was programmed from a user-friendly proprietary language. Through the integrated sensor on the robot, the force and torque exerted on the part during the finishing process was obtained at these different speeds and orientations of the workpiece inside the media. The output of this integrated sensor was verification by comparing the data with an external Kistler Dynamometer. In order to obtain real-time data from the robot a program to request it from the robot was created using the graphical programming language LabVIEW. The program was designed to create specific data packets according to UR documentation to request the data needed, then read a steady stream of data packets and send them to a file which was processed at a later time.

Research Mentor: José C. M. Outeiro

Abstract: 317

**Education Through Storytelling in *A Visit for a Week* by Lucy Peacock**

*Hollie Rode*

*A Visit for a Week* by Lucy Peacock, first published in 1794, was the most popular work of the author; however, it and many of her other works have been overlooked by scholarship. This is common enough for female authors from the Victorian era, especially due to the limitations of what was considered acceptable areas of publication for women. Yet this neglect remains surprising due to some of Lucy Peacock’s audience, such as the children of the royal family. More specifically Princess Mary, to whom Peacock’s *The Adventures of the Six Princesses of Babylon* was dedicated. *A Visit for a Week* uses an anecdotal approach to teaching children about the natural world and to warn of the follies that come from neglecting education, hiding its lessons within a story about a young girl and her brother, both of whom are left under the supervision of their aunt for a week while their father is busy with business endeavors. Examination of this work provides us with a better understanding of how children were being educated at the time and the materials that were considered important to this education, forming the minds and interests of the next generation to come. In this research, I will examine the subjects chosen to be covered within this work, establish timely cultural relevance for the context of the story, and consider any biographical implications about Lucy Peacock that may be uncovered in the process.

Research Mentor: Alan Rauch

Abstract: 318

**Make ML cheaper with this one easy trick: Targeted Rank Regularisation**

*Ethan Nguyen*

The dawn of large models is upon us, with the size and intelligence of these models growing at a near-exponential rate. However, this growth necessitates capping the model size to facilitate scalability and deployment. To address this challenge, we introduce a novel, easy-to-implement regularization term. This low-rank inducing regularization term can be added during the training process to decrease the number of parameters required to describe the model. Consequently, we achieve a smaller, simpler, and more cost-effective model. Our method effectively reduces the size of large models while maintaining comparable performance to high-performing models, even with over 50% or more of the parameters removed.

By majorizing a non-convex surrogate function of the rank, we have developed an algorithm that outperforms many existing techniques in the quest to shrink models. This algorithm enables cheaper and more environmentally friendly deployment of "high intelligence" models without the need for vast resources. Moreover, our framework was rigorously tested against other leading models, demonstrating its efficacy and efficiency. Expanding the use of this approach across various methods could provide a foundational solution to teaching models to be intelligent without over-parameterizing weights. This work holds significant implications for the future of model scalability and deployment in the field of artificial intelligence.

Research Mentor: Christian Kümmerle

Abstract: 319

**Characterizing E.Coli and Vibrio Cholera Proteins to determine UDP-MaNAcA Synthesis.**

*Jennifer Lopez*

The Troutman lab investigates bacterial polysaccharides, their underlying biochemistry, and their application in developing novel therapeutics and bacterial sensing strategies. One of the projects aims to track the biosynthesis of vibrio polysaccharide (VPS) and the preparation of VPS using recombinant proteins of VPS. Vibrio cholerae, the bacterium responsible for cholera—a severe, life-threatening disease marked by dehydration and diarrhea due to contaminated water (3). Of particular importance is that VPS is an exopolysaccharide produced by VC that is a major component of biofilms. VPS is a polymer made of repeating units assembled on lipid carrier bactoprenol phosphate (BP) via the Wzx-Wzy dependent pathway. VPS is produced in two variants: 80% of major and 20% of minor variants. Alpha-d-glucose in the major variant is replaced by alpha-d-GlcNAc to produce the minor variant. L-Guluronic Acid is a rare sugar in VPS predicted to be made by VpsA (predicted UDP-GlcNAc-2-Epimerase) and VpsB(predicted UDP-ManNAc dehydrogenase); appended to BP by VpsK (predicted UDP-ManNAcA transferase) and finally ManNAcA is epimerized to Guluronic Acid by VpsJ (predicted UDP-ManNAcA C5 epimerase). Based on alpha-fold predictions VPSA, VPSB, and VPSK are similar to WecB, WecC, and WecG enzymes in the ECA pathway of E.coli. Specific aims of this work are to compare the products made by VpsA with WecB, VpsB with WecC; test VpsK transferase activity to append UDP-ManNAcA to BPP-GlcNAc like WecG, and track higher-order structure formation between VpsA and VpsB. Recombinant proteins with His-tag are purified using Ni-NTA affinity chromatography and UDP-linked sugar products of In vitro reactions are monitored using HPLC and BPP-linked sugar products are monitored using LC-MS. Higher order structures of VpsA and VpsB are tracked crosslinking with BS3.

Research Mentor: Manoj Dooda

Abstract: 320

**Evaluating the Adsorption and Fate of Dissolved Osmium onto Clay Minerals During Salinity Transitions Between Riverine, Brackish, and Seawater Environments**

*Jackson Williams*

Osmium (Os) has been utilized as a geochemical tracer because it responds acutely to environmental change over long and short geologic timescales (>106-103 years), providing geoscientists context on secular and dynamic global changes in weathering and climate through Earth history. However, a critical and unknown question is how dissolved Os liberated from weathering of rocks is transported during transition from riverine to brackish and to seawater salinity conditions and how this change in solution chemistry affects the adsorption of Os onto clay minerals. To address this fundamental question, this research project investigates Os adsorption onto the surface of kaolinite, a common clay mineral found in riverine sediments, under three salinity conditions, representative of river water at 1% salinity, brackish water 2%, and seawater 3%. After each change in salinity, the degree and rate of adsorption of Os onto kaolinite will be quantified. The experimental time-series dissolved Os concentration analyses of these samples are currently pending. These data will allow us to better understand the efficacy for Os to be used as a geochemical tracer for deciphering mineral weathering reactions that are ultimately related to carbon cycling reactions happening on long geologic and short human timescales.

Research Mentor: Drew Syverson

Abstract: 321

**A Better America?: Reflecting on The 2024 Civil Rights Trip**

*Andrew Bartkowiak*

The Civil Rights movement continues today, just in a different form. The issues being fought for in the modern movement are housing inequality, gentrification, healthcare inequities, gerrymandering, and mass incarceration. One cannot address these issues without having an awareness and acknowledgement of the wrongs of the past, and the tactics used by those fighting to correct them.

The locations, memorials, and museums visited further illuminated the need to correct racial injustices today. Stories from the trip served as a strong reminder of the lengths individuals would go to in order to maintain racial superiority, and how ordinary citizens rallied against the status quo to sacrifice, and make a difference for us today. Injustices faced by African Americans were laid bare for all to face, head on, unfiltered. Reflections on how these injustices impact today occurred naturally,The Bryant market served as a stark reminder of how far we still have to go as a country. The marker where this historic racial terror lynching occurred was in such disrepair, it was obvious the area is simply trying to remove this history from public consciousness.

I will teach students about the heroic actions of those involved in the Birmingham Children's March, about the horrific atrocities faced by the Till family, and how it served as a catalyst for the Civil Rights movement while also interweaving how the material relates into the modern injustices faced by African Americans from the 1980s to the present.

Keywords: Awareness, Acknowledgement,racial terror lynchings, Justice, Peace,

Research Mentor: Scott Gartlan

Abstract: 322

**Investigating if Fat-Tissue Specific Hsp90 Overexpression Delays the onset of Neurodegenerative Diseases**

*Bija Babb*

Could a change in fat metabolism improve or even cure certain neurodegenerative diseases? Lipids released during fat metabolism are involved in various processes, including cellular signal regulation. Obesity, however, is associated with increased risk of cognitive impairment in late life. Research in our group found that fat metabolism and storage can be influenced by the altered expression of the chaperone protein Hsp90 in the *C. elegans gut*. Animals with Hsp90 overexpression (Hsp90 o/e) in the intestine store less fat and exhibit reduced toxicity in neurons impaired by neurodegenerative disease proteins, such as amyloid beta. Here, we examine how fat storage is altered in *C. elegans* models for Alzheimer’s and Huntington’s Disease; and investigate the molecular cause underlying reduced neuronal toxicity. A recent transcriptome analysis identified that autophagy is increased in C. elegans with intestinal Hsp90 o/e. Autophagy is the recycling of ‘unneeded’ cellular components, acting as cellular maintenance and defense against potential disease-causing molecules. When autophagy is reduced, it can lead to the formation of neuronal aggregates, the cause of Alzheimer’s and Huntington’s disease. Investigating this, we first determined triglyceride storage levels in amyloid disease and non-disease expressing worms using Oil-red-O staining. In addition, *C.elegans* with autophagy gene reporter fluorescence were used to determine if autophagic flux is changed with Hsp90 o/e and the tissue of occurrence. These results support that the metabolic change induced by Hsp90 o/e increases autophagy, which leads to the improvement of certain neurodegenerative diseases and slowed aging in generally healthy individuals.

Research Mentor: Patricija van Oosten-Hawle

Abstract: 323

**Designing Parts as Combinations of Smaller Pieces for Sustainable and Automated Manufacturing**

*Will Cowan*

Millions of tons of steel and aluminum are discarded every year from various industries. While metal recycling is an important process for repurposing these limited resources, the process costs large amounts of power and money. By reusing metal scrap through simple combinations and decompositions of common scrap parts, large quantities of scrap metal can be repurposed efficiently.

The research presented at this symposium is part of the research team’s larger goal to develop software that will generate designs using repurposed scrap metal. Of the many systems required to create this software, this research is focused on learning how to extract useful geometries from scrap material, providing physical models of products made from such material, and effectively 3D modeling existing scrap.

This research details the various aluminum and steel products that have been constructed through conjoining smaller scrap metal from various sources. The paper also displays models of larger parts that have been cut to discover uses for fractions of larger pieces. Through building multiple physical models, common scrap characteristics and their design applications were categorized. 3D models of scrap material were generated in multiple ways to test their efficiency and comprehensiveness. Handheld 3D scanners and augmented reality systems both rendered models of various parts, each displaying distinct strengths and weaknesses.

Research Mentor: Mahmoud Dinar

Abstract: 324

**Environmental scan of UNC Charlotte vending machines**

*Cheyenne Jennings*

Almost 22 million students are enrolled in college or graduate school in the United States. Previous research and literature has found that universities don’t offer a healthy food environment through the types of food and beverages they allow to be sold on campus. K-12 schools have healthy nutrition and beverage policies, but universities don’t. Many young adults entering college may not have the space, capacity or knowledge to cook their own healthy meals, thus they rely on their university’s dining services and vending machines. Past literature finds that when universities implement a healthy food and beverage policy on campus, students eat more fruits and vegetables, while sales revenues increase at the same time. Using the Nutrition Environment Measures Survey-Vending (NEMS-V) tool, I scanned 341 vending machine items in 10 public access buildings at UNC Charlotte for the presence of healthy and unhealthy items defined by NEMS-V guidelines. I also examined the location, proportion of serving size, price and any signage promoting healthy choices. I found that over 80% of vending items, 286 out of 341, collected on campus are red, or unhealthy. The majority of food and beverage items sold in vending machines are chips, candy, sodas, energy drinks and sweets, with little variety in item choices across vending machines. Only 12 of the 341 items collected are green, or healthy items. Implementing a healthy food and beverage policy on college campuses could help with the rising rates of obesity among college aged students, while providing healthier options to students.

Research Mentor: Alicia Dahl

Abstract: 325

**Influx of Rainwater on BDAs in a Natural Stream**

*Yaritza Galvez*

To restore and conserve Earth’s natural resource, water, we must understand its behaviors in conjecture to its surroundings. To the naked eye a stream may seem meager but to a keen eye it signals a potential of abundance. In the heart of Morganton, North Carolina lies a stream hidden in the safety of a conservancy, ready to exude life. Along the stream are several sites of beaver dam analogues (BDA), a cost-effective restoration method of man-made structures that mimic the job of Earth’s natural engineer, the beaver. They are put in place to mediate nutrient cycling, promote the hyporheic zone (where groundwater mixes with surface water exchanging nutrients) and promote stream meandering. During a normal season with minimal rainfall the stream experiences base flow. When there is a deviation in weather and a large quantity of rainfall is experienced, we call the amount of water flowing through the stream, high flow. Late July forecasted for continual showers. We collected data from the stream by using a water level meter in which two values were collected, depth to well water and depth to surface water at each piezometer. The piezometers are three feet above and below ground at each BDA site and the soil in the area consists of sandy and clay loam with moderate permeability. With the data we collected we find the vertical hydraulic gradient (VHG) which is the difference between surface water and groundwater elevations. By collecting depth to groundwater (DTW) and depth to surface water (DTSW) we can calculate either a positive VHG indicates upwelling in the hyporheic zone which means it is discharging from the zone or a negative VHG indicating water is entering the zone. Based on the data collected from the natural stream we can see the high flow conditions amplify the original type of welling. BDAs follow a usual pattern of downwelling upstream and upwelling downstream of the dams. The overall data demonstrated slight increases in negative VHG which signifies the presence of downwelling. BDAs execute their purpose by promoting the hyporheic zone and supporting the downwelling of the stream in which water is entering the hyporheic zone to be cycled eventually discharging into the stream.

Research Mentor: Sandra Clinton

Abstract: 326

**Ghosts of the Past:How They Haunt Our Present**

*Tam Hawk*

There’s nothing new in this world; everything is an  echo from the past. I felt that while experiencing the Civil Rights Trip. Similarities to today’s political and cultural climate can make us question our progress as a nation. Displays of photographs, quotes, and news clips filled with hate rhetoric from white supremacists and southern politicians of the past are echoed in current political discourse. These same beliefs still haunt us.

What does it mean to be equal?  Historically? These ideas aren’t new and have been part of social structures.  Connections can be drawn between social hierarchies like the Caste System, Jim Crow, the Modern Civil Rights Struggle and today.  Class systems always impact society to the benefit of some at the expense of others. Studying history means to be aware of ghosts from the past that influence the present.  Photos from the Jackson Civil Rights Museum,  “Separate but Equal '' show white children in classrooms with desks, bookshelves, and small class sizes, while black students had no desks, books on their laps, larger class sizes and barren classrooms. School vouchers have negatively impacted public education, with less money, less supplies, and larger class sizes. Issues like voting rights, prison labor, demonization of political foes, using dangerous rhetoric, and emphasis on state’s rights can be traced to Jim Crow times, but what about in ancient times?  The benefit of students learning how the ancient concept of caste created schisms between classes in society is important to understanding the fluidity of history.

Research Mentor: Scott Gartlan

Abstract: 327

**Labeling kinetics of amino acids using 5-carboxyfluorescein succinimidyl ester**

*Chloe Tan*

Capillary electrophoresis coupled with laser-induced fluorescence (CE-LIF) is an analytical separation tool that is used in different biological and chemical applications due to its high sensitivity detection and separation efficiency with small samples. This project used this tool to separate the amino acids labeled with 5-carboxyfluorescein succinimidyl ester (CFSE; λex=490 nm; λem=520 nm). Detection limits are limited in-part by the efficiency of the fluorescence conjugation. To maximize labeling efficiency, the competing hydrolysis of the fluorophore needs to be minimized relative to the labeling reaction. However, while an optimized condition is found by observing the labeling completeness at various pH and temperature conditions, *in situ* applications may operate within a temperature tolerance of  5℃.  A complete understanding of the reaction kinetics involved for both labeling and completing hydrolysis of the fluorophore is warranted to assess how labeling efficiency is influenced for a suite of amino acids at a range of pH and temperatures. Basic amino acids are stronger nucleophiles than acidic amino acids. Thus, higher labeling efficiencies are observed for basic amino acids like arginine compared to acidic amino acids, including aspartic acid. This work investigated the labeling completeness for 5 amino acids and the first-order kinetics for the CFSE hydrolysis reaction using CE-LIF to monitor the reaction progress in pH levels of 8.5, 9.0, 9.5, and 10.0 at temperatures in the range of 10℃ ~ 25℃. Next steps will expand the investigation into aminolysis kinetics to mathematically derive the relationship between labeling completeness, dye concentration, and hydrolysis kinetics.

Research Mentor: Laura Casto-Boggess

Abstract: 328

**Battery Failure Mechanisms Analysis**

*Ryan Guthrey*

Battery thermal runaway remains a critical safety concern impeding the broader adoption of battery-powered technologies. Early detection of thermal runaway is crucial for preventing catastrophic failure. This research paper investigates the feasibility of designing a sensor capable of detecting the onset of thermal runaway in battery packs. Building upon the current understanding of thermal runaway triggers and progression, this study explores potential sensing and reporting to identify early warning signs of thermal runaway. The insights gained from this research will inform the development of effective and reliable thermal runaway detection sensors, ultimately enhancing battery safety and facilitating the widespread adoption of battery-powered technologies across various applications.

Research Mentor: Lin Ma

Abstract: 329

**Being the Light: Overcoming Fear and Control in American HistoryBy Elizabeth Abel, 1st Grade, Rivergate Elementary School**

*Elizabeth Abel*

“What Fear Can Do” are the words that rang in my ears as I experienced this trip. Each museum, tour, and speaker showed the horrific things that took place in our history, and exhibited the cowardice of people. The cowardice of losing power, workers, and being outnumbered. The results became barbaric as people continued to want to control. The white south was outnumbered and they were afraid. From slavery to post- enslavement the south’s laws became more radical as they began to fear losing their power. Newspaper articles explained that harsher and crueler actions were legally allowed to be inflicted on the enslaved as the population of enslaved people increased. I saw through the KKK, lynchings, Jim Crowe Laws, Emmet Till and the response to the Civil Rights Movment that this was the response to fear. Being present in these places made history come to life. I learned we are not as removed from this history as we would like to think we are.

It is important to teach students not to be ruled by fear and power. It is important to teach students the history of our nation. The good, the bad, and the hope. Not only did this trip show the horrors of the past, but showed the people who stood up to make a change. I heard on the trip the quote “I didn’t curse the darkness, I just lit a light.” I want my students to become informed and light the candle for goodness. Hezekiah Watkins, an original Freedom Rider, continues to sit in the museum to talk with people about the importance of “doing good in everything you do.” As a first grade teacher, I desire for my students to understand the importance of doing good and I plan for my students to learn about the people who lit the light.

Research Mentor: Scott Gartlan

Abstract: 330

**Assessing University Food Environments: Healthfulness, Protocols, and Nutritional Impact**

*Jessica Mathew*

This study examines the accessibility and availability of nutritious food options on college campuses and their impact on students’ weight gain. By analyzing the variety, cost, and convenience of healthy versus unhealthy food choices available in campus dining facilities and surrounding areas, we identify significant barriers to and opportunities for maintaining a balanced diet. The research highlights how limited access to affordable, nutritious meals compels students to opt for readily available, calorie-dense, nutrient-poor foods, contributing to an increase in weight gain. We conducted a literature review of campus food environments and presented the evidence of college students and weight gain using search terms such as “food service contract,” “weight gain,” and “university” or “college.” The findings emphasize the need for institutional policies to enhance the accessibility of nutritious meals, which could mitigate weight gain and improve overall student health. Future steps of the research will be applying the Nutrition Environment Measures Survey for University Cafeterias (NEMS-UC) to evaluate food environments in campus dining halls and cafeterias in the UNC system. This project will outline the protocol steps for conducting these assessments.

Research Mentor: Alicia Dahl

Abstract: 331

**From Legacy Museum to Living Museum: Taking Lessons from a Civil Rights Trip to the ClassroomJwantina R. Williams, Exceptional Children, Statesville Road Elementary School**

*Jwantina Williams*

Reflective Summary

The Civil Rights Tour was not just a trip, it was life changing. Nothing prepared me for what was seen and felt. Not only the engagement experienced at the museums, but also the opportunity of sharing with others who had a sincere desire to confront the hurt and pain of the African Experience.

The most impactful experience to me was the Legacy Museum in Montgomery. This immersive museum offered the opportunity to delve into the destructive and painful experience from the beginning of slave trafficking through the Civil Rights Experience. It offers the opportunity to see how mass incarcerations continue to get African Americans in bondage and prevent them from fully realizing the American Dream.

Sitting in the courtroom at The Emmett Till Interpretive Center where injustice prevailed and was a catalyst for Civil Rights in America was thought provoking. No one knew at the time this lynching would change the course of Black American activism. The bravery of Mamie Till-Mobley was a true testament to not only African Americans but to a mother’s love.

My goal, as an elementary school teacher, is to plan a living museum of African American history for our students. The students will select an historical figure (for example, Medgar Evers, Shirley Chisolm, Rev. George Lee, and John Lewis) to be the focus of this project, dress in attire to represent their selection, write a synopsis paper and present it to the student body and parents. This will be a positive experience for students to explore the contributions of African Americans.

Research Mentor: Scott Gartlan

Abstract: 332

**Regeneration of Zeolite Nano Resins for Wastewater Treatment**

*Adrian Rodriguez*

Water Pollution is a global issue that affects many people. As a result, the interest in finding ways to purify drinkable water has increased in the past couple of years. Although there are current methods that aid in achieving adequate results, such as activated carbon or organic frameworks, there are certain limitations that prevent such methods from being the definitive answer to cleaning water. High cost, high energy input, and lack of regenerative qualities are just some of the issues that these current methods have yet to resolve. In this study, zeolites, or naturally formed crystalline minerals, that have been imbued with ion exchange resins of 120 monomers in length were measured to determine if such issues from the previously mentioned materials could be resolved. The regenerative capabilities were the main target and were initially measured using a surrogate compound of per- and polyfluoroalkyl substances (PFAS), a common pollutant found in water. Our findings highlight that zeolite nano resins are a viable solution to removing PFAS from water through adsorption and can be regenerated with the use of a particular solvent mixture involving chlorine anions. Using multiple salts, the optimal regenerant solution was determined to be calcium chloride in a mixture of 20% by volume water in methanol and resulted in an initial desorption of 86% regeneration of our zeolite grains. By continuing to work with zeolites, more parameters can be refined to confidently determine that an eco-friendly method for removing pollutants in water has been determined.

Research Mentor: Jordan Poler

Abstract: 333

**Synthesis, Growth Mechanism Study, and Property Measurement of Metalloid Tellurium Nano/microstructures**

*William Franklin*

Metalloids are a group of elemental materials with properties that are between metals and nonmetals, such as Boron (B), Silicon (Si), Germanium (Ge), Arsenic (As), Tellurium (Te), and Antimony (Sb). While various nanostructures of B, Si, and Ge have been studied involving synthesis, property measurement, and device testing, the nanostructures of other metalloids have not been thoroughly investigated. Recent research has been focused on producing Te nano/microstructures for their improved optical and electrical properties. Because of its facile applicability and low cost, physical vapor deposition (PVD) has been employed for the synthesis of Te nano/microstructures. This research is focused on the growth mechanism of Te nanostructures (nanowires and nanoplates) and microstructures (microrods, microtubules, and microplates) to explore parameter effects on the growth of Te. The Te nano/microstructures produced from this research will be used for optical device fabrication and property measurement.

Research Mentor: HaiTao Zhang

Abstract: 334

**Thursday June 13th - Sunday June 16th, 2024 The South Civil Rights Trail: The Journey to Freedom**

*Le'Quanza Johnson*

The Freedom Memorial Sculpture Park has a large wall with more than 100,000 names representing millions of black families and I had the honor of finding my family’s names there.

The Civil Rights Sites tour of Montgomery with Shirley Cherry who gave us the history of the city. She shared priceless information about Dr. Martin Luther King Jr., Ralph Abernathy, Rosa Parks, Holt Street Baptist Church and so many more people and places that made the tour an unforgettable experience.

In Selma, Ala when I walked across the Edmund Pettus bridge into Montgomery, I felt empowered and connected to the peaceful protesters who crossed the bridge for the right to vote.

The Mississippi Civil Rights Museum is full of history. I had the pleasure of meeting Hezekiah Watkins, one of the youngest Freedom Riders. I was able to record an interview with him, purchase his books and shirts that were personally autographed.

I plan to provide the opportunity to engage my students in discussions about the Civil Rights Movement by sharing photos of people and places that I visited. Students will write about what they know based on the photos. We will expand on their prior knowledge and discuss voting rights. We will discuss if they believe that people have a responsibility to stand up for what’s right even when it puts them at risk. My students will produce original work through their artistic expression, for example drawings or writings, that will be showcased on the bulletin board.

Research Mentor: Scott Gartlan

Abstract: 335

**Comparing infection of two human pancreatic cancer cell lines with vesicular stomatitis virus**

*Irakli Mataradze*

Vesicular Stomatitis Virus (VSV) is a promising oncolytic virus (OV), which is capable of selectively infecting and killing cancer cell lines, while leaving normal cells unharmed. In this project, we examined the susceptibility of two human cell lines of pancreatic ductal adenocarcinoma (PDAC), Suit-2 and MiaPaCa-2, and compared it to VSV replication in BHK-21, a reference hamster cell line, which is highly permissive to VSV. In this study we used VSV-ΔM51-GFP, a modified VSV recombinant, which has an enhanced oncoselectivity (it still infects and kills cancer cell lines but does not harm normal cells). We cultured and passaged the three cell lines, and afterwards, infected them with serial dilutions of VSV-ΔM51-GFP. To measure the viral replication and cell destruction, we performed plaque assays. The results revealed different levels of permissiveness of these cell lines to VSV-ΔM51-GFP induced cell death. Our research contributes to the understanding why some cancers are more resistant to OV than others, to maximize the future impact of OV therapy in clinical practice.

Research Mentor: Valery Grdzelishvili

Abstract: 336

**Computational Methods in Renewable Energy: Wind Energy Aerodynamics**

*Ben Janke*

Wind energy must be cost effective and reliable to compete with energy produced from fossil fuels. One way to increase the wind turbine power is through the use of morphing blades. Adapting the blade shape can improve aerodynamic performance across a broad range of wind speeds. The blade is transformed by twisting it, or by varying the local angle of attack, along the blade length. This action optimizes the blade loads to increase power production and reduce dynamic loads. In this study, actively twisted blades are modeled on a reference turbine. An optimal twist that is found is verified using fluid simulation software. Previous results indicate that this capability can increase efficiency up to 14% and reduce thrust loads by up to 80%. By twisting the blades of a turbine, the turbine can more efficiently produce energy, last longer, and as a result, have a smaller impact on the environment.

Research Mentor: John Hall

Abstract: 337

**Developing a GIS Framework for a Stormwater Pipe System in an Urban Micro-Watershed**

*Heather Corton*

Through the main campus of University of North Carolina at Charlotte (UNCC), Toby Creek flows north into Mallard Creek and frequently experiences flash flooding. During storms, the flooding separates the main campus in the east from the engineering campus and sports fields in the west. Improving our understanding of how Toby Creek floods will contribute to future improvements in stormwater infrastructure both on UNCC’s campus and in Mecklenburg County, especially given the high rates of urbanization in the region. My project aims to create a framework and conduct an exploratory data analysis of a stormwater pipe system on campus within a micro-watershed of Toby Creek. To create the data directory for modeling, I utilized various data inputs: a digital elevation model (DEM), rainfall interval gauge data from Mallard Creek, soil type map, land use/cover map made in ENVI, and pipe system components with additional stormwater infrastructure data obtained from public county records and my own field work. All external data sources modified to fit my study area were compiled in ArcGIS Pro with my original field data. The results from my project provide a hydrologic framework of the study area for the purpose of modeling hydraulic outflows to Toby Creek from the pipe system. The project results will also inform relevant stakeholders as to how the system outflow rates change due to various parameters such as increased imperviousness due to urbanization or extreme weather events.

Research Mentor: Craig Allan

Abstract: 338

**Imaging Poliovirus Vaccine With Scanning Electron Microscopy**

*Sean Campbell*

Cold-chain storage is a vital step in ensuring the stability of biologics like vaccines. The polio vaccine in particular is thermally sensitive, and needs to be kept at 4°C in order to avoid damage to the viral particle and its attached proteins. A problem arises in places where there is little to no access to cold storage options. This calls for methods of biopreservation in which cold-chain storage is bypassed. Scientists currently utilize processes such as lyophilization, also known as freeze drying, as well as spray drying and foam drying. Although useful, these techniques can induce unwanted stress on the biologics. This calls for a process known as light-assisted drying (LAD), which can stabilize vaccines at room temperature. In order to achieve the greatest effect when administering vaccines, the proteins and capsid must be intact and minimally damaged. As a means of showing the efficacy of vaccines after processing, viral particle structure of processed samples must be compared to that of unprocessed vaccines. This is accomplished through the use of scanning electron microscopy (SEM), an imaging technique that utilizes an electron beam to gain information about the sample being imaged. We expect that the imaging will allow us to see physical identifiers that suggest an undisturbed viral capsid. In the future, these images can be compared to those of LAD-processed samples in order to determine efficacy.

Research Mentor: Susan Trammell

Abstract: 339

**An Analysis of AXI Interconnects**

*William Miller*

Processor and memory communication is the backbone of a device's efficiency. Despite the potential of each individual component, their ability to interact effectively will limit the overall performance. Interconnects are the hardware used to connect the two and manage data transmission between them. The rate of data transmission, known as bandwidth, is one of the main traits used to measure their performance. There are a variety of interconnect designs available, but having a more advanced interconnect may not always be the most effective choice for a product. Greater complexity can lead to increased costs, power demand, and resources requirements for constructing the device. AXI Interconnect is one of the designs available and its successor, AXI SmartConnect, brought additional improvements over the old model. This study seeks to determine whether AXI SmartConnect provides better bandwidth for a single-core design when compared to AXI Interconnect. By using a Basys3 FPGA and AMD's Vivado software suite, an experiment was designed to perform a variety of read and write operations to memory. The runtime of these operations was recorded and compared. The experiment found that AXI Interconnect, despite being less optimized than SmartConnect, was able to perform these operations one microsecond faster. This provides justification for using a less optimized interconnect for simpler designs. By choosing more appropriate interconnects, consumer devices can maintain efficiency while reducing resource requirements and costs, ultimately providing the public with greater access to these essential devices.

Research Mentor: Ronald Sass

Abstract: 340

**Educating an Educator**

*Jackie Smith*

The most overwhelming fact I took away from our Civil Rights trip was just how large a hole I had in my formal education. I had heard of Emmett Till and Freedom Rides, but knew nothing of the details and what they meant. I had never heard of Joe McNeely or Willie McDaniel, Mecklenburg County's two racial terror lynching victims, at all. From my work as an attorney, I knew that the vast majority of my criminal defendant clients were people of color, but I never understood the roots of the crisis we have in our criminal justice system. Even more than all that, on this trip I watched my colleagues of color and their reactions to the things we saw and learned and I was struck by how much of my country's history was foreign to me. My takeaway is just how much more I have to learn and how imperative it is that my children and grandchildren learn this history, and learn it long before they reach my age.

Research Mentor: Scott Gartlan

Abstract: 341

**What Was I Made For: The Study of Girlhood through Time Utilizing Materiality of Books**

*Isabella Di Biasi*

Women’s History has frequently been dismissed and forgotten, leading to misconceptions about their experiences and opinions. Marginalia are notations on the margins of books and documents, sometimes scribbles or personal thoughts on a page. By highlighting these women’s voices in UNC Charlotte’s Rare Book Collection, we were able to showcase the history of these women through a public exhibit and a paper that will build on women’s intellectual history with a focus on the words they wrote themselves in the marginalia.

Utilizing the Atkins Library Database, facilitated the work of searching for Rare Books with annotations. The database helped narrow down hundreds of books on file on and off campus at the Storage Facility. Other librarians who had written the description for the book sometimes remark an annotation or notes on the pages, which shows up in the search. We then find the book on the shelf and look through it page by page to find any marginalia.

This content helped create an idea and highlighted personal aspects of women's inner lives during a time when they could not leave their mark. These results should help enlighten and shed light on the internal struggles these women faced due to external forces and struggles that might have been forgotten in history. The goal of our project is to encourage other researchers and common readers to explore the misunderstood, forgotten parts of women’s experiences.

Research Mentor: Randi Beem

Abstract: 342

**Optimizing Growth and Storage of *Mycetohabitans spp.***

*Taylor Yonemura*

Fungi serve a variety of roles, from mycorrhizal partners that aid in plant productivity to saprophytes that consume organic material. Within some fungi are endosymbiotic bacteria that can alter their traits, including pathogenicity or reproduction. *Mycetohabitans spp.* are bacteria that live within the pathogenic fungus *Rhizopus microsporus.* These bacteria are endohyphal symbionts of the fungus that can be cultured independently from their host but rely on each other to complete their full reproductive cycle. Their partial codependency causes the bacteria to be inconsistent in their growth in laboratory media and isolated long-term storage. Currently, bacterial strains must be continuously subcultured in liquid media with additive antibiotics to prevent contamination. This can become time consuming and costly. It also introduces the potential for artificial evolution as bacteria adapt to growth outside of their host, for strain death, or for loss of phenotypic traits such as colonization ability. To optimize long-term storage, we decided to freeze-store *Mycetohabitans spp.* using glycerol as a cryoprotectant. Before storage, both polymerase chain reaction (PCR) with genus-specific primers and culturing plates were used to verify purity of liquid cultures. The cultures were then mixed with varying levels of cryoprotectant and stored at -80 °C before being resuscitated and cultured. We found that a concentration of 5% glycerol produced the highest rate of bacterial recovery. After growth was confirmed by optical density measurements, PCR was performed again to confirm *Mycetohabitans spp.*. Continuing research on effective storage and growth methods of *Mycetohabitans* will enable reliable research on non-model, endosymbiotic organisms and provide guidance to other laboratories working with similarly intractable species.

Research Mentor: Morgan Carter

Abstract: 401

**Efficacy of Anterior Heel Wedge at Reducing Knee Flexion Contracture after Total Knee Arthroplasty: A Pilot Investigation**

*Gracyn Dwyer*

Total knee arthroplasty (TKA) is the most common type of total joint replacement surgery. With nearly 20% of the population being 65+, the number of TKAs performed per year will exceed 3.5 million by 2030. While TKA is generally successful at erasing the symptoms of knee osteoarthritis, it has complications. Knee flexion contracture, the inability to fully straighten the knee, poses a significant challenge in post-operative rehabilitation, impairing mobility/quality of life. Current treatments to combat knee flexion contracture are invasive. By exploring non-invasive interventions that could mitigate this condition, this study guides clinicians in optimizing post-surgical treatment protocols. The purpose of this is to evaluate the effectiveness of an anterior heel wedge in altering gait patterns and reducing knee flexion contracture in individuals who have undergone a TKA. This study involves 20 participants, male and female and over 18, who have undergone primary, unilateral TKA. Each individual will complete a series of assessments: baseline, 2 weeks, and 4 weeks. During baseline, participants will be provided with an anterior heel wedge to wear on their shoe for the duration of the study. The intervention's efficacy will be assessed through online surveys, strength evaluations, and biomechanical assessments during walking. Additionally, sensors will be used to track anatomical landmarks/movement patterns. Participants must wear the wedge continuously for 4 weeks during their daily activities. This study's findings will inform future research and clinical practices regarding non-invasive treatments for knee flexion contracture post-TKA, improving patient outcomes and enhancing the recovery processes.

Research Mentor: Abbey Thomas

Abstract: 402

**Mexico's Role in Shaping Latin American Diplomacy and Global Debt Management in the 1980s**

*Ashley Alcivar Conteron*

Before the 1980s, Mexico experienced an era of strong economic growth fueled by investments, an oil boom, and government reforms and policies. The country entered the 80s with a newfound prominence in the Latin American region. Its seemingly ever-growing presence in the area was complemented by its initiative to promote international economic justice. The government of Mexico served as the spearheading leader behind “global north-south” discussions and proposed a “new international economic order” to the United Nations. This initiative faced backlash from the global north. At the same time, the debt crisis in the early 1980s overshadowed this leadership in international economic discussions was promptly overshadowed by the debt crisis in the early 1980s.

Policy statements, bilateral agreements, and speeches from the U.S. Department of State Archives, Office of the Historian, and the Ronald Reagan Library and Museum will be used to enhance understanding of the topic and U.S. opposition to Mexico’s economic proposals. Combined, these findings will document Mexico’s decline in influence after the crisis and its crucial impact on shaping international debt management. Moreover, this research seeks to better understand international relations on economic dynamics and Latin American Diplomacy.

Research Mentor: Jürgen Buchenau

Abstract: 403

**Improving State Space Models using Structured Low Rank Optimization**

*Brian Mohseni*

State space models (SSMs) have become increasingly important in the analysis of time-series data, including applications in natural language processing with state-of-the-art performance on tasks with long sequence data. Apart from token-specific selection mechanisms, a significant advancement in the growth of these models lies in diagonalization techniques. Diagonalization transforms the state space representation into a format such that the state variables become independent, allowing more efficient storage of information in the hidden layer’s parameters. This independence allows for a reduction in the number of hidden dimensions while preserving informational content. Our research seeks to further improve the computational efficiency of SSMs of the Mamba(2)-type (Gu and Dao 2023, Dao and Gu 2024), utilizing a block-Toeplitz structure of a modified sequence transformation matrix and associated fast matrix operations based on the Fast Fourier transform. We compare the efficiency of the proposed model with the baselines in terms of clocktime and theoretical time and space complexity.

Research Mentor: Christian Kümmerle

Abstract: 404

**Designing parts as combinations of smaller pieces for sustainable Manufacturing**

*Gabriel Bonus*

Designing parts as combinations of smaller pieces for sustainable and obfuscated manufacturing is becoming increasingly essential in an evolving economy with growing environmental preservation concerns. This research explores how designing parts in this manner can enhance both sustainability and security in manufacturing processes. Traditional manufacturing methods often lead to significant material waste and are vulnerable to reverse engineering. Addressing these issues requires innovative approaches that use resources more efficiently and leverage their properties for other useful projects. The methodology of this research involved collecting a variety of scrap metals from nearby workshops located at the university. After analyzing the shapes and properties of these materials, the new item designs were created using a 3D printer scanner and CAD programming. By combining smaller pieces to form larger parts, this study proposes a method that optimizes material usage and simplifies recycling processes. This modular design approach not only reduces waste but also increases the complexity of potential reverse engineering, thereby enhancing security. The findings highlight the potential of modular design for sustainable and secure manufacturing. The research demonstrates a practical solution to current manufacturing challenges by utilizing scrap materials and advanced design technologies. Future research could explore automated optimization algorithms and broader industry applications to advance these techniques further. Such advancements could lead to more efficient manufacturing processes and a significant reduction in environmental impact, aligning with the growing emphasis on sustainability in the industrial sector.

Research Mentor: Mahmoud Dinar

Abstract: 405

**Effect of KRAS Inhibitors on Oncolytic VirotherapyNathaniel Foret1 and Valery Grdzelishvili11Department of Biological Sciences University of North Carolina at Charlotte, Charlotte, North Carolina, USA.**

*Nathaniel Foret*

Pancreatic ductal adenocarcinoma (PDAC) is one of the most aggressive and lethal malignancies with immense therapeutic difficulties. Oncolytic Virotherapy (OV) is a relatively new anticancer approach exploiting viruses that selectively replicate in and kill cancer cells. Vesicular stomatitis virus (VSV) is one of the promising OVs currently evaluated in several clinical trials against other malignancies. Development of effective OV therapies for PDACs, requires more insight into factors that could positively or negatively affect viral replication. KRAS is an oncogene that is mutated in most PDACs and acts as a critical driver of PDAC via immune escape, metabolic reprogramming, and therapy resistance. Not surprisingly, several KRAS inhibitors have been investigated as anticancer drugs. In this project, we used several KRAS inhibitors to determine how KRAS-driven pathways affect VSV replication in PDAC cells. Based on the previous literature, we hypothesized that inhibiting KRAS will result in an increase in antiviral signaling and thus will cause a decrease in VSV replication. Through a variety of methods such as viral kinetics and western blot analyses, we demonstrate that KRAS inhibitors caused an upregulation of antiviral signaling, which in turn caused a down regulation of VSV replication. Our data demonstrates that oncogenic KRAS pathway stimulates VSV replication. While KRAS inhibitors and OV therapies are individually very promising anticancer approaches, combining these therapies should be avoided in future treatments for pancreatic cancer.

Research Mentor: Valery Grdzelishvili

Abstract: 406

**Measurement of Gas Flow in the Laser Powder Bed Fusion Additive Manufacturing Process**

*Andrew Thompson*

Laser powder bed fusion (LPBF) is an additive manufacturing process that produces parts using a high-power laser to fuse layers of metal powder particles. The process occurs in a sealed build chamber filled with an inert gas. Gas is also blown across the powder surface to remove by-products that arise, such as spatter and plumes, that can introduce defects in the part and reduce the part quality. The gas flow speed is ideally uniform above the powder surface to remove the by-products. Prior literature has reported that the speed of gas along the powder surface is non-uniform, however, the direction of gas flow has not been measured, and has led researchers to assume flow direction. This experiment aims to measure the speed and direction of the gas flow by measuring the flow velocity at multiple locations within the build chamber by creating an automated fixture to move the gas velocity sensors to specific locations above the powder surface. The data will be analyzed to visualize the velocity of the gas flow, identify factors that influence it, e.g., temperature, and determine if there is a relationship between the gas flow conditions and the quality of printed parts. The expected result is that the velocity field of the gas will be stable by the gas inlet with the highest speed and uniform direction. However, as the distance from the inlet increases, the velocity field will become non-uniform and destabilized. This allows researchers to optimize to reduce defects and failures from by-products.

Research Mentor: Jaime Berez

Abstract: 407

**The Mechanism and Sensitivity of Alcohol Sensing Utilizing Dipyridinium Thiazolo[5,4-d]Thiazole**

*Aiden Hawkins*

Alcohol sensing can be used for applications including breathalyzer tests, detecting unwanted side products in organic synthesis, and industrial purposes. Dipyridinium thiazolo[5,4-d]thiazole (TTz) is a water soluble, rigid, highly planar, heterocyclic molecule that is electrochromic, electrofluorochromic, and photochromic. In water, TTz2+ absorbs at 400 nm causing it to look yellow; upon gaining an electron, the absorbance shifts to 610 nm (TTz•+), which looks purple, and gaining one more electron will shift the absorbance to 710 nm (TTz0), causing a blue color. This color change is easily reversible as TTz will readily give up the electrons if introduced to an oxidizing agent. With the addition of a strong base, methanol and ethanol are an electron source for the TTz molecule, reducing it to the TTz•+ state giving the solution a purple color instantly. In this reaction, TTz gains an electron, leading to a color and electronic change much like the change previously reported with electrochromism or photochromism. This study is an exploration into the mechanism, sensitivity, and environmental influence of this reaction with varying alcohols. Multiple spectroscopic techniques will be utilized to track and evaluate the reaction mechanism and sensitivity. These techniques include Matrix-Assisted Laser Desorption/Ionization Time-of-Flight (MALDI-TOF) mass spectrometry, Nuclear Magnetic Resonance (NMR) spectroscopy, Ultraviolet-Visible (UV-Vis) spectroscopy, and Spectrofluorometry. This study will also serve as an advancement in alcohol sensing and the capabilities/degradation of TTz.

Research Mentor: Michael Walter

Abstract: 408

**Revisiting the Mission: An Ethnographic Evaluation of Identity Discourse and Advocacy Efforts in Non-Profit Organizations**

*Eesha Alla*

Public discourse surrounding race, racial inequity, and injustice has grown exponentially over recent years. However, organizational responses and advocacy efforts in the Non-profit space have remained diverse, significantly impacting factors like operations, organizational trust, and ability to serve community members. In this research, we thematically analyzed 22 semi-structured interview transcripts from a 2021 study on Non-profits in Charlotte and their impacts on social and economic mobility. Using applied thematic analysis, we focused on the theme of Racism and Restorative Justice within a larger dataset and assessed participant responses on personal and organizational perceptions of race and racism, internal and external communication, and advocacy efforts in various domains. To establish patterns and key themes, qualitative and quantitative data analysis and visualization techniques were employed, in addition to strategies commonly used in the User Experience field such as personas and affinity mapping. Preliminary findings revealed that a majority of leadership roles were held by people of White ethnicity while non-leadership roles were primarily held by People of Color. Internal organizational communication on race and racism received ratings between ‘poor’ and ‘good’. However, external communication between the organization and community members reflected vague responses or unawareness. Flood Protection and Black Lives Matter emerged as the least prioritized advocacy sectors. Equity and open communication are important factors for community representation and organizational success. Considering the current and historical context, proactivity and developing a shared definition of advocacy can empower communities served by these organizations while establishing trust and hope across staff and community members.

Research Mentor: Sharon Watson

Abstract: 409

**Multisite phosphorylation of the yeast co-chaperone Cdc37 fines-tunes the global yeast stress response**

*Ashley Choi*

The Hsp90 co-chaperone Cdc37 stabilizes the catalytic domain of 90% of kinases, making it a master regulator of signal transduction. Cdc37 is overexpressed in many cancers and supports the stability of oncogenic kinases that drive tumorigenesis. Previous studies on Cdc37 in yeast and mammalian cells identified two sites of phosphorylation (Ser14 and Ser17) that are required for its function. More recently, global proteomic studies have identified 21 additional phosphorylation sites on Cdc37, but their function remains uncharacterized. To determine how these novel phosphorylation sites alter Cdc37 in yeast, we generated a collection of 46 Cdc37 phosphorylation site mutants, where each of the 23 phosphosites was mutated to either an Alanine (A) or Phenylalanine (F) to block phosphorylation, or an Aspartic (D) or Glutamic (E) Acid to mimic constitutive phosphorylation. We screened this collection of mutants for growth in the presence of a variety of stressors, including heat shock, nutrient deprivation, DNA damage, and cell wall damaging agents. Thus far, we have identified seven mutants with unique phenotypic profiles with the various stimuli. Going forward, we hope to identify the specific kinases impacted by each of the Cdc37 phosphorylation sites using proteomic analysis.

Research Mentor: Andrew Truman

Abstract: 501

**Mrs. E.W. Payne: A Literary Contribution to Science and Religion**

*Haywood Hayes*

Scientific revelations and artistic endeavors have for centuries been attributed to men, leaving women of the same notability unrecognized. This is the case for women during the Victorian period. One of those women who I seek to discuss is “Mrs. Eliza W. Payne,” or, “Mrs. E.W. Payne.” Through an analysis of a few written books by Payne and an assessment of archival records regarding the writer, her knowledge of science and culture, and her dispensation of knowledge, compares to, or out shines, many men during the Victorian period. Payne’s scientific works are comprised within the genre of children’s literature. The works discuss complex scientific information and is explained through a narrative of a mother to a her son. The works brilliantly take scientific knowledge, such as plants and fossils, and presents it for all ages to read and understand. The core of her work, though, is to connect science and religion by placing it within these narrative. Having published through the Religious Tract Society, her work is critical in showing how science and religion could correlate without having to separate them, while presenting them in narrative form. Though there is little to no biographical information on Payne, her work remains critical to be read and evaluated. This presentation will seek to evaluate Payne’s work and its contribution to knowledge within the period by providing analysis through her work and other resources, Payne’s works will prove to be valuable to all readers and show her importance in education in comparison or greater than her male counterparts.

Research Mentor: Alan Rauch

Abstract: 502

**Understanding the Kar2 Chaperone Code**

*Erica Flores*

Approximately one-third of all protein synthesis occurs at the endoplasmic reticulum (ER) and requires the coordinated action of both ER-localized molecular chaperones and a suite of specialized co-chaperone proteins. However, even in the presence of this suite of factors that facilitate protein folding, protein misfolding is common and leads to human pathologies. While previous studies have defined roles for ER chaperones on individual client proteins, little is known about the unique contribution of specific chaperones on the folding of distinct clients. The ER-resident Hsp70 orthologue Kar2 is critical both for folding of new proteins and for targeted degradation of proteins that can no longer be refolded. The effect of co-chaperones on specific BiP-dependent client proteins and pathways are difficult to study because total inhibition of general chaperone function is lethal for the cell. While it is well-established that the activity of the Hsp70 and Hsp90-chaperone family is fine-tuned by co-chaperones, the specific roles of the yeast and human ER co-chaperone proteins have yet to be fully characterized. Recent evidence has revealed the presence of a large number of post-translational modifications (PTMs) on chaperone proteins (“Chaperone Code”) that fine-tune their activity and specificity. In this project, we aim to explore the role of PTMs on Kar2 function in the model organism budding yeast. We have generated a collection of 42 yeast strains expressing mutations and mimics in known phosphorylation sites. We identified one mutant, T538E, that was not viable under normal growing conditions and two other mutants, 59A and T538A, that were slow-growing. Serial dilutions revealed specific mutants with inhibited growth under various stress conditions: T60A, T60E, S385A, and S643D with HU; and S493D under heat stress (37°C, 39°C). This indicates that these sites are essential for DNA damage response and heat shock response. We are currently conducting halo assays for the entire mutant library to assess the effects of other stressors, such as diamide, TM, alpha factor, MMS, and rapamycin, to assess the role of these PTMs on oxidative stress, ER stress, cell cycle arrest, and DNA damage response.

Research Mentor: Chathura Paththamperuma and Andrew W. Truman

Abstract: 503

**The Mechanical Integrity of Mycelium-Hemp Structures**

*Trenton Brooks*

Most of us who are familiar with the term ceramics instantly gravitate towards the image of clay on a pottery wheel undergoing becoming a beautiful work of art in its own right. However, as malleable as the clay that makes up the physical composition of ceramics, the same can be said for its use outside of the art world and its involvement in the world of manufacturing engineering. Ceramics are one of the many mechanical materials contributing to the evolution of how many structures are being constructed. Ceramic possesses a certain chemical inertness, firmness, and resistance wear, proving they can be an effective alternative to the current practices of structural construction.

Materials subject themselves to various loads and forces when they are in use and that mechanical behavior reflects the deformation of those applied forces and loads. When considering the concepts of loads as they pertain to materialistic design it is worth it to understand the tension, compression, and shear forces that are being acted upon it. This research will analyze the tensile stress and strain of the mycelium-hemp (composite of mushroom and hemp padding) hybrid to see where in the sample the tension is at its greatest and how much force can it be subject to before failure. The tensile test will quantity the structure’s ability to undergo a tensile load. Examining the sample post-failure will provide insights into the failure mode, i.e., within bulk or at the mycelium-ceramic interface.

Research Mentor: Brigid Mullany

Abstract: 504

**Mexico and Global Economic Justice: An analysis on the Carter administration**

*Sofia Fuentes*

As a leader of the Global South with the longest border with a Global North country, Mexico leveraged its strategic position to influence international dynamics significantly. This study examines U.S.-Mexican relations during the Carter administration (1977-1981) and the presidency of José López Portillo (1976-1982), highlighting three critical developments.

Firstly, Mexico's ability to influence the appointment of U.S. ambassador Patrick J. Lucey showcased its diplomatic leverage. During Carter's administration, Washington needed Mexico to increase its oil output due to Middle Eastern instability and anti-American sentiment in Iran. To meet this objective and appease President López Portillo's request for a "non-hyphenated American" ambassador, Carter appointed Lucey, significantly impacting bilateral negotiations.

Secondly, the discovery of oil in Mexico elevated its international status, offering the U.S. closer access to crucial resources and strengthening alliances. This is linked to the "resource curse," where reliance on natural resources led to economic instability and political challenges.

Lastly, the dynamic between Carter and López Portillo showed initial cooperation but led to strained relations. Mexico’s asylum to the Shah of Iran during the American hostage crisis in Tehran caused significant tension and contributed to Carter's electoral defeat.

Using sources like New York Times articles, López Portillo's speeches, U.S. Office of the Historian documents, and the Wilson Center, this research aims to provide insights into Mexico's diplomatic strategies and their impact on global economic and political landscapes during this critical period.

Research Mentor: Jürgen Buchenau

Abstract: 505

**Prototyping a Coordinated Multi-Drone Network System using Autonomous Path-finding Algorithms**

*Chandra Siddhartha Geddam, Mohammad Hasan*

Unmanned Aerial Vehicles (UAVs), commonly known as autonomous drones, are aircraft systems that can be remotely controlled by a human operator or independently guided by onboard computers. Many control systems choose to gather a group of drones around one device which can place significant pressure and decision-making burden on the host. This setup can create a single point where things might go wrong if that device fails, and it also needs a lot of computing power to work properly. This research project will explore the possibility of distributing control amongst a network of drones which will have the capability to make its own decisions independently and collaborate with others to efficiently accomplish tasks without interference. The subject drones will gather local data using sensors and communicate with each other to determine the best actions and movements needed to achieve their objectives effectively. This is accomplished by first engineering smart drones with computational capacity for independent decision making, infusing autonomous navigation algorithms and wirelessly communicating with each other in order to effectively coordinate actions. Wireless communication between the drones can be achieved by using the Wi-Fi module provided by the on-board processor and integrating it with a flight controller.  The outcomes and discoveries from this project are poised to be applied in diverse uses such as search and rescue operations, agricultural monitoring, event coverage, package delivery services, and surveying in construction sites.

Research Mentor: Ran Zhang

Abstract: 506

**What does Wilhelm Reich have to teach us about health today?**

*Joseph Thompson*

Recent years have seen an increase in interest in holistic understandings of human physiological, psychological, and social life, which involves appreciating the interrelated nature of these separate disciplines and rejecting a functionalist approach. This development mirrors previous work done by Wilhelm Reich, whose medical and psychoanalytic training enabled him to examine the physical manifestations of human mental life and which lead him to argue that the unconscious is stored in and reflected by the body and that unconscious movement is driven by the autonomic nervous system. This presentation will discuss the importance of Reich’s work in the context of current psychological contributions to psychosomatic health issues that have been traditionally categorized as purely physiological in nature. Particular attention will be paid to the role of emotions, particularly stress as they relate to established psychosomatic conditions within medical research literature as well as discussing conditions for which newfound evidence is emerging about potential emotional causes. This study will highlight the importance of emotional health within a broader holistic health framework. In light of Reich’s heavy emphasis on the prevention of illness, this review could serve future interventions which aim to improve emotional health as a vehicle of preventing future psychophysiological problems in various populations. Future studies should also consider the importance of Reich’s contributions to the interdisciplinary field of psychophysiological health.

Research Mentor: Shannon Sullivan

Abstract: 507

**Light-Activated Nanoparticles for Elimination of Bacteria**

*Atqiya Nafisa*

Antimicrobial resistance (AR) happens when bacteria develop the ability to defeat the drugs designed to kill them. According to the CDC, “Antimicrobial resistance is an urgent global public health threat, killing at least 1.27 million people worldwide and associated with nearly 5 million deaths in 2019.” Due to indiscriminate use of antibiotics for human treatment, AR is becoming more prevalent. Antibiotics impose selective pressure by killing susceptible bacteria while resistant bacteria grows rapidly. Antibiotic resistance poses a problem because the evolution of antibiotic resistant bacteria is increasing at a faster rate than the development of new antibiotics. Bacteria possess the ability to evolve rapidly through mutations and horizontal gene transfer. Bacteria have developed many mechanisms to overcome the effects of antibiotics, making the current antibacterial drugs available less effective overtime. This may pose challenges when treating antibiotic-resistant bacterial infections and diseases. Nanotechnology can be used to develop effective methods for complete elimination of ARB to treat infections. Silver nanoparticles (AgNPs) have shown antibacterial activity at lower doses that present minimal toxicity to humans while overcoming many antibiotic resistance mechanisms in bacteria. In addition, photosensitizers (PSs) are promising antimicrobial agents with low tendency for antimicrobial resistance development. Hence, the goal of this project is to design light-activated nanoparticles to improve the removal of ARB. Silver nanoparticles functionalized with organic molecules (PSs) activable by sequential light irradiation will eliminate ARB by inactivating the embedded bacteria.

Research Mentor: Juan Vivero-Escoto

Abstract: 508

**Blood Memory - Resistance**

*Amaree Ratliff*

African American traditions are easily discarded in today’s westernized society. In school we are taught watered down historical events, if they even make it into the curriculum. I investigated an African American tradition brought over by the enslaved people of the Americas. This tradition held steady throughout slavery, rallied the community together, passed secret messages, and protected African culture despite strict regulations; this tradition is called Shouting. This project is important because it spreads an African American movement tradition that most of today’s society has not yet heard about. With the research conducted I created a dance film and shared it within my peers and online in order to generate interest in this tradition. African American tradition influenced the modern styles of ballet, tap, jazz, and hip-hop, but the sacred traditions like Ring Shout are as quiet as our ancestors when they were repressed. The irony is that Ring Shout is a form of resistance that our ancestors used in order to keep their voice, it was a form of rights and dignity for them, it was a way to speak to the higher being. Today’s descendants of the enslaved people of the Americas hold our ancestors' blood memory, the memories of oppression, beatings, labor, resistance but most importantly the memories of newfound freedom, passed through generations through the blood shared. Our ancestors' decisions that required boldness and bravery are the reason that we are able to and should carry on these traditions today.

Research Mentor: Tamara Williams

**Notes:**

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