URC 2025

Conference Program

and Abstract Book

17 April 2025

Popp Martin Student Union

UNIVERSITY OF NORTH CAROLINA
CHARLOTTE

Welcome to the 2025 Undergraduate Research Conference at UNC Charlotte! The Undergraduate Research Conference is one of the highlights of each academic year, showcasing research and creative projects completed by undergraduate students at all levels and from across the University. As an R1 research university, UNC Charlotte is committed to engaging undergraduate students in our innovative and high-impact knowledge creation.

Thank you to the Office of Undergraduate Research, Academic Affairs, the Division of Research, the Honors College, and the Levine Scholars Program for helping to organize and sponsor the Undergraduate Research Conference. Worthy of a special thank you are the faculty mentors who support students in their research and creative works. The Undergraduate Research Conference is an important component of our commitment to expand our undergraduate students' opportunities for personal growth and academic success. Students who participate in the Undergraduate Research Conference are rewarded with a rich experience that extends beyond the application of what they learn in the classroom.

Congratulations to all of the undergraduate students presenting at the Undergraduate Research Conference 2025! As students, you read about the products of research in your courses, and you use and benefit from the products of research on a daily basis. But your work with faculty in the field, in their labs, in studios, and in the intellectual exercise that research demands means that you have taken advantage of the best of what a research university offers - you get to participate in the process of discovery. What you learn may eventually end up in someone else's textbook or may lay the groundwork for new technology. Whether that happens or not, you have acquired important knowledge and skills through research. Participating in the Undergraduate Research Conference will serve you well in the future. Many Niner alumni who have gone before you got their start at the Undergraduate Research Conference and are now making a local-to-global impact in their respective fields.

Students, UNC Charlotte is committed to your success! On behalf of the faculty mentors that you work with, I want to add that we are proud of the research and creative endeavors that you are presenting today. We can't wait to see where this opportunity takes you in the future.

Go Niners!

Jennifer Troyer
Provost and Vice Chancellor for Academic Affairs

URC 2025

Welcome to the 2025 UNC Charlotte Undergraduate Research Conference (URC)! The URC 2025 is a reflection of the excellence in research at the University. This URC 2025 is special because it corresponds with Charlotte receiving Research 1 or R1 status. The URC is brought to you by UNC Charlotte's Office of Undergraduate Research (OUR). The URC reflects one of the goals of the OUR, which is to support undergraduate students through opportunities to communicate their research to the wider community. Thank you to Academic Affairs, the Division of Research, the Honors College, the Levine Scholars Program, the Mu Chapter of the Phi Beta Delta (PBD) Honor Society for International Scholars, the Phi Kappa Phi (PKP) Honor Society, The Charlotte Chapter of Sigma Xi, and urbanCORE for supporting the URC. Many thanks to the Office of Sustainability and the Sustainable Development Goals (SDG) Student Organization for helping to move the URC to a Zero-Waste event. Aligned with Zero Waste principles, the URC refreshment areas minimize plastic, uses recyclable products, and offer finger foods to cut packaging and emphasize composting.

The URC is a hybrid conference that includes a virtual component. Please visit the URC Symposium site to view the presentations virtually: symposium.foragerone.com/urc2025. The URC would not be possible without the commitment of our UNC Charlotte faculty. The conference has a strong representation from faculty members who participate as research mentors. The URC also represents the dedication of UNC Charlotte's staff and graduate students, who participate as commenters. A big thank you to all of you for your service and dedication to undergraduate research, creativity, and scholarship. Likewise, special recognition goes to the staff in the Office of Undergraduate Research, the URC student leaders, and the conference organizing committee who all played integral parts in the planning for URC 2025. Most of all, please join us in congratulating our undergraduate researchers for their hard work and efforts! At the end of the conference, please complete the URC Evaluation and Feedback form, which is located at: https://tinyurl.com/URC25evaluation. Enjoy the URC 2025!

Dr. Erik Jon Byker, Chairperson of the URC 2025 Organizing Committee
and Senior Faculty Fellow in the Office of Undergraduate Research

URC 2025 Organizing Committee Members and Advisory Ambassadors

Dr. Lance Barton, Director, Office of Undergraduate Research
Dr. Sarah Powell, Associate Director, Office of Undergraduate Research
Ms. Sarah Hedrick, Administrative Assistant, Office of Undergraduate Research
Ms. Emma Wakeman, Graduate Assistant, Office of Undergraduate Research
Dr. Sandra Clinton, College of Humanities, Earth, and Social Sciences
Dr. Luke Donovan, College of Health and Human Services
Dr. Abasifreke Ebong, William States Lee College of Engineering
Dr. Cindy Gilson, Honors College
Dr. Tamara Johnson, Director of Engaged Scholarship, urbanCORE
Mr. Adam Justice, College of Arts + Architecture
Dr. Stephanie Norander, Levine Scholars Program
Dr. Michelle Pass, Klein College of Science
Dr. Mohsen Dorodchi, College of Computing and Informatics, URC Advisory Board Ambassador
Dr. Didier Dréau, Klein College of Science, URC Advisory Board Ambassador
Mr. Ryan Harris, J. Murrey Atkins Library, URC Advisory Board Ambassador
Dr. Megan Smith, College of Health and Human Services, URC Advisory Board Ambassador
Undergraduate Student Leaders on the URC Committee:

Shaina Bothra Mara Mcphail Andrew Simmons Rokia Sissoko

URC 2025 Student Leadership Team

A big thank you to the URC 2025 Student Leadership Team for helping with organizing and leading the volunteer efforts for the URC!

Shaina Bothra
OUR Student Leader Intern

Mara Mcphail
URC Lead Organizer

Rokia Sissoko
URC Lead Organizer

Andrew Simmons
URC Lead Organizer

Naami Abbey

Rachel Alexander

Aditi Babar

Taryn Bailey

Yazi Bulluck

Aria Cornwall

Cassandra Domingo

Thu Duong

Kate Dydynski

Leena Ganta

Ryan Giuliani

Madison Hernandez-Concha

Nethika Hettiarachchi

Laasya Machineni

Áine McMahon

Karlee McMullen

Sushmita Nelabhotla

Frida Guerrero Ochoa

Shreyas Raychaudhuri

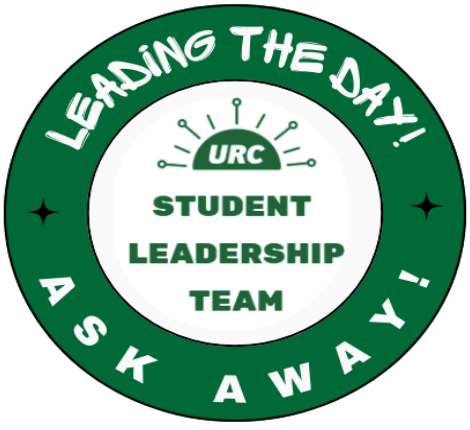
Mallory Schwarz

Michelle Song

Dikshitha Subramanian

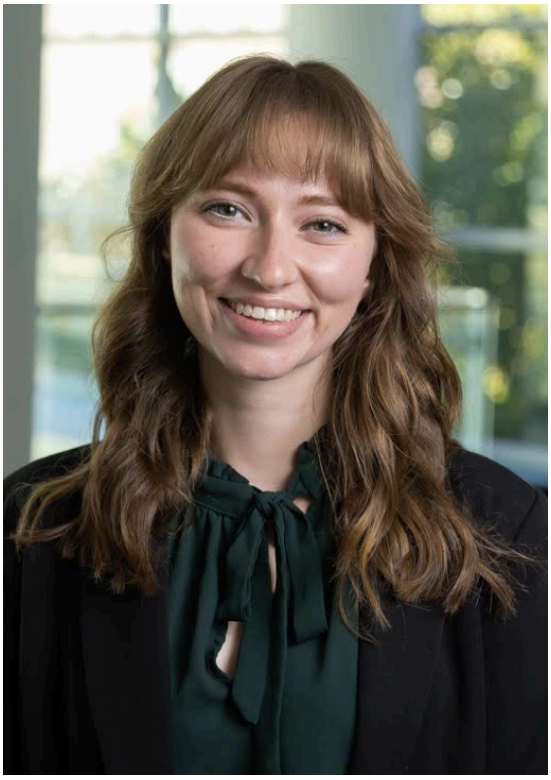
Alli Tuck

URC
UNDERGRADUATE
RESEARCH
CONFERENCE



Logo Credits: Much thanks to Ashley Legassie (Class of 2024) who designed the new URC logo. Thank you to Nishal Hettiarachchi for creating the URC Student Leadership Team logo. Members of the Student Leadership Team will be wearing t-shirts with this logo during the URC.

Featured Alum Keynote Speaker



Keynote Alum Speaker: Claire Patrick

Claire Patrick was born and raised in Lexington, North Carolina. She graduated Summa Cum Laude from UNC Charlotte in 2022 with a Bachelor of Science in Geography and dual minors in Public Health and Religious Studies, with Geography Honors, and from the University Honors Program.

During her time at UNC Charlotte, she worked on a variety of mixed-methods, community engaged research projects which inspired Claire to pursue a Master of City and Regional Planning at the Georgia Institute of Technology, supported in part by a Phi Kappa Phi (PKP) fellowship. While in graduate school, Claire continued serving on various research projects, interned at an environmental justice non-profit, and studied abroad in India. Claire currently works as an urban planning consultant at WSP in Atlanta, Georgia.

Thank you to Supporters of the URC!

URC Poster Printing	URC Organizers	Community-Engaged Research	Honors College
DIVISION OF RESEARCH	OFFICE OF UNDERGRADUATE RESEARCH	URBANCORE	HONORS COLLEGE
Mu Chapter of Phi Beta Delta (PBD)	**Phi Kappa Phi (PKP)**	**Student Leaders**	**Sigma Xi**
ΦΒΔ SCIENTIA MUTUA MUNDI	THE HONOR SOCIETY OF PHI KAPPA PHI ΦΚΦ	LEVINE SCHOLARS	ΣΞ

URC 2025 Schedule

Monday, April 14, 2025

8 AM: The URC 2025 Symposium system opens to the public. University community members are invited to comment on the presentations. Registration is required before comments can be submitted. Please remember our commitment to advancing a culture and community of mutual respect at UNC Charlotte; refrain from negative comments.

Thursday, April 17, in the Popp Martin Student Union

8:30 AM: URC 2025 Registration opens outside of the 340 Ballroom

9:15 AM – 10 AM: Opening Ceremony and Keynote Address in the 340 Ballroom

Dr. Erik Jon Byker, Chair of URC 2025

Tatyana Torres, Sustainable Development Goals (SDG) Club

Dr. John Daniels, Vice Chancellor for Research, Division of Research

Dr. Lance Barton, Director of the Office of Undergraduate Research (OUR)

Shaina Bothra, Introduction of Keynote Speaker

Claire Patrick , Keynote Speaker, UNC Charlotte Alum

*Thank you to Honors College and the OUR for sponsoring the Keynote

10:15 AM – 11:15 AM: Concurrent Presentations Session A

11:30 AM – 12:30 PM: Concurrent Presentations Session B

12:45 PM – 1:45 PM: Concurrent Presentation Session C

Creative Arts and Poster Research Presentation Sessions in the 340 Ballroom

Oral Presentations and Panel Sessions in the 200 Level Rooms

Applied and Health Sciences – Room 261

Arts, Design, & Engineering - Room 262

Humanities - Room 263

Psychological and Social Sciences - Room 265

STEM: Biological Sciences I - Room 266

STEM: Biological Sciences II - Room 267

2 PM – 3 PM: Closing Ceremony in the 340 Ballroom**

Dr. Erik Jon Byker, Chair of URC 2025

Claire Patrick, Alum Speaker with Closing Reflections

Dr. Sarah Powell, Associate Director of OUR

Emma Wakeman, OUR Graduate Assistant and Scholar

Praneeta Veluri & Courtney-Grace Neizer, ETHEL Journal

Honor Society Representatives

Recognitions

**At the conclusion of the Ceremony, further instructions about group pictures may be provided. Thank you to the University Communications Office for providing photography for the URC 2025.

3 PM – 4 PM: Dessert reception to follow on the Third Floor of the Popp Martin Student Union

ETHEL
RESEARCH JOURNAL

The *ETHEL Undergraduate Research Journal* stands for Excellence, Transformation, Honor, Equity, and Leadership. The journal was established to provide undergraduate students with a platform to share their research with the broader community. Recognizing the need for an inclusive platform at UNC Charlotte, *ETHEL* highlights work from across disciplines, fostering interdisciplinary dialogue and showcasing the diversity of student scholarship. *ETHEL*'s very first issue is coming out this semester! Stay tuned on our website at etheljournal.com and follow us on Instagram @ethel_journal for updates.

Editorial Board Members:
Editor-in-Chief: Praneeta Veluri
Associate Editor-in-Chief: Mia Huffman
Podcast Director: Courtney-Grace Neizer
Web & Media Developer: Arnav Sareen
Social Media Director & Lead Designer: Angelika Santero

ZERO WASTE

The URC is proud to be moving toward a Zero Waste event at UNC Charlotte. In coordination with Associate Vice Chancellor Cavenny-Cox, the Office of Sustainability, and the Sustainable Development Goals (SDG) Student Organization, the refreshment and reception areas of the URC will include compost and recycling bins to promote sustainability and divert as much waste as possible from going to the landfill. Zero Waste promotes recycling and compost to reduce landfill waste.

Oral and Panel Presentations: Applied and Health Sciences
Room 261

Note: Presentations can be viewed on the URC Symposium site. Please visit: symposium.foragerone.com/urc2025 and search by author's name or presentation title.

10:15 AM: *Fostering Research Engagement in Nursing: Exploring Barriers, Early Exposure, and the Impact of Doctoral Education* by Jalen London; Mentor: Susan Lynch, College of Health and Human Services

10:30 AM: *Exploring the Relationship Between BMI, Age, and HbA1c in Active Older African American Women* by Samantha Webb; Mentor: Trudy Moore-Harrison, College of Health and Human Services

10:45 AM: **BREAK**

11:30 AM: **Panel Presentation:** *Thriving Together: Sustainable Solutions for Women's Health* organized by Meenu Murugan, Divya Agarwal, and Krish Karri; Mentor: Erik Jon Byker, Office of Undergraduate Research

12:30 PM: **BREAK**

12:45 PM: *High-Resolution Mapping of Human Activity Zones for Understanding Malaria Transmission in Southern Africa* by Natasha Kroll and Anupam Sharma; Mentor: Yao Li, College of Humanities & Earth and Social Sciences

1:00 PM: *Exercise is Medicine: Enhancing p53 Tumor Suppression through the AMPK Pathway* by Naiya Roberts; Mentor: Ellen Wisner, College of Health and Human Services

1:15 PM: Empowering Change: The Evolution of UNC Charlotte's Sustainable Development Goals Club by Isabelle Kleckner and Mackenzie Smart; Mentor: Erik Jon Byker, Cato College of Education

Oral Presentations: Arts, Design, & Engineering
Room 262

10:15 AM: *The Great Organelle Hunt: Game-Based Learning for Cellular Biology* by Devin Cho; Mentor: Jessica 'JB' Burke, College of Arts + Architecture

10:30 AM: *Art and History of Marginalized Communities: Marc Chagall and Robert Mapplethorpe* by Alastor Gilbert; Mentor: Malin Pereira, Honors College

10:45 AM: *Who Is This Genius Child?* by Monisha Moore; Mentor: Jay Grymes, College of Arts + Architecture

11:00 AM: **BREAK**

11:30 AM: *Solar-Powered Self-Sustainable UAV Communication Networks with Fixed-Wing UAVs* by Mohammad Hasan and Chandra Geddam; Mentor: Ran Zhang, William States Lee College of Engineering

11:45 AM: *Gamification in Early Educational Learning* by Kathryn Russell; Mentor: Jessica 'JB' Burke, College of Arts + Architecture

12:00 PM: *The Effectiveness of Music Therapy for Treatment of Autism Spectrum In Children* by Mahogany Williams; Mentor: Jay Grymes, College of Arts + Architecture

12:15 PM: *Women Composers of the Classical Era* by Ali Chrisley; Mentor: Jay Grymes, College of Arts + Architecture

12:30 PM: **BREAK**

12:45 PM *Incapable of Joyful Expression? The Bass Clarinet as a Solo Instrument* by Sufian Azar; Mentor: Jay Grymes, College of Arts + Architecture

1:00 PM: *American 19th Century Songs* by Andrew Williams; Mentor: Jay Grymes, College of Arts + Architecture

1:15 PM: *UAV Space-Air-Ground Integrated Network for Autonomous Land Vehicle Navigation* by Gabriel Almodovar; Mentor: Miao Wang, William States Lee College of Engineering

1:30 PM: *Machine Learning Future Drive Towards Enhanced Learning* by Mujaba Ali Khan and Hafsa Konain; Mentor: Erik Jon Byker, Office of Undergraduate Research

Oral Presentations: Humanities
Room 263

10:15 AM: *A Tale of Two Cities Bosnian War Aid Discrepancy in the Face of Occupancy* by Berina Rucic; Mentor: Jill Massino, College of Humanities & Earth and Social Sciences

10:30 AM: *Tourism, Security, and Sacred Space at Bethany Beyond the Jordan* by Olivia Stockwell; Mentor: Eric Hoenes del Pinal, College of Humanities & Earth and Social Sciences

10:45 AM: *Women and the Production of 19th Century Knowledge* by Leila Hachani; Mentor: Alan Rauch; College of Humanities & Earth and Social Sciences

11:00 AM: *A Conversation about Conversion: Catawba Religious and Cultural Evolution to Mormonism and the Mormon Conversion of the Catawba Nation* by Neha Panajkar; Mentor: Peter Ferdinando, College of Humanities & Earth and Social Sciences

11:15 AM: **BREAK**

11:45 AM*:* *Bondage to Business in the Bull City: Booker T. Washington and the National Negro Business League's Impact on the Development of Black Capitalism in Durham and Other NC Cities* by Lee Queveon Tate; Mentor: Willie Griffin, College of Humanities & Earth and Social Sciences

12:00 PM: *We Have Invented Nothing: Prehistory, Modernity, and Cognition* by Celia Castaldo; Mentor: Jae Emerling, College of Arts + Architecture

12:15 PM: **BREAK**

12:45 PM: *Chimeras, Discords, and Altercations: O'odham Motivations Behind the Uprising of 1751* by Cayla Avant; Mentor: Carol Higham, College of Humanities & Earth and Social Sciences

1:00 PM: *Translation Project: Literary Experience by Alfonso Reyes* by Ysabelle Blaine Mentor: Donald Cross; College of Humanities & Earth and Social Sciences

Oral Presentations: Psychological and Social Sciences
Room 265

10:15 AM: *Misogynoir and Psychological Distress in Black Women* by Gabriella Boutte; Mentor: Amy Canevello, College of Humanities & Earth and Social Sciences

10:30 AM: *Taboo of Death: How Does the Sociological Approach to Religion interconnect with Death Perception?* by MacKenzie Kirby; Mentor: Diane Zablotsky, College of Humanities & Earth and Social Sciences

10:45 AM: *Investigation of Burial Sites of enslaved Africans in Charlotte, North Carolina* by Mara McPhail; Mentor: Emily Makas, College of Arts + Architecture

11:00 AM: *Bridging the Gap: Enhancing Support for Hispanic Students in Charlotte-Mecklenburg Schools* by Claire Broome; Mentor: Allison Stedman, College of Humanities & Earth and Social Sciences

11:15 AM: **BREAK**

11:30 AM: *Inclusive Language Evolution in Spanish: Exploring Institutional Impact* by Saniya Gabriel; Mentor: Allison Stedman, College of Humanities & Earth and Social Sciences

11:45 AM: *Opportunities for Relevant Work Experience: Perceptions of Undergraduate Psychology Students* by Ethan Wilkins; Mentor: Kim Buch, College of Humanities & Earth and Social Sciences

12:00 PM: *Identifying Changes in Communication Consultant Confidence Across the Years* by James Meanor, Shreya Sridher, Sridula Vardireddy, and Kaitlin Ferguson; Mentor: Heather Bastian, University College

12:15 PM *Weather Communications: The Relationship between Generations and Information* by Zachary Tolman; Mentor: Terry Shirley, College of Humanities & Earth and Social Sciences

Oral Presentations: STEM- Biological Sciences I
Room 266

10:15 AM: *Examining beneficial fungal partnerships in wild and cultivated soybean* by Kody Angell; Mentor: Bao-Hua Song, Klein College of Science

10:30 AM: *The role of macrophage-inducible C-type lectin, Mincle in staphylococcal osteomyelitis* by Nicole Azar; Mentors: Erin Mills, Ian Marriott, and M. Brittany Johnson, Klein College of Science

10:45 AM: *Substance P and IFN-β's Role in Murine Osteoblast Differentiation* by Thomas Hoggarth; Mentor: M. Brittany Johnson, Klein College of Science

11:00 AM: *Role of SEA complex in micro-autophagy* by Shehdan Abbasi; Mentor: Richard Chi, Klein College of Science

11:15 AM: **BREAK**

11:30 AM: *Unveiling Novel Cargo in the AP-3 Pathway* by Brianna Collado-Almonte Mentor: Richard Chi, Klein College of Science

11:45 AM: *Genetic diversity of HLA pseudogenes in Amerindian populations: copy number variation and population dynamics* by Asrin Jama; Mentor: Danillo Augusto, Klein College of Science

12:00 PM: *Exploring allele frequencies and copy number variation of HLA pseudogenes in Amerindian Populations* by Jana Obeid; Mentor: Danillo Augusto, Klein College of Science

12:15 PM: *Experimental Evolution of Vesicular Stomatitis Viruses* by Charlotte Johnstone Mentor: Valery Z. Grdzelishvili, Klein College of Science

12:30 PM: **BREAK**

12:45 PM: *Exploring the Dispersal of Fungal Species by Bees* by Taylor Yonemura; Mentor: Morgan Carter, Klein College of Science

1:00 PM: *FLAVi 2: Increasing Efficiency and Accessibility of Flaviviridae Genome Annotation* by Cayden Jacobsen; Mentor: Denis Jacob Machado, College of Computing and Informatics

Oral Presentations: STEM- Biological Sciences II
Room 267

10:15 AM: *Identify Chromosomal Instability in Prostate Cancer Cells with Acquired Chemoresistance* by Yara Kayali; Mentor: Junya Tomida, Klein College of Science

10:30 AM: *Identifying REV7 Domain/Sites Regulating p53 Protein Stability* by Skyler Kuncik; Mentor: Junya Tomida, Klein College of Science

10:45 AM: *Developing an Oral Tolerization Therapy for Multiple Sclerosis Using Genetically Engineered Soybeans Expressing MOG-Sigma1 Fusion Protein* by Meenu Murugan, Mentors: Daniel Nelson and Kenneth Piller, Klein College of Science

11:00 AM: *Development of Thiazolo[5,4-d]thiazole Photosensitizers for Photodynamic Therapy and for Photoinactivation of Bacteria* by Nick Eberwein; Mentor: Michael Walter, Klein College of Science

11:15 AM: BREAK

11:30 AM: *MHV Induced Tau Hyperphosphorylation In The Hippocampus* by Erik Sopiqoti; Mentor: Kristen Funk, Klein College of Science

11:45 AM: *Analyzing the Response of the Immune System in Males vs Females that Occurs after Mouse Coronavirus Infection* by Luke Williams; Mentor: Kristen Funk, Klein College of Science

12:00 PM: *Efficacy of MVA-MUC1 Vaccine in MUC1.Tg Mouse Model of Pancreatic Ductal Adenocarcinoma* by Mauricio Lopez; Mentors: Pinku Mukherjee and Arjun Tiwari, Klein College of Science

12:15 PM: *CXCL12 and CXCL4 Chemokine Heterodimerization and CXCR4 Signaling in Breast Cancer Cells* by Zoe Vette; Mentor: Didier Dréau, Klein College of Science

12:30 PM: BREAK

12:45 PM: *Reactive oxygen species and NLRP3 Inflammasome alter macrophages and inflammation within the breast tumor microenvironment* by Shely Acosta; Mentor: Didier Dréau, Klein College of Science

1:00 PM: *Temporal Variability of Viruses During Freshwater Harmful Algal Bloom* by Heven Siyum; Mentor: Elaine Luo, Klein College of Science

1:15 PM: *Predicting Protein Contributions to Carbon Fixation in Autotrophic Freshwater Microbes Using Statistical and Machine Learning Models* by Courtney-Grace Neizer; Mentor: Elaine Luo, Klein College of Science

Creative Arts Presentations
340 Ballroom

Note: Presentations can be viewed on the URC Symposium site. Please visit: symposium.foragerone.com/urc2025 and search by author's name or presentation title.

Session A: 10:15am - 11:15am

Easel 91 - *A Path Shared* by Morgan Alexander; Mentor: Lydia Thompson, College of Arts + Architecture

Easel 92 - *Medical Illustration Surgical Study after Maclise* by Fairlight Strong; Mentor: Jessica 'JB' Burke, College of Arts + Architecture

Easel 93 - *Organic Abstraction* by Ava Weaver; Mentor: Jessica 'JB' Burke, College of Arts + Architecture

Session B: 11:30am - 12:30pm

Easel 94 - *Visualizing Water Contamination Through Art* by Balmore Corvera; Mentor: Missy Eppes, College of Humanities & Earth and Social Sciences

Easel 95 - *Midscape* by Maya Hutagalung; Mentor: Maja Godlewska, College of Arts + Architecture

Poster Research Presentations
340 Ballroom

Note: Presentations can be viewed on the URC Symposium site. Please visit: symposium.foragerone.com/urc2025 and search by author's name or presentation title.

Session A: 10:15am - 11:15am

Easel 100 - *Climate Change and Infectious Diseases* by Eleanor Ahdieh; Mentor: Jack Scheff, College of Humanities & Earth and Social Sciences

Easel 101- *Bridging Employment and Childcare Gaps: A Research Project on Charlotte's Growing Community* by Katie Benitez Diaz; Mentor: Stephanie Potochnick, College of Humanities & Earth and Social Sciences

Easel 102 - *Investigating and Comparing Sustainable Development Goal #13 in Germany and the United States* by Russell Beyer, David Henriquez, and Lama Abelraham, Mentor: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Easel 103 - *Assessing Neuronal DNA Damage Induced by CD8+ T Cells During Viral Infection Using an Optimized Comet Assays* by Aayush Bhatt; Mentor: Kristen Funk, Klein College of Science

Easel 104 - *A Shape-Morphing Airfoil Using Nitinol Actuation for UAV and Small-Scale Airplanes* by Haryshwa Bipin; Mentor: John Hall, William States Lee College of Engineering

Easel 105 - *Turning Research into Networking Opportunities* by Shaina Bothra; Mentor: Erik Jon Byker, Office of Undergraduate Research

Easel 106 - *Matrix Effects on ZNR Removal of PFAS* by Maren Clark; Mentor: Jordan Poler, Klein College of Science

Easel 107 - *Using an LLM to Enhance Source Code Documentation Generation in Doxygen* by Robert Craig; Mentor: Yonghong Yan, College of Computing and Informatics

Easel 108 - *Changes in Political Animus Among College Students During the 2024 Election* by Natalie Doerfler; Mentor: Jason Giersch, College Humanities & Earth and Social Sciences

Easel 109 - *Investigation of the chemical properties responsible for antibacterial activity of the stingless bee honey from Costa Rica* by Natalya Drapievskaya, Noor Elhalabi, and Kaustubh Tiwari; Mentor: Joanna Krueger, Klein College of Science

Easel 110 - *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 & Human Services

Easel 111 - *A Deep Dive into Singular Value Decomposition's Utility for Noise Reduction in Audio Signals and Language Processing* by Julian Evan; Mentor: Xingjie Li, Klein College of Science

Easel 112 - *Exploring Rhizopus and Mycetohabitans Relationships Through Genome Sequencing* by Sara Field; Mentor: Morgan Carter, Klein College of Science

Easel 113 - *From Science to Civil Rights: Examining Teacher's Experiences Conducting Site-Based Professional Development* by Kendall Fording and Madelyn Torkelson; Mentor: Scott Gartlan, College of Humanities & Earth and Social Sciences

Easel 114 - *Investigating and Comparing Sustainable Development Goal #1 in Germany and the United States* by Daniel Gamez, Aya Zedan, and Ashley Antonio; Mentor: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Easel 115 - *Exploring Motivational Drivers of Physical Activity Engagement through Qualitative Coding of Physical Activity Related Social Media Posts* by Jaidyn Graham; Mentor: Sara Levens, College of Humanities & Earth and Social Sciences

Easel 116 - *Dance and Communities: Scouts and Guides* by Naiya Graham; Mentor: Kaustavi Sarkar, College of Arts + Architecture, Honors College

Easel 117 - *Assessing the Writing Quality & Cohesion of Mathematical Writing from a Summer Intervention* by Kylie Greenelsh; Mentor: Madelyn Williams-Colonnese, Cato College of Education

Easel 118 - *Patch Antenna Miniaturization via Ferromagnetic Nanoparticle Metamaterial Substrate Integration* by Ryan Guthrey; Mentor: Andrew Willis, William States Lee College of Engineering

Easel 119 - *An Analysis of the Coins Found in the Necropolis of Sa Mitza Salida, Masullas* by Emma Harper; Mentor: Luca Lai, College of Humanities & Earth and Social Sciences, Honors College

Easel 120 - *Using AI Generated Humor to Boost Student Engagement during Assessments* by Krish Iyer; Mentor: Razvan Bunescu, College of Computing and Informatics

Easel 121 - *Analyzing Total Suspended Solids (TSS) in Urban Stormwater and Beaver Ponds* by Safiyyah James; Mentor: Sandra Clinton, College of Humanities & Earth and Social Sciences

Easel 122 - *Mapping the Impacts of Transportation Infrastructure Development on Health Outcomes in Charlotte* by Catherine Jones; Mentor: Fushcia Hoover, College of Humanities & Earth and Social Sciences

Easel 123 - *Data Collection and Preparation of Molecular Datasets for Studies of Biomedicine* by Venus Kajangu; Mentor: Daniel Janies, College of Computing and Informatics

Easel 124 - *Extracting Image Descriptions from Papers* by Patrick Kengsoontra; Mentor: Razvan Bunescu, College of Computing and Informatics

Easel 125 - *A Radiation Treatment Planning System from a Browser* by Adrian Khlim; Mentor: Yonghong Yan, College of Computing and Informatics

Easel 126 - *Investigating and Comparing Sustainable Development Goal #3 in Germany and the United States* by Mikayla King, Teagen Johnson, and Daniela Betancourt; Mentor: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Easel 127 - *Public Perception of Reproductive Rights* by Ana Krstanovic; Mentor: Erin Basinger, College of Humanities & Earth and Social Sciences

Easel 128 - *Gene Therapy: How Effective Is It?* by Gaella Malembi; Mentor: Aimee Smith, College of Humanities & Earth and Social Sciences

Easel 129 - *Investigating and Comparing Sustainable Development Goal #16 in Germany and the United States* by Emily McDaniel, Jayvone Green, and Sam Trajano; Mentor: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Easel 130 - *Biodiversity in Urbanizing Forests: An Assessment of Vertebrate Wildlife at UNC Charlotte* by Hannah Meador; Mentor: Jennifer Warner, Klein College of Science

Easel 131 - *Connecting Erosion, Landscape Evolution, and Tourism* by Madeline Montemurro; Mentor: Missy Eppes, College of Humanities & Earth and Social Sciences

Easel 132 - *Performance Evaluation of Bifacial Solar Photovoltaic Modules with Various Ground Materials* by Michael Murphy; Mentor: Jaewon Oh, William States Lee College of Engineering

Easel 133 - *Synthesis of Light-Activated Nanoparticles for Elimination of Bacteria* by Atqiya Nafisa; Mentor: Juan Vivero-Escoto, Klein College of Science

Easel 134 - *Palliative Care Readiness (PALCARE) Tool for Older Adults with Cancer and Their Family Caregivers: Development and Validation* by Savannah Norris; Mentor: Jyotsana Parajuli, College of Health & Human Services

Easel 135 - *Linguistic Inequity in Schools: Marshallese Student Language Practices and Educational Outcomes* by Lori Aine O'Healy; Mentor: Elise Berman, College of Humanities & Earth and Social Sciences

Easel 136 - *Investigating and Comparing SDG #6: Clean Water and Sanitation in Germany and the United States* by Ginny Ohlhaut, Ann Maupin, and Caleb Reid Mentor: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Easel 137 - *TickBusters: Investigating Tick-Borne Diseases in North Carolina and Brazil* by Wynn Oo; Mentor: Rafael Felipe Da Costa Vieira, College of Health & Human Services

Easel 138 - *The Impact of Financial and Racial Disparities on the Quality of Life Experienced by Young Populations Living with Sickle Cell Disease* by Khadija Ouedraogo; Mentor: Aimee Smith, College of Health & Human Services

Easel 139 - *Improving Electroporation Protocols to Effectively Transform a Gram Negative Bacterium* by MyAsia Owens; Mentors: Ruth Wright and Morgan Carter, Klein College of Science

Easel 140 - *Carbonyl Redox Chemistry: A Versatile Platform to Access Rigid Polycyclic Frameworks with Defined Substituent Patterns* by Zachary Perry, Nicholas Brace, and Nikita Spambetov; Mentor: Markus Etzkorn, Klein College of Science

Easel 141 - *Geolocation Authentication* by Erica Phann; Mentor: Heather Lipford, College of Computing and Informatics

Easel 142 - *Building Defiance: Amaza Lee Meredith's Architectural Resistance* by Mo Pirela; Mentor: Emily Makas, College of Arts + Architecture

Easel 143 - *Serial Evaluation of Knee Cartilage Using Ultrasound in Athletes* by Kacey Podielsky; Mentor: Abbey Fenwick, College of Health & Human Services

Easel 144 - *Spatial Patterns of Climate Justice Hotspots in Mecklenburg County* by Karen Regalado; Mentor: Fushcia-Ann Hoover, College of Humanities & Earth and Social Sciences

Easel 145 - *The Germline Controls HSP-90 Chaperone Expression During Stress and Aging; Cell Nonautonomously in Caenorhabditis elegans* by Robbie Richmond; Mentor: Patricija Van Oosten-Hawle, Klein College of Science

Easel 146 - *Bacteriophages: The Future in Everywhere and Anywhere* by Jessica Robles Gonzalez and Lily McGuirt; Mentors: Michelle Pass and Sharon Bullock, Klein College of Science

Easel 147 - *Utilizing ZNR for Effective Water Purification* by Adrian Rodriguez; Mentor: Jordan Poler, Klein College of Science

Easel 148 - *TickBusters: Investigating Tick-Borne Diseases in North Carolina and Brazil* by Marielle Rosalez; Mentor: Rafael Vieira, College of Health & Human Services

Easel 149 - *The Influence of Modal Mineralogy and Grain Size on The Coefficient of Thermal Expansion (CTE) in North Carolina Aggregates* by Davis Rowe; Mentor: Valerie Reynolds, College of Humanities & Earth and Social Sciences

Easel 150 - *Utilizing Atomistic Simulations to Investigate the Thermal and Ionic Transport in Superlattice Perovskite Cells* by Nizam Sait; Mentor: Xiang Chen, William States Lee College of Engineering

Easel 151 - *Interactive Learning and Assessment Modules for Early CS Learning* by Jacob Sasser and Brandon Tiseo; Mentor: Kalpathi Subramanian, College of Computing and Informatics

Easel 152 - *The Use of Games to Train Cognitive Flexibility: A Proposal of Mechanics and Interviews Among Therapists and Clients* by Nikhil Saxena; Mentor: Doug Markant, College of Humanities & Earth and Social Sciences

Easel 153 - *Geologic Mapping and Illustration in the Atlantic Ocean Basin* by Erin Sescourka; Mentor: Missy Eppes, College of Humanities & Earth and Social Sciences

Easel 154 - *Supporting the Socioemotional Needs of Unhoused Black Students in an Urban School District* by Emma-Leigh Stoll; Mentor: Susan Harden, Cato College of Education

Easel 155 - *Investigating and Comparing Sustainable Development Goal #5 in Germany and the United States* by Aiden Terrick, Lucy Weaver, and Tati Greer; Mentors: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Easel 156 - *Mapping Trash: Improving Environmental Quality in Mecklenburg County Through a Community Partnership* by Dylan Toh; Mentor: Youngseob Eum, College of Humanities & Earth and Social Sciences

Easel 157 - *How Perceptual Variability Impacts the Communication of Probabilities with Icon Arrays* by Isabella Tsai and Ata Yilmazemre; Mentor: Douglas Markant, College of Humanities & Earth and Social Sciences

Easel 158 - *Exploring the Neural Correlates of Immersion in Virtual Reality* by Ata Yilmazemre; Mentor: Mark Faust, College of Humanities & Earth and Social Sciences

Easel 159 - *Dragonfly Larvae Distribution in Ponds in the Charlotte-Mecklenburg Region* by Mckenna Zelna; Mentor: Sandra Clinton, College of Humanities & Earth and Social Sciences

Session B: 11:30am - 12:30pm

Easel 100 - *Aggregating Data on Viral Hosts of H5N1 in North America* by Rachel Alexander; Mentor: Daniel Janies, College of Computing and Informatics

Easel 101 - *Aware and Share: A Visual Guide to Phishing Scams Targeting International Students* by Eesha Alla; Mentor: Cori Faklaris, College of Computing and Informatics

Easel 102 - *The Effect of 4-Hydroxy-TEMPO on the Photochromism of Thiazolothiazole films* by Aboud Alshatat; Mentor: Michael G. Walter, Klein College of Science

Easel 103 - *Explainable Distributed Machine Learning for Outlier Detection* by Rowan Amanna; Mentor: Qiong Cheng, College of Computing and Informatics

Easel 104 - *Genetic Diversity of HLA and KIR genes in the Ashanti Tribe of Ghana* by Ishmael Ayalingo; Mentor: Danillo Augusto, Klein College of Science

Easel 105 - *Reddit (as) Therapy?: Online Disclosures and Help-seeking Among Intimate Partner Violence Survivors* by Madilyn Blackmon and Carrie Gorman; Mentor: Jennifer Langhinrichsen-Rohling, College of Humanities & Earth and Social Sciences

Easel 106 - *Lyapunov Functions in Deep Reinforcement Learning* by Craig Bowman; Mentor: Scott Kelly, William States Lee College of Engineering

Easel 107 - *Exploring the role of Tumor-Intrinsic Interferon Signaling in Chemotherapy-Induced Pancreatic Cancer Cell Death* by Kaitlyn Bruno; Mentor: Youjun Wu, Klein College of Science

Easel 108 - *Implementation Facilitators and Barriers of School-Based Health Centers* by Yazi Bulluck; Mentor: Victoria Scott, College of Health & Human Services

Easel 109 - *Using Art to Communicate Landslide Risks in Puerto Rico* by Rose Casillas; Mentor: Missy Eppes, College of Humanities & Earth and Social Sciences

Easel 110 - *Osteobiography and the Ethical Dilemmas of Skeletal Collections* by Mayah Clark; Mentor: Sara Juengst, College of Humanities & Earth and Social Sciences

Easel 111 - *Shinbutsu Bunri: The Material Effects of Forced Shinto and Buddhist Separation on Japanese Religious Culture* by Jack Corning; Mentor: Janna Shedd, College of Humanities & Earth and Social Sciences

Easel 112 - *Comparison of Voltage Sensitive Asymmetric Thiazolothiazole Dyes in Cellular Imaging Applications* by Charlie Darby and Joy Amuzu; Mentor: Michael G. Walter, Klein College of Science

Easel 113 - *The Impact of Soil Characteristics on Biodiversity: A Visual Depiction* by Nate Davis; Mentor: Missy Eppes, College of Humanities & Earth and Social Sciences

Easel 114 - *Deploying Fast Centrality Algorithms in Gephi* by Reece Devenney; Mentor: Erik Saule, College of Computing and Informatics

Easel 115 - *Investigating and Comparing SDG #2: Zero Hunger in Germany and the United States* by Madiouma Diawara, Evan Lewis, and John Bonilla;
Mentors: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Easel 116 - *Optimizing fungal-bacterial association protocol to study plant health* by Paola Diaz-Matamoros; Mentor: Morgan Carter, Klein College of Science

Easel 117 - *Collecting and Synthesizing Academic Knowledge on Fat Liberation and Menopause* by Wissal Dkhir; Mentor: Margaret Quinlan, College of Humanities & Earth and Social Sciences

Easel 118 - *Deep Learning for Adaptive Gait Rehabilitation: Integrating sEMG, IMUs, and Pose Keypoint Data in FES* by Eric Fackelman; Mentor: Minhaj Alam, William States Lee College of Engineering

Easel 119 - *Investigating and Comparing SDG #1: No Poverty in Germany and the United States* by Robbie Flanagan, Sa'Rya Parker, and Ahmed Abdullatef;
Mentor: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Easel 120 - *Stress-Specific Regulation of Yeast BiP Through Multisite Phosphorylation* by Erica Flores; Mentors: Chathura Paththamperuma and Andrew W. Truman, Klein College of Science

Easel 121 - *Novel Solvers for Sparse Generalized Linear Models* by Sindhu Gadiraju; Mentor: Christian Kuemmerle, College of Computing and Informatics

Easel 122 - *Investigating and Comparing Sustainable Development Goal #11 in Japan and the United States* by Andy Garcia and Hinata Asada; Mentor: Erik Jon Byker, Cato College of Education

Easel 123 - *Interpreting Puerto Rico's Surficial Geology Through Art: A Visual Exploration of Landscape and Culture* by Josue Guevara; Mentor: Missy Eppes, College of Humanities & Earth and Social Sciences

Easel 124 - *Data Visualization for the CS1 Compendium for Improving Personalized Education* by Kento Hopkins; Mentor: Razvan Bunescu, College of Computing and Informatics

Easel 125 - *Phylogeny as an Indicator of Gene Transfer in Bacteriophages* by Harrison Huffmon, Anngiselle Vallejo, Zeel Desai, and Nathaniel Foret; Mentor: Tonya Bates, Klein College of Science

Easel 126 - *Filtration of PFAS through Ion Exchange Resins and Tetrachloride Metals* by Rachel Irving; Mentor: Mei Sun, William States Lee College of Engineering

Easel 127 - *Extracting Nanocellulose Fibers from Plant Matter to Make Biocomposites* by Bhagavanth Mehul Jammannagari; Mentor: Roger Tipton, William States Lee College of Engineering

Easel 128 - *Reclaiming Fat and Disabled: Discourses of Fatness and Disability in Women's Health* by Grayce Jeter; Mentor: Margaret Quinlan, College of Humanities & Earth and Social Sciences

Easel 129 - *The Problem Is We Call It A Problem: College Level Students With ADHD and Higher Order Writing* by Katelyn Kerr; Mentors: Katie Garahan and Mark Hall, College of Humanities & Earth and Social Sciences

Easel 130 - *Serial Ultrasound Imaging of Ankle Cartilage in Athletes* by Samuel Limparis; Mentor: Abbey Thomas Fenwick, College of Health & Human Services

Easel 131 - *Not Sold on AlphaFold? An Exploration of Unknown Protein Functions Using New AI* by Lily McGuirt, Sarah Wigren, Jessica Robles Gonzalez, and Skylar Godwin; Mentors: Ellen Wisner and Tonya Bates, Klein College of Science

Easel 132 - *Exploring Geomorphic Formations Through Artistic World Building* by Robert McLaughlin; Mentor: Missy Eppes, College of Humanities & Earth and Social Sciences

Easel 133 - *Political Economy of Policing* by Sarah Nti; Mentor: Martin Shuster, College of Humanities & Earth and Social Sciences

Easel 134 - *It's a slip and slide down there: Influencing Fertility; The Role of TikTok in Shaping Public Perceptions of Fertility Supplements* by Erin Oakley and Alissa Mok; Mentor: Margaret Quinlan, College of Humanities & Earth and Social Sciences

Easel 135 - *Optimization of Laser-Induced Fluorescence for Frequency-Encoded Detection* by Brinda Patel; Mentor: Laura Casto-Boggess, Klein College of Science

Easel 136 - *Investigation of Post Translational Modifications on Copper Chaperone for Superoxide Dismutase* by Colin Raddant; Mentor: Eva Ge, Klein College of Science

Easel 137 - *Pavement Marking Detection from LiDAR Data* by Kevin Richard; Mentor: Depeng Xu, College of Computing and Informatics

Easel 138 - *The Structural and Functional Dynamics of the Major Capsid Protease Fusion Protein* by Shamanasia Richardson, Daune Signorelli, Joseph Kim, and Heven Siyum; Mentors: Ellen Wisner and Tonya Bates, Klein College of Science

Easel 139 - *3D Printing of Fully Integrated Flexible Humidity Sensor for Long-Term Health Monitoring* by Prabhtej Sahni; Mentor: Erina B. Joyee, William States Lee College of Engineering

Easel 140 - *Sandham's Perambulations of a Bee and a Butterfly: Introducing Nature to Young Readers in Early 19th Century* by Abeer Saleem Naznin; Mentor: Alan Rauch, College of Humanities & Earth and Social Sciences

Easel 141 - *Creating User-Specific Pathfinding Modules & Algorithms for the Lightning Network and their Evaluation* by Rohan Salwekar; Mentor: Christian Kuemmerle, College of Computing and Informatics

Easel 142 - *Leveraging AI to Enhance Medical Adherence in Older Adults with Type 2 Diabetes* by Sneaha Santra; Mentor: Mohsen Dorodchi, College of Computing and Informatics

Easel 143 - *Developing Antibacterial Metallic-coated Silica-capped Iron Oxide Nanoparticles* by Laura Scala; Mentor: Juan Vivero-Escoto, Klein College of Science

Easel 144 - *Surficial Geology of Earthquakes Pertaining to Human Experience* by Yana Staroverov; Mentor: Missy Eppes, College of Humanities & Earth and Social Sciences

Easel 145 - *Testing the Transactivation Abilities of Four Tumor Suppressor (p53) Mutants* by Ruth Tamirat, Kaustubh Tiwari, Simran Bali, Adrienna Fanelli, and Bryson Schreiner; Mentor: Ellen Wisner, Klein College of Science

Easel 146 - *Comparing the Effects of Human Fitspiration, Anime-themed Fitspiration, and Body Image Flexibility Quotes on State Body Image, Mood, and Exercise Motivation in Young Adult Men* by Joseph Thompson; Mentor: Jennifer Webb, College of Humanities & Earth and Social Sciences

Easel 147 - *Earth Science and Art: The blending of two disciplines* by Zachary Tolman; Mentor: Missy Eppes, College of Humanities & Earth and Social Sciences

Easel 148 - *Social Well-Being and Pain Interference: The Role of Self-Esteem* by Drew VanDine and Oliva Woods; Mentor: Scott Ravyts, College of Humanities & Earth and Social Sciences

Easel 149 - *Investigating the Epigenetic Mechanisms of Polycomb Components Through Single-Molecule Imaging* by Sridula Vardireddy; Mentor: Xiaojun Ren, Klein College of Science

Easel 150 - *Development of a Method for Preparing and Purifying Myofibrils from Rabbit Skeletal Muscle Tissue to Study Myosin Motors Cooperativity in Sarcomeres During Muscle Force Production* by Riley Van Ravesteyn; Mentor: Yuri Nesmelov, Klein College of Science

Easel 151 - *Enhancing Reliability and Performance of Marine Energy Systems* by Shreyas Vimaldev; Mentors: Wesley Williams and Michael Smith, William States Lee College of Engineering

Easel 152 - *Quantum Computing: Beyond Classical Limits* by Sushanth Yarlagadda; Mentor: Todd Dobbs, College of Computing and Informatics

Easel 153 - *Shifting Downtime: The Impact of Habitat Type on Resting Behavior in White-Handed Gibbons Across Thailand* by Lauren Yost; Mentor: Lydia E. O. Light, College of Humanities & Earth and Social Sciences

Session C: 12:45 pm - 1:45pm

Easel 100 - *LLM-Powered Vulnerability Detection* by Peter Akintunde-Yale; Mentor: Marco Viera, College of Computing and Informatics

Easel 101 - *Individual Factors Affecting the Relationship Between Job Autonomy and Work Outcomes* by Sahara Al-Wajeh, Layna Hubbard, Tasmia Ashrafi, and Catlyn Auton; Mentor: Meghan Davenport, College of Humanities & Earth and Social Sciences

Easel 102 - *Electrochromic Properties of Novel Thiazolo[5,4-d]thiazole Derivatives* by James Anderson; Mentor: Michael G. Walter, Klein College of Science

Easel 103 - *The Roles of Anticipated Stigma and Social Support Processes in the Disclosure of Mood Disorders: A Study of Freshman Roommates* by Gabriella Boutte, Kristin Wilson, Brett Connell, Aine Sotillo, and Luke Adams; Mentor: Amy Canevello, College of Humanities & Earth and Social Sciences

Easel 104 - *Rethinking Conservation Strategy: Comparing Corporate vs. Household Pollution within the Catawba River Basin* by Sean Brule; Mentor: Missy Eppes, College of Humanities & Earth and Social Sciences

Easel 105 - *Weather Modeling and Visualization Using Distributed Computing* by Kaitlyn Brunhaver; Mentor: Erik Saule, College of Computing and Informatics

Easel 106 - *Apartheid's Lasting Effects on Shaping Psychological Health in Black South African Communities* by Noorkaran Chima; Mentor: Heather Smith, College of Humanities & Earth and Social Sciences

Easel 107 - *Investigating and Comparing Sustainable Development Goal #10 in Germany and the United States* by Jazmin Darwin, Zionah Davis, Hailey Morritt, and Jamari Young; Mentors: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Easel 108 - *Synthesis of Antimicrobial Peptide Analogs for DNA Conjugation* by Dhairya Desai; Mentor: Eva Ge, Klein College of Science

Easel 109 - *The Physiographic Evolution of the American Southwest* by Jazmine Ellis; Mentor: Missy Eppes, College of Humanities & Earth and Social Sciences

Easel 110 - *Utilizing Machine Learning to Optimize Stormwater Infrastructure Management Decisions* by Amanda Fye; Mentor: Nicole Roberts and Michael Smith, William States Lee College of Engineering

Easel 111 - *Investigating and Comparing Sustainable Development Goal #4 in Germany and the United States* by Ryan Gee, Kyla Teamer, Landon Griffin, and Mick Keough; Mentors: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Easel 112 - *Leveraging Large Language Models to Enhance Learning Outcomes in Undergraduate Software Engineering* by Jason Gianni; Mentor: Mohsen Dorodchi, College of Computing and Informatics

Easel 113 - *Effect of KRAS Inhibitors on Replication of Oncolytic Vesicular Stomatitis Virus in Pancreatic Cancer Cells* by Aroosh Goje; Mentor: Valery Grdzelishvili, Klein College of Science

Easel 114 - *Scaling Art Classification Models: Enhancing Binary Classifiers and Tackling the Challenge of AI-Generated Art* by Brendan Gorman; Mentor: Todd Dobbs, College of Computing and Informatics

Easel 115 - *Super(efficient)computer: Using High Bandwidth CPU-GPU Memory Interface to Improve Efficiency and Performance* by Andy Ha; Mentor: Tyler Allen, College of Computing and Informatics

Easel 116 - *Developing an Indoor Marine Robotics Testbed for Multi-Robot Navigation and Control* by Madison Hasley; Mentor: Artur Wolek, William States Lee College of Engineering

Easel 117 - *Investigating and Comparing Sustainable Development Goal #3 Good Health & Well Being in Germany and the United States* by Isaiah Hartness, Karol Moreno, and Karina Vilandrosa; Mentors: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Easel 118 - *Palliative Care Readiness (PALCARE) Tool for Older Adults with Cancer and Their Family Caregivers: Development and Validation* by Liliana Hernandez, Savannah Norris, Regine Smith, and Zhuo Job Chen; Mentor: Jyotsana Parajuli, College of Health and Human Services

Easel 119 - *The phage discovery of 'Magdalena'* by Naw Hlaing; Mentors: Sharon Bullock and Michelle Pass, Klein College of Science

Easel 120 - *Tailoring a Sexual Violence Intervention Towards Sexual and Gender Minority Young Adults* by Rhoen Hoff, Parth Vyas, Yasmine Paige, Itati Ramirez, and Sage Rowe; Mentors: Jessamyn Moxie and Annelise Mennicke, College of Health & Human Services

Easel 121 - *Manufacturing Education and Training Using Immersive Digital Twins* by Jia Holt; Mentor: Jose C.M. Outeiro, William States Lee College of Engineering

Easel 122 - *The Effects of Social Support on Prisoner Reentry Outcomes in Emerging Adulthood* by Mia Huffman; Mentor: Shelley Johnson, College of Humanities & Earth and Social Sciences

Easel 123 - *Diversity of Epigeic Spider Species in Different Ground Cover Types in the UNC Charlotte Botanical Gardens* by Hope Hulse; Mentor: Sarah Stellwagen, Klein College of Science

Easel 124 - *A Multifaceted Nature: an Art-Science Exploration of Identities and North Carolina Geology* by Maya Hutagalung; Mentor: Missy Eppes, College of Humanities & Earth and Social Sciences

Easel 125 - *Building Annotated Datasets for AI-Enhanced Cybersecurity Education* by Melody Long; Mentor: Cori Faklaris, College of Computing and Informatics

Easel 126 - *Mental Health and Child Development: An Analysis of Maternal Well-Being as a Predictor of School-Age Children's Cognitive Development* by Sierra Lowery; Mentor: Stephanie Bradley, College of Humanities & Earth and Social Sciences

Easel 127 - *Dynamic Studies of Fluorescently Labeled APE1 Protein in Liquid-Liquid Phase Separation and its Role in Genome Integrity* by Anthony Malone;
Mentor: Shan Yan, Klein College of Science

Easel 128 - *Assessing stream restoration success: Dissolved inorganic carbon as a metric of water quality and watershed function in pre- and post-restoration streams (Reedy Creek, Charlotte, NC)* by Charles McKinnon; Mentor: David Vinson, College of Humanities & Earth and Social Sciences

Easel 129 - *The Political Economy of Policing* by Yasmin Moaf; Mentor: Martin Shuster, College of Humanities & Earth and Social Sciences

Easel 130 - *A Rural Success Story: Rowan County's Public Health Response to the 1918 Spanish Flu Epidemic* by Madison Morgan; Mentor: Heather Perry, College of Humanities & Earth and Social Sciences

Easel 131 - *Creating an AI Assistant Prototype to Improve Mobile Security* by Tyler LaFramboise; Mentor: Cori Faklaris, College of Computing and Informatics

Easel 132 - *Sorority and Self Study* by Alexis Libardi; Mentor: Hannah Peach, College of Humanities & Earth and Social Sciences

Easel 133 - *Development of a Slip-Ring Swivel-Based Mooring System Prototype for a Wave Energy Converter (WEC)* by Justin Logan; Mentor: Michael Smith, William States Lee College of Engineering

Easel 134 - *Design, Manufacturing, and Testing of a High-Speed Loading Device for Material Characterization* by Sebastian Mares; Mentors: Qiuming Wei and Jose C. M. Outeiro, William States Lee College of Engineering

Easel 135 - *Designing Solutions to Improve Digital Safety and Connectivity with Participation from International Students* by Nishka Mathew; Mentors: Sarah Tabassum and Cori Faklaris, College of Computing and Informatics

Easel 136 - *Mechanical Properties of Non-planar 5-axis Polymer Additive Manufacturing* by Gabriel McAnuff; Mentor: Taner Tunc, William States Lee College of Engineering

Easel 137 - *A Comparative Study of Error-Bounded Lossy Compression Techniques for Scientific Data using Machine Learning Model* by Inkwon Oh; Mentor: Jinzhen Wang, College of Computing and Informatics

Easel 138 - *Developing items for measure of bystander intervention to prevent problematic alcohol use among college students* by Justin Ohiaeri, Brianna Jones, Zihui Qiu, and Cristty Castillo; Mentor: Annelise Mennicke and Erika Montanaro, College of Humanities & Earth and Social Sciences

Easel 139 - *Decoding the Link: Hsp70 Phosphorylation and TORC1 Signaling in Yeast* by Shreya Patel; Mentor: Andrew Truman, Klein College of Science

Easel 140 - *Parameter-Efficient Training through Efficient Joint Sparse and Low-Rank Adaptation* by Edgar Perez-Raygoza; Mentor: Christian Kuemmerle, College of Computing and Informatics

Easel 141 - *Zeolite Nanoresin's ability to remove fluoride from water* by Anna Pham; Mentor: Jordan Poler, Klein College of Science

Easel 142 - *A Comparative Study of Pretrained Models for Soybean Disease Classification* by Evan Pickett; Mentor: Opeyemi Alabi, College of Computing and Informatics

Easel 143 - *A Gamified App for Social & Reflective Learning* by Nandana Pillai; Mentor: Qiong Cheng, College of Computing and Informatics

Easel 144 - *Development of a process for Extracting Nanocellulose Fibers from Plant Matter* by Madhava Aditya Bharadwaj Pinapati; Mentor: Roger Tipton, William States Lee College of Engineering

Easel 145 - *Sleeping Beauty Transposase - DNA Complex Structure* by Ragul Ramesh; Mentor: Yuri Nesmelov, Klein College of Science

Easel 146 - *Developing an Evidence-Based Children's Book Based on Emotional Clarity as a Pathway to Public Dissemination* by Tori Rogers; Mentor: Sara Levens, College of Humanities & Earth and Social Sciences

Easel 147 - *Perceptions of Diversity and Sense of Belonging Among Arts Majors and Alumni* by Jahdoi Russell; Mentor: Vaughn Schmutz, College of Humanities & Earth and Social Sciences

Easel 148 - *Assessing MLL Gene Translocations in Human Cells Treated with Bioflavonoids and other Genotoxins* by Emilee Trivette; Mentor: Christine Richardson, Klein College of Science

Creative Arts Abstracts

Note: Abstracts organized in alphabetical order by lead author's last names. All presentations can be viewed on https://symposium.foragerone.com/urc2025/presentations

A Path Shared

Morgan Alexander
Mentored by: Lydia Thompson, College of Arts + Architecture

Using themes of personal growth and identity, I take inspiration from the natural world and the inner workings of biology and ecology in my work. For this project, A Path Shared, I focused specifically on the unique qualities of mollusks and snails by sculpting and illustrating a trio of snails through their trails of self-acceptance. Given that snails are known for their slow movements and protective shells, they are symbols for personal growth - a gradual and often uncomfortable process. In A Path Shared, each snail learns to live and grow within its shell. In my narrative, the snails find that they feel hindered by the confines of their shells. Yet, whether they welcome it or not, their shell is an inseparable part of them. Through their mutual struggles, the journey toward self-acceptance for my snails becomes a little easier. I combined the narrative quality of illustration with the sculptural possibilities of ceramics. To achieve this, working with grey stoneware, I researched how to use the ancient ceramic technique of sgraffito to translate my illustrations onto the surface of the clay. By scraping off the negative space on a colored slip, I told the story of the snail's trials of self-discovery. Through this, I learned how to create exciting possibilities for blending illustrations with ceramics. This project represents a conceptual growth in my work processing modes of community and self-assurance, as well as a technical development to hone my craft.

Mindscape 2024
Maya Hutagalung.
Mentored by: Maja Godlewska, College of Arts + Architecture

“Mindscape” is a surreal Oil and Acrylic painting on hand-built canvas. The purpose of the project was to create a surreal scene. The project encouraged technique exploration. As the project was open ended, I decided to focus on my personal identity. “Mindscape” takes inspiration from traditional Chinese Paintings and gives a contemporary twist. I began by adding texture and splashes of color by laying the canvas facedown onto a tarp covered in dollops of paint. The goal of this technique was to take away any control I had in planning the scene. This was an intuitive painting process. I learned how to let go of control in my painting process in order to allow self-reflection and expression to come through. My marks were made on the spot, challenging me to reflect on how I felt in the current moment. By diverging from my usual process, “Mindscape” broke me out of my conventions and showed me a new way of expression through art. Art can evoke self-reflection. My exploration of my American Chinese-Indonesian identity informed my piece. Specifically, how Chinese-Indonesian discrimination impacted my family. I lost a huge connection to my Chinese roots and struggle to reconnect with this portion of my identity. What’s fascinating is when viewers tell me of the different conclusions they draw from it related to their own identities. With this intuitive painting process, I aim to learn more about how my personal experiences bleed onto the canvas and translate to the audiences’ own.

Medical Illustration Surgical Study after Maclise
Fairlight Strong
Mentored by: Jessica Burke, College of Arts + Architecture

This drawing was used to better understand the complex anatomy of human hands. It is based on the drawings of Joseph Maclise, Fellow of the Royal College of Surgeons, for ‘Quain’s Anatomy of the Arteries” and for his own surgical anatomy. This is indeed ‘high’ art, only incidentally of an anatomical subject. If the analogy is not too far-fetched, Maclise’s drawing may be compared with the work in different media of English Romantic poets or of the composer Berlioz. This analogy inspired my use of color and media.

Organic Abstraction
Ava Weaver
Mentored by: Jessica Burke, College of Arts + Architecture

This artwork explores deforestation and the loss of biodiversity. At the outset of the 20th century, there were approximately 31 million square miles of forest around the world. Today, that number has shrunk to less than 25 million square miles. Much of this decline can be attributed to expanding agricultural land use and increasing demand for wood and paper products. To expand upon these ideas, I used a warm, red-toned color palette for the piece. This is inspired by the arid, barren appearance of areas that have been affected by mass deforestation. To add a bit of a narrative, I decided to play off the idea of “Mother Nature” by making the form slightly feminine. This is done by placing the fungi pieces in a way that replicates the idea of a female form, with hair, a head, arms, and a dress, while still allowing the form to remain abstract. This piece is created entirely with Prisma Color Colored pencils on orange-toned paper. An interesting aspect of this project is that we were required to create our own reference images by digitally dissecting and compositing other images. This allowed us to create a reference that does not break copyright rules, as it is a new creation, and all pieces gathered had to have a Creative Commons license. The use of toned paper and colored pencils also pushed us to increase our skills with color media. The process of creating this piece was quite time-consuming, as colored pencil is quite a slow medium, given the process involves a slow and careful layering of color to achieve the correct hue and blend between colors. Specific areas of this piece that took the most time and attention to render are the large bunch of yellow fungi, as well as the delicate white fungi that make up the middle of the piece

Oral Presentation Abstracts

Note: Abstracts organized in alphabetical order by lead author's last names. All presentations can be viewed on https://symposium.foragerone.com/urc2025/presentations

Role of SEA complex in micro-autophagy

Shehdan Abbasi
Mentored by: Richard Chi, Klein College of Science

The SEA complex is a key modulator of TORC1, the central regulator of growth, metabolism and macro-autophagy for all cells. However, it is not known if the SEA complex also has roles in other TORC1 catabolic pathways such as micro-autophagy.
Micro-autophagy plays a crucial role in maintaining cellular homeostasis by removing damaged or excess components, ensuring the proper balance of cellular functions. It facilitates nutrient recycling, allowing cells to break down and reuse biomolecules, particularly during periods of nutrient deprivation. However, despite its significance, very little is known about its precise molecular mechanisms, and further research is needed to fully understand how micro-autophagy is regulated and executed within cells. Overall, micro-autophagy is essential for cell survival, adaptation, and maintaining overall cellular integrity. In this study, we demonstrate that micro-autophagy protein Vph1-GFP processing is defective 2-fold in SEA complex mutants, while Vph1-GFP vacuole morphology is 95% defective. This is a significant result since little is known about the regulation of micro-autophagy and this is the first time the SEA complex has been implicated in micro-autophagy.

Special category: Honors College

Reactive oxygen species and NLRP3 Inflammasome alter macrophages and inflammation within the breast tumor microenvironment

Shely Acosta
Mentored by: Didier Dréau, Klein College of Science

Triple-negative breast cancer (TNBCs) represents 15-21% of all breast cancer cases in the US and exhibit poor response to current therapies, with a 65% 5-year survival rate. Standard care, including neoadjuvant chemotherapy, improves survival rates, while emerging cancer immunotherapies show promise. Tumor-associated macrophages (TAMs) play a crucial role in TNBC progression by secreting proinflammatory cytokines. TAMs are predominantly M2-like, immunosuppressive, and pro-angiogenic, contributing to inflammation through inflammasome activation. The NLRP3 inflammasome triggers the secretion of IL-1β and IL-18 inflammatory cytokines, and inhibiting NLRP3 with MCC950 reduces both caspase-1 activity and IL-1β secretion. Reactive oxygen species (ROS) expression is regulated by glutathione, and the deglutathionylation of the scaffolding protein ASC1 promotes the formation of active NLRP3 complex. Thus, we hypothesized that interactions between ROS expression and NLRP3 formation may drive NLRP3 inflammasome activation modulating ROS expression and cell apoptosis. In silico data identified specific glutathione transferases as associated with breast cancer progression. Experimentally, glutathione supplementation drastically decreased ROS expression and J774 apoptosis. Moreover, inhibitors of glutathione transferases also altered ROS expression and apoptosis associated with NLRP3 inflammasome activation triggered by the canonical ATP and LPS activator cocktail as well as in the presence of TNBC conditioned media mimicking the tumor microenvironment. Interestingly, the chemokine CXCL12 led to a significant decrease in TNBC-driven ROS expression in macrophages. Together, these findings highlight the potential of the complex interplay between oxidative stress and NLPR3 inflammasome-driven inflammation in breast cancer progression.

Machine Learning Future Drive Towards Enhanced Learning

Mujtaba Ali Khan & Hafsa Konain
Mentored by: Erik Jon Byker, Office of Undergraduate Research

Abstract – Real-world applications are strongly associated with data, their storage, their consistency that require Machine Learning Techniques. While this data is maintained, it may sometimes lead to poor quality of data, insufficient information which has an adverse effect on the applications of Machine Learning techniques. Various data storage techniques may encounter issues in accessing which is adversely correlated to the data privacy, its security and the regulations that encompasses it. Considering these challenges, our study discusses extensive approaches to review the existing research that discusses the various modeling techniques of machine learning that can enhance the data regulations. Our study involves various dynamics of data revolutions, Human Computer Integration, Natural Language processing, medical observations and various corporate aspects. We have also discussed the critical analysis of data privacy integrated with machine learning models and their simulation with neural network and AI based generative models. The challenges and opportunities that prevail in this field and their potential for future developments are also discussed.

Special category: Globally Focused Research

Joint energy and data transfer optimization in collaborative aerial and ground vehicular network

Gabriel Almodovar
Mentored by: Miao Wang, William States Lee College of Engineering

As self-driving vehicles become more common, they face a critical challenge: maintaining safe, real-time navigation in areas where traditional communication infrastructure is limited, unreliable, or unavailable. This research addresses that gap by developing a framework for joint optimization of energy and data transfer in a collaborative network of unmanned aerial vehicles (UAVs) and autonomous land vehicles. By integrating UAVs into a Space-Air-Ground Integrated Network (SAGIN), we propose a system where drones act as mobile communication relays, providing real-time guidance and connectivity support — especially along highways and infrastructure-sparse regions. These UAVs interact with ground stations and edge computing nodes to ensure fast data exchange and situational awareness while conserving limited onboard energy. The formulation process defines core system variables — including UAV and vehicle dynamics, communication data rate, latency, transmission power, and energy consumption — all expressed in tensor form for multi-agent scalability. System parameters are then introduced to reflect realistic operational constraints. Objective functions are constructed to balance both communication performance and energy efficiency. Future work includes implementing these formulations in simulation, testing how effectively UAVs can support land vehicles under dynamic mobility and terrain conditions. This framework lays the groundwork for a scalable, intelligent transportation network that ensures reliable, real-time connectivity for autonomous vehicles through collaborative air–ground optimization.

Special category: OUR Scholars

Examining beneficial fungal partnerships in wild and cultivated soybean
Kody Angell
Mentored by: Bao-Hua Song, Klein College of Science

Soybean (*Glycine max*) is a staple food crop globally valued for its protein and oil content. However, soybean growth is influenced by various biotic and abiotic factors, including soil nutrient availability and microbial interactions. Notably, arbuscular mycorrhizal fungi (AMF) form symbiotic relationships with plants, enhancing nutrient uptake and stress tolerance. Previous studies have explored the individual interactions between soybean and AMF, demonstrating that AMF can improve plant health, particularly in nutrient-poor soils. However, little is known about the comparative effects of AMF on plant performance (e.g., plant height and biomass) in cultivated soybean and its wild ancestor (*Glycine soja*). Despite being a rich source of genetic diversity, wild soybeans have been largely underutilized in agricultural research. This study is the first to investigate how AMF influences plant height and root biomass in both cultivated and wild soybeans. Specifically, a mixture of AMF species was employed to examine its effects on plant growth traits across two treatment groups: control and AMF-inoculated. Our findings suggest that AMF boosts plant height and root biomass more for wild soybean than it does for cultivated soybean. This study provides novel insights into AMF-mediated growth enhancement, which could inform strategies for improving soybean productivity and resilience through the introduction of wild alleles.

Special category: Honors College

“Chimeras, Discords, and Altercations”: O’odham Motivations Behind the Uprising of 1751

Cayla Avant
Mentored by: Carol Higham, College of Humanities & Earth and Social Sciences

In the late 1680s, Father Eusebio Francisco Kino led Spanish Jesuit missionization across the Pimeria Alta in modern-day Northern Mexico and Southern Arizona and established mission settlements that transformed the lives of the O’odham, also referred to as the Pima, through Spanish land theft, exploitation of Indigenous labor, and Christianization. European racial ideologies and governance systems poisoned Jesuit's understandings of the O'odham's needs while the fear of the insurrectionary Indian pervaded the treatment of Indigenous groups across New Spain. As a result of over a century of Spanish colonization, the Pueblo Revolt of 1680 forced Spanish officials and Franciscan missionaries out of Pueblo territory for twelve years. Invigorated by the success of the Pueblo Revolt, the O’odham led multiple smaller-scale revolts and raids against Jesuit missionaries and Spanish authorities from 1684 to 1751. In 1751, O’odham’s grievances and their previous smaller-scale revolts culminated in the O’odham uprising against Spanish authorities and Jesuit missionaries, primarily led by native Captain General Luis Oacpicagigua. This presentation will address Jesuit and Spanish encroachment on O'odham traditional lifeways, destruction of agricultural practices, changing power structures among the O’odham, and how the influence of other indigenous revolts within New Spain outweighed the mutually beneficial aspects of O'odham-Spanish relations and motivated the 1751 revolt.

Special category: Honors College

The role of macrophage-inducible C-type lectin, Mincle in staphylococcal osteomyelitis

Nicole Azar
Mentored by: Erin Mills, Ian Marriott, and M. Brittany Johnson, Klein College of Science

Osteomyelitis is a serious infection of the bone and joints that causes progressive inflammatory tissue damage and osteonecrosis. Despite current treatment options, infections are often recalcitrant and recurrent due to the rise of antibiotic resistance in the primary causative agent, Staphylococcus aureus, and the ability of S. aureus to persist inside resident bone cells. This necessitates further investigation of S. aureus pathogenesis to identify new therapeutic targets. It is now known that resident bone-forming osteoblasts express pattern recognition receptors (PRRs) that are crucial for detecting bacterial ligands and initiating the production of cytokines and chemokines. Our previous studies demonstrate that primary murine osteoblasts upregulate mRNA encoding macrophage inducible C-type lectin receptor, Mincle, following bacteria challenge. Mincle is a known PRR that is expressed by innate immune cells and recognizes bacterial ligands; however, its role during Staphylococcal osteomyelitis is undefined. Here, we hypothesized that Mincle plays a role in initiating bone cell cytokine responses to S. aureus infection during osteomyelitis. Our data indicates that primary human osteoblasts constitutively express Mincle at low levels and that such expression is markedly upregulated following stimulation with known Mincle ligands and S. aureus infection. Accompanying changes in Mincle expression, Mincle-specific ligands, and S. aureus stimulate significant production of the proinflammatory cytokine, IL-6, by human osteoblasts, supporting a potential role for Mincle during Staphylococcal osteomyelitis. Studies are ongoing to determine the contribution of Mincle activation to bone cell inflammatory responses and evaluate if Mincle-mediated responses are protective or detrimental during osteomyelitis.

Special category: Honors College

“Incapable of Joyful Expression?” The Bass Clarinet as a Solo Instrument

Sufian Azfar
Mentored by: Jay Grymes, College of Arts + Architecture

The bass clarinet, a low woodwind instrument in the clarinet family, has evolved significantly since its early prototypes in the 18th century. Originally conceived as a more robust alternative to the bassoon, it underwent numerous design changes before reaching its modern form, largely influenced by Adolphe Sax. Despite its long-standing role in orchestral settings, the bass clarinet has increasingly emerged as a solo instrument.
While some composers viewed it as limited in expression, others, such as Hector Berlioz and Kent Kennan, recognized its unique timbral qualities and solo potential. The instrument’s deep, resonant low register and surprising agility make it well-suited for expressive solo passages across genres. A pivotal moment for the bass clarinet’s solo presence came with jazz musician Eric Dolphy, whose groundbreaking performance of *God Bless the Child* showcased the instrument’s full emotional and technical range. Dolphy’s virtuosic improvisation and extended techniques redefined the bass clarinet’s role, demonstrating its potential beyond classical music. Through historical analysis and key musical examples, this paper explores the bass clarinet’s transformation from an overlooked orchestral voice to a powerful solo instrument. In this lecture, I will discuss the bass clarinet’s capabilities as a powerful solo instrument in both the jazz and classical world and perform Eric Dolphy’s famous rendition of *God Bless the Chil*d, which showcases the instrument’s solo versatility.

Misogynoir and Psychological Distress in Black Women

Gabriella Boutte
Mentored by: Amy Canevello, College of Humanities & Earth and Social Sciences

Black women's race and gender are identities of marginality that interact in ways that create unique experiences of discrimination for them (Donovan & West, 2015). Misogynoir is defined as the intersection of racism and sexism directed exclusively at Black women (Bailey, 2021). It is characterized by stereotypes that paint Black women as hypersexual, aggressive, unreasonable, and unprofessional. Misogynoir targets Black women exclusively for things beyond their control, such as their appearance, and often leaves them feeling unsafe and misunderstood (Bailey, 2021), which may correlate with experiences of psychological distress. Despite suggested relationships between misogynoir and symptoms of psychological distress, its direct relation to Black women's mental health is currently understudied (Lewis et al., 2017). I hypothesized that misogynoir would relate to feelings of inadequacy which will positively correlate with symptoms of dysthymia (a low-grade depression characterized by its prolonged persistence), and whether social support will moderate the potential link between the constructs. Additionally, I hypothesized that misogynoir will negatively relate to feelings of safety and subsequently positively correlates with symptoms of anxiety. I will recruit 250 Black women to complete online measures of misogynoir, dysthymia, feelings of inadequacy, perceived available social support, anxiety, and feelings of safety. I will test the hypotheses using mediation analyses. If the hypotheses are supported, findings will suggest a link between misogynoir and negative mental health outcomes in Black women.

Special categories: Community Engaged Research, Honors College

Bridging the Gap: Enhancing Support for Hispanic Students in Charlotte-Mecklenburg Schools

Claire Broome
Mentored by: Allison Stedman, College of Humanities & Earth and Social Sciences

As one of the fastest growing metropolitan areas in the nation Charlotte, NC has not only seen a rapid increase in its overall population of citizens, but also in its economic growth, and cultural diversity. This has been due in part to a surge in Hispanic residents that live within the city, and the population increase of this particular group has caused significant changes to the demographics within the Charlotte-Mecklenburg School system (CMS). As of 2024, the school system was serving over 43,000 Hispanic students, which is a little over 28% of the district population. However, despite the district's growing experience with serving Hispanic students over the past few decades, these students are still consistently falling behind in graduation rates, standardized test scores, and post-secondary academic success as compared to their non-Hispanic peers. Research suggests that Hispanic students are even more likely to experience the potentially adverse effects of acculturation if they attend schools within the CMS system that have a predominantly white, or non-Hispanic population. Acculturation can produce stress, low self-esteem, and division within the familial unit due to differences in Hispanic cultural values and those of the dominant American population. This suggests that CMS are currently not providing enough resources to support the cultural gap that repeatedly negatively impacts the success of Hispanic students every year. This thesis will analyze the three main programs within CMS that currently attempt to address the unique social challenges that Hispanic students face while attending public schools. The goal of this research will be to assess the strengths and weaknesses of these support programs to provide potential recommendations for how the resources and opportunities to Hispanic students throughout the district might be improved to ensure that these students have the best chance for success.

Special category: Honors College

We Have Invented Nothing: Prehistory, Modernity, and Cognition
Celia Castaldo
Mentored by: Jae Emerling, College of Arts + Architecture

Prehistoric art is simultaneously distant and familiar, timeless but temporally specific. It is a key to understanding humanity's aesthetic and existential concerns across eras. Art creation as both symbolic mark-marking and place-making signifies the anthropological development of symbolic thought and a fundamental shift in cognition that encapsulates humanity's transition from toolmaking to symbolic expression. This research project explores the epistemic ruptures caused by the cognitive return to prehistoric art (40,000-10,000 BCE) within modernism. From Picasso to Brancusi to the Surrealists, modernism constructed itself in relation to urbanization and large societal transformations, but also through a complex relation to prehistoric art. My thesis is that these two pivotal moments embody instances of transformative creativity that reshaped human cognition and cultural perception. More specifically, I posit prehistoric art and Surrealism as experiments with unconscious and symbolic realms that retrace the limits of epistemology. Drawing primarily on Maria Starvinaki, Georges Bataille, and Philippe Descola, I argue that art practice is neither a reflection of a preexisting cultural or political history nor is it autonomous from these contexts. Instead, art renders visible and intelligible the intensified experiences of human beings both within and beyond their immediate present in ways that refute the distinctions between nature and culture. Modernism is haunted by its central paradox: the pursuit of the new through a return to origins. As Picasso famously said when he encountered the prehistoric cave paintings in Altamira, "we have invented nothing." To this we should add: *but we can evoke everything*.

Special category: Globally Focused Research

The Great Organelle Hunt: Game-Based Learning for Cellular Biology

Devin Cho
Mentored by: Jessica Burke, College of Arts + Architecture

The Great Organelle Hunt! Enhances learning and retention of biological concepts in children aged 8–12. Players travel through a eukaryotic cell, collecting eight organelles and racing to the nucleus. The game transforms complex topics, such as organelle functions and cellular processes, into interactive and engaging gameplay. Unlike passive learning methods, it promotes active participation through decision-making, challenges, and immediate feedback. During early childhood development, children build critical thinking skills and make sense of the world through experimentation, a fundamental learning process. Research supports this by showing that game-based learning, which encourages exploration and problem-solving, fosters social skills, emotional regulation, motivation, and engagement. These cognitive, social, and emotional benefits ($g = 0.38$ to $g = 0.44$) (Alotaibi, 2024) demonstrate how interactive learning enhances development. *The Great Organelle Hunt!* Balances scientific accuracy with engaging gameplay, making biological concepts accessible and enjoyable. A key challenge was simplifying complex topics, which was addressed through relatable analogies, such as “the mitochondrion is like a power plant.” To further increase engagement, I illustrated character-based organelle pawns, bringing science to life. I also referenced electron micrograph imagery to ensure accurate yet visually appealing representations of organelles, enhancing the educational experience through artistic interpretation. By merging art and science through visual, tactile, and auditory experiences, the game is a model for future educational tools that make complex subjects more accessible and adaptable across STEM disciplines.

Women Composers of the Classical Era

Ali Chrisley
Mentored by: Jay Grymes, College of Arts + Architecture

For as long as music has been a pivotal force in culture and society, women have contributed, even as history repeats itself: attempting to repress their achievements. What would examining women composers of the Classical era teach scholars about the impact their compositions had in a male-dominated world? I analyzed five women composers of different backgrounds and statuses during the Classical era and compared their works to each other and their male counterparts. Maria Theresa Agnesi's reputation as a composer is highly regarded, but unappreciated by modern-day musicologists. Her performances in vocal and harpsichord music caught the attention of nobles which led to her career of composing for the Empress of Austria who supported women's rights, the Enlightenment, and was a loyal patron of Agnesi. All preserved pieces by Agnesi reflect her skill as a performer. *Son Confusa Pastorella* is one of her most famous vocal works and showcases her strong focus on emotion and characters. Her elaborate text painting, attention to detail and her portrayal of the heroine solidifies Agnesi's reputation as a sensitive composer. Although she had the education and skill to become a well-known composer, her husband acted irresponsibly with their finances, and when he passed, Agnesi relied heavily on patrons such as the Empress Maria Theresia. Despite the efforts of her followers, Agnesi sadly spent her final years in poverty and isolation from the musical scene. Maria Teresa Agnesi was an artist by vocation, professional by training, but forever an "amateur" because she was a woman.

Unveiling Novel Cargo in the AP-3 Pathway

Brianna Collado-Almonte
Mentored by: Richard Chi, Klein College of Science

The AP-3 pathway is a critical cellular transport system responsible for directing specific proteins from the trans-Golgi network to the lysosome (vacuole in yeast). Identification and transportation of cargo proteins usually involves the AP-3 complex, which plays a key role in cargo recognition and transport. However, very little is known about most proteins that reside on this organelle. Budding yeast, whose vacuole is the equivalent of the metazoan lysosome, has proven to be an important model system for studying the biogenesis of lysosome related organelles. Defects in the AP-3 complex were first discovered in yeast, and have been linked to various diseases, including Hermansky-Pudlak Syndrome, Batten disease, and Schizophrenia in humans. In this study, we conducted a high-content visualization screen to uncover novel cargos that utilized the AP-3 pathway to localize to the vacuole in yeast. We visualized over 300 yeast proteins annotated to be localized on the vacuole membrane and scored for the presence and absence of vacuole localization in wild type and AP-3 mutant cells. Using this strategy, we believe we have uncovered multiple novel cargoes that utilize the AP-3 complex and believe these findings will provide further insight into the mechanisms that underlie AP-3 related diseases.

Special categories: Globally Focused Research, Honors College

Development of Thiazolo[5,4-d]thiazole Photosensitizers for Photodynamic Therapy and for Photoinactivation of Bacteria

Nick Eberwein
Mentored by: Michael Walter, Klein College of Science

In recent years, photodynamic therapy (PDT) has been used to offer non-invasive cancer treatments, dermatological treatments for psoriasis and eczema, and other medical interventions. Despite being used since the 1980s, there are only a handful of FDA approved photosensitizers, the majority of which are porphyrin derivatives. Here, a non-porphyrin derived compound is suggested for its use as a photosensitizer for both clinical and non-clinical applications. Thiazolo[5,4-d]thiazole (TTz), and its derivatives, are a group of widely applicable dyes. The core is a highly rigid and planar bicyclic heterocycle, which can be elongated with organic substituents. This group of compounds has been widely studied for their use in cell voltage-sensing, photoredox catalysis, electrochromic and photochromic applications, and in other photochemical applications. An asymmetric TTz derivative will be evaluated for its photosensitizing property.

Special categories: Honors College, Phi Kappa Phi (PKP) Member, Sustainability Research

Inclusive Language Evolution in Spanish: Exploring Institutional Impact
Saniya Gabriel
Mentored by: Allison Stedman, College of Humanities & Earth and Social Sciences

The evolution of inclusive language in Spanish, especially regarding the incorporation of gender-neutral terminology, has sparked significant debate and reform in recent years. Much of the existing literature focuses on the social and cultural drivers behind this linguistic shift, including the influence of feminist movements and LGBTQIA+ advocacy. However, the role of cultural institutions in advancing or slowing these changes remains insufficiently examined. This thesis seeks to address this gap by exploring the impact of key Spanish language academies, particularly the Real Academia Española (RAE) and the Academia Norteamericana de la Lengua Española (ANLE), on the adoption and legitimization of inclusive language. Through an analysis of policies, publications, and official statements from these institutions, this study will evaluate their role in influencing public language use and shaping linguistic norms. This thesis will also draw on academic discourse regarding linguistic inclusivity, providing an in-depth exploration of the broader social, political, and cultural forces that contribute to linguistic evolution. It is expected that this research will provide deeper insight into the mechanisms that allow these academies to balance traditional language with new inclusive practices. The findings will contribute to a more comprehensive understanding of how cultural institutions affect the development and acceptance of inclusive language in the Spanish-speaking world.

Special category: Honors College

Art and History of Marginalized Communities: Marc Chagall and Robert Mapplethorpe
Alastor Gilbert
Mentored by: Malin Pereira, Honors College

Art and its many media communicate political and personal turmoil, often preserving the artist's internal conflict in relation to their engagement with political movements of their time. Marc Chagall and Robert Mapplethorpe famously exemplify the progression of understanding one's place in their community by making radical changes in art. Chagall incorporates his experience growing up as a Jewish man surrounded by other Jews becoming displaced throughout his life, preceding and through the Holocaust. Mapplethorpe works through his realization and acceptance of being gay during the AIDS Epidemic. These artist's journeys of self-understanding are almost mirrored, creating a unique opportunity to develop an understanding of their art and communities.
Comparing the evolution of the symbolism, form, and content of these two artists and their art, reveals the preservation of radical art and ideas in marginalized communities through history. Simultaneously, the art Chagall and Mapplethorpe produced, preserved, and progressed the public opinion of the marginalized communities they represented. This inquiry intends to bring attention to the humanity and history of the Jewish and LGBTQIA+ communities in the present. The visual arts field will benefit from the connection made between Chagall and Mapplethorpe through the in-depth study of their impact as members of marginalized communities.

Special category: Honors College

Women and the Production of 19th Century Knowledge
Leila Hachani
Mentored by: Alan Rauch, College of Humanities & Earth and Social Sciences

In an era when women's intellectual activities were largely restricted to the domestic sphere, Catherine Vale Whitwell's *An Astronomical Catechism* (1818) uniquely integrated scientific education with maternal instruction. By presenting astronomy lessons as dialogues between a mother and daughter, Whitwell effectively made scientific inquiry accessible, subtly challenging prevailing assumptions regarding women's intellectual capabilities. Whitwell's adoption of the catechism—a format traditionally associated with religious teachings—extended scientific knowledge to women and young learners, traditionally excluded from formal scientific discourse. Utilizing archival research and feminist theoretical frameworks, this analysis explores how Whitwell's text disrupted established boundaries between public and private spheres, thereby asserting women's intellectual authority in domains typically closed to them. Beyond merely carving out space for women's participation in scientific discussion, Whitwell's catechism underscores the significant cultural role scientific catechisms played within early educational movements. By embedding science within maternal instruction, Whitwell democratized knowledge and created an environment where women's intellectual contributions could gain legitimacy despite societal constraints. Ultimately, Whitwell's innovative approach broadened access to scientific knowledge and laid essential foundations for future generations. Her pioneering efforts contributed significantly to shaping scientific communities and expanding the recognition of women's contributions to science. Today, Whitwell's work stands as a testament to bold innovation and its lasting influence on science and education.

Special category: OUR Scholars

Autonomous Decentralized Multi-UAV Coordinated System
Mohammad Hasan & Chandra Siddhartha Geddam
Mentored by: Ran Zhang, William States Lee College of Engineering

Unmanned Aerial Vehicles (UAVs), commonly known as autonomous drones, play a critical role in next-generation aerial systems, offering flexible, adaptive solutions for a wide range of applications. This research focuses on the development of a decentralized multi-UAV communication and coordination system, where multiple drones collaborate without centralized control. Leveraging advanced onboard sensors, including stereo vision-based depth cameras, UVDAR systems, and 3D LiDARs, alongside compact high-performance computing platforms like the Intel NUC, each UAV operates with real-time situational awareness and decision-making capabilities. Intelligent coordination protocols and reinforcement learning algorithms enable UAVs to dynamically share information such as spatial positioning, task priorities, and network coverage requirements. This decentralized approach allows the UAV network to make cooperative decisions in real-time, enhancing mission performance in complex environments. Applications include autonomous search and rescue, large-scale mapping, and scalable aerial communication networks that adapt to dynamic conditions. Through sensor fusion and distributed learning, the proposed system demonstrates a robust and resilient framework for next-generation UAV operations.

Special category: OUR Scholars

Substance P and IFN-β's Role in Murine Osteoblast Differentiation

Thomas Hoggarth
Mentored by: M. Brittany Johnson, Klein College of Science

Osteomyelitis is a bone infection characterized by inflammatory bone loss with *Staphylococcus aureus* accounting for 80% of recorded cases. Despite medical advances, current treatment options including systemic antibiotics and surgical debridement often fail, highlighting the need for alternative approaches to protect bone health. During osteomyelitis there is a disruption of bone homeostasis by the imbalance between bone-building osteoblast and bone-resorbing osteoclasts, leading to net bone loss. Therefore, identifying new regulators of bone homeostasis could reveal novel therapeutic targets for treatment. Osteoblast differentiation, the process of bone-forming cell maturation, may be influenced by two potential regulators our lab has identified: the neuropeptide substance P (SP) and the type I interferon (IFN-β). SP is secreted by neurons including those that innervate bone tissue. We previously demonstrated that bone cells express the neurokinin receptor 1 (NK-1R) and respond to SP treatment. Additionally, during *S. aureus* challenge osteoblasts produce the immune mediator, IFN-β which has been implicated in modulating bone homeostasis. Here, we investigated the hypothesis that IFN-β and SP cause a decrease in osteoblast differentiation. To investigate their effects on osteoblast function, we measured alkaline phosphatase (ALP) expression, a marker of osteoblast differentiation. Our findings indicate that IFN-β exhibits a trending decrease in osteoblast differentiation, whereas SP has no effect. These results suggest that IFN-β may inhibit osteoblast maturation thereby impair bone regeneration during *S. aureus* infection. Understanding the mechanism underlying IFN-β modulation of osteoblast differentiation may inform future therapeutic approaches aimed at preserving osteoblast function and mitigating bone loss in osteomyelitis.

Special category: Honors College

FLAVi 2: Increasing Efficiency and Accessibility of *Flaviviridae* Genome Annotation

Cayden Jacobsen
Mentored by: Denis Jacob Machado, Klein College of Science

Genome annotation is a fundamental process in bioinformatics, enabling researchers to predict the position and function of genes. The Fast Loci Annotator for Viruses (FLAVi) is a computational tool designed for *Flaviviridae* genome annotation. However, the original FLAVi implementation relies on outdated dependencies such as TransDecoder and GeneWise 2.0, which limit its efficiency and usability. This thesis focuses on optimizing FLAVi's performance and accessibility by removing deprecated dependencies, implementing a containerized deployment, and enhancing annotation accuracy using Profile Hidden Markov Models (HMMs) for signal peptide recognition. Much of this work also involves expanding FLAVi's capabilities to support CSV to GFF3 format conversion, improving interoperability with genomic data pipelines. By restructuring and modernizing FLAVi, we aim to increase its annotation speed by at least 10%, maintain its accuracy, and make it more accessible to researchers through an intuitive containerized deployment.

Special categories: Honors College, Phi Kappa Phi (PKP) Member

Genetic diversity of HLA pseudogenes in Amerindian populations: copy number variation and population dynamics

Asrin Jama
Mentored by: Danillo G. Augusto, Klein College of Science

The human leukocyte antigen (HLA) complex plays a crucial role in immune response and transplantation outcomes. There is a gap in the study of *HLA* pseudogenes— presumed non-functional genomic segments that can provide valuable insights into evolutionary history. The Guarani and Kaingang, indigenous populations of South America, exhibit unique genetic profiles shaped by centuries of geographical isolation and distinct migrations patterns. The aim is to characterize copy number variation (CNV) in four specific *HLA* pseudogenes (*HLA-H, HLA-N, HLA-S,* and *HLA-J*) among Guarani (n=50) and Kaingang (n=50 populations. By examining these pseudogenes, we seek to contribute to a more comprehensive understanding of HLA complex diversity. Genomic DNA was extracted from blood samples. Droplet digital PCR (ddPCR) was used to accurately quantify copy numbers of the target pseudogenes, using RPP30 as a reference gene. Copy number analysis was performed using QX Manager software, which measured fluorescence intensity for each droplet across all channels, classifying them as positive or negative. The copy number variation was assessed by comparing concentration of specific targets with the copy-stable reference gene RPP30. Our preliminary findings revealed consistent copy numbers of two for pseudogenes *HLA-H, HLA-N,* and *HLA-S* across 8 tested samples in both populations, indicating their stable presence throughout these groups. This pattern suggests low copy number variation of these pseudogenes in the studied populations. Notably, the *HLA-J* pseudogene was absent in three samples. Our study pioneers the mapping of *HLA* pseudogene CNVs in Amerindian populations, revealing novel aspects of their genetic diversity and evolutionary history. These findings promote inclusive genetic research, a better characterization of human genetic diversity, and might bring novel insights regarding population-specific clinical approaches for these communities.

Research team: Asrin Jama, Luciana de Brito Vargas, Hellen C. Issler, Maria Luiza Petzl-Erler, Ticiana Della Justina Farias, Danillo G. Augusto

Special category: Honors College

Experimental Evolution of Vesicular Stomatitis Viruses

Charlotte Johnstone
Mentored by: Valery Z. Grdzelishvili, Klein College of Science

Pancreatic adenocarcinoma (PDAC) is a devastating disease with limited treatment options. Oncolytic virotherapy (OV) represents a promising approach by utilizing replication-competent viruses to selectively target and destroy cancer cells. Our lab focuses on vesicular stomatitis virus (VSV), particularly VSV-ΔM51, as a potential therapy for PDAC. Although this virus has demonstrated effectiveness against certain PDAC cell lines, it has been less successful against more resistant types. To address this challenge, our lab has previously employed experimental evolution by subjecting VSV to serial passaging in resistant PDAC cell lines within liquid media. Our study builds on this earlier work by modifying the environmental conditions to which the virus is exposed, specifically comparing liquid media with an agar overlay to mimic the PDAC tumor environment. In our experiment, we developed six viral mutants - three passaged in agar and three in liquid media - and assessed phenotypic changes during each passage using plaque assays. We were particularly interested in variations in plaque number and size among the viral mutants, as these characteristics offer insight into each mutant's ability to infect, replicate, and lyse PDAC cells. Going forward, we will continue employing plaque assays alongside additional methods, such as viral kinetics and particle production, to further characterize viral fitness. The ultimate objective of this study is to develop a virus capable of effectively replicating in resistant PDAC cell lines and within an environment that closely resembles a PDAC tumor.

Identify Chromosomal Instability in Prostate Cancer Cells with Acquired Chemoresistance

Yara Kayali
Mentored by: Junya Tomida, Klein College of Science

Prostate cancer is a leading cause of cancer deaths in men, with over 313,000 new cases and 35,000 deaths expected in the U.S. in 2025. A major challenge in treating advanced prostate cancer is the development of resistance to chemotherapy drugs. While certain chemotherapeutics are effective for some patients, many patients either don't respond or develop resistance. The protein FAM35A is a key regulator in DNA damage repair and facilitates non-homologous end joining when DNA double-strand break occurs in the cells. Our previous report suggested that FAM35A is frequently deleted in prostate cancer and metastatic prostate cancer. Also, FAM35A is expressed at an even lower rate in metastatic prostate cancers. Interestingly, our group found that deletion of FAM35A and another gene causes chemoresistance in breast cancer. We expect that FAM35A is also involved in the development of chemoresistance in prostate cancer. Through our study, we aimed to understand how FAM35A contributes to chemotherapy resistance in prostate cancer cells. We created chemoresistant prostate cancer cell lines and measured the induction of chromosomal instability in these lines. The results of this research will provide new insights into a novel mechanism of chemoresistance in prostate cancer.

Special category: Honors College

Taboo of Death: How Does the Sociological Approach to Religion Interconnect with Death Perception?

MacKenzie Kirby
Mentored by: Diane Zablotsky, College of Humanities & Earth and Social Sciences

In Western cultures, death is a topic that progresses and molds as societal norms and institutions develop. Death is still deemed a relative nuisance to the psychological welfare of our society. Because of this, euphemisms are used through religions causing the confrontation of death in its entirety to be delayed. The Taboo of Death Theory suggests that people treat the topic of death and sex the same. Both are uncomfortable topics, leading to the usage of euphemisms to express. This study investigates and analyzes how different religions (Catholic, Judaism, and Islam) and cultures contribute to applying the Taboo of Death. Conducting Interviews with Priests, Rabbis, and Imans serves as a gateway into understanding how different faiths interact with death and parallel sex. This study also acknowledges the customs and folkways of those who practice these religions. This presses us to find out why we treat death the way we do. The expected findings are that each religious community gives a unique perspective on how the Taboo of Death contributes to and relates to their practices. Data will be gathered through Critical Literature Interviews and Key Informants. This research is important because it opens opportunities to have sophisticated discussions about death healthily. This research also promotes questions about why religions and cultures interlink their faith with death. Understanding the parallel between the two, alongside The Taboo of Death Theory, can create a new, more sociological way of thinking in our society.

Special categories: Community Engaged Research, Globally Focused Research

Empowering Change: The Evolution of UNC Charlotte's Sustainable Development Goals Club

Isabella Kleckner & Mackenzie Smart
Mentored by: Erik Jon Byker, Cato College of Education

The Sustainable Development Goals (SDG) Club at UNC Charlotte was founded in March of 2021 after the club's founder, Mackenzie Smart, participated in the United Nations' Millennium Fellowship. She wanted a way to raise awareness and foster action on UNC Charlotte's campus toward the United Nations (UN) 17 Sustainable Development Goals. Isabella Kleckner was one of the first members of the SDG Club and currently holds a board position. Over the past four years, the club has evolved from a small group of passionate students into an actively engaged community dedicated to sustainability initiatives. Additionally, the club sparked the development of a separate nonprofit stemming from one of their first projects called The Crayon Project. The purpose of this presentation is to describe and report on how a seed of an idea can blossom into a student organization and a nonprofit initiative. We discuss our case study research of the SDG Club and ways to take global goals and apply them to a local level. We have found that the SDG Club has made an influential difference within our college campus and to the wider Charlotte community through volunteer efforts, educational initiatives, and collaborations within our community. In conclusion, the presentation will also explain the evolution of the SDG Club, the lessons we have learned, and the impact on the UNC Charlotte campus from the viewpoint of two leaders over the course of the past four years.

Special categories: Community Engaged Research, Globally Focused Research, Sustainability Research

High-Resolution Mapping of Human Activity Zones for Understanding Malaria Transmission in Southern Africa

Natasha Kroll & Anupam Sharma
Mentored by: Yao Li, College of Humanities & Earth and Social Sciences

Malaria remains a significant global health challenge, with an estimated 249 million cases and 608,000 deaths in 2022 alone. Its impact on communities, economies, and healthcare systems is especially pronounced in resource-limited settings. As public health officials strive to reduce and ultimately eliminate malaria, detailed, localized data on the factors driving infection risk is vital for targeted resource allocation and effective control strategies. However, conventional surveillance methods often lack the spatial resolution needed to accurately highlight high-risk areas. To address this gap, this research proposes an integrated geospatial deep learning framework—combining remote sensing, deep learning, and geospatial analytics—to detect potential human activity zones in three districts of Zambia. To detect trends at differing population levels, we collected data from three Zambian districts: Ndola, Choma, and Nchelenge. This dataset includes WorldCover 2022 for land use classification, WorldPop for population distribution, and Microsoft Building Footprint data for mapping human settlements. Our methodology integrates ArcGIS Pro for spatial processing, foundation deep learning models in Python, Google Earth Engine for large-scale satellite data analysis, and Kepler.gl for interactive visualization. For this project, we propose mapping high-resolution human activity zones across three Zambian districts, which is an essential step toward understanding malaria transmission. Additionally, these maps can serve as a foundation for identifying human-vector contact zones in the region. The proposed framework can also be adapted for other vector-borne diseases, including dengue and Zika.

Special category: Globally Focused Research, OUR Scholars

Identifying REV7 Domain/Sites Regulating p53 Protein Stability

Skyler Kuncik
Mentored by: Junya Tomida, Klein College of Science

Fanconi Anemia (FA) is a rare genetic disorder characterized by the inability to repair DNA damage, including damage induced by endogenous metabolic products and by-products. FA patients suffer from an increased risk of developing cancer and bone marrow failure. REV7 (also known as FANCV) is one of 32 DNA damage repair genes involved in the FA pathway. Our recent study revealed a direct interaction between REV7 and p53 and demonstrated that REV7 is involved in p53 destabilization. Known as the “Guardian of the Genome,” p53 is a tumor suppressor that regulates various cellular pathways such as apoptosis, DNA damage repair, and cell cycle regulation. A mutation in TP53 can lead to uncontrollable multiplication of cells and tumor growth because p53 is unable to bind properly to DNA. This project investigated which REV7 domain regulates p53 protein stability using complementation assays. We also purified REV7 mutant proteins to investigate the effect on the direct interaction between p53 and REV7. The results of this research will provide new insights into a novel mechanism of p53 regulation
via REV7.

Keywords: p53, REV7, Fanconi Anemia, DNA repair

Special category: Honors College

Fostering Research Engagement in Nursing: Exploring Barriers, Early Exposure, and the Impact of Doctoral Education

Jalen London
Mentored by: Susan Lynch, College of Health & Human Services

Research is essential for advancing healthcare practices, yet studies show that fewer nurses and nursing students are pursuing Ph.D. programs. My work aims to explore the reasons behind this declining interest in research-based doctoral degrees within nursing. Additionally, it examines how introducing nursing students to research early in their education could increase participation in nursing research. Lastly, I will draw on my personal experience in biochemistry research to evaluate how pursuing a research degree has influenced my critical thinking and problem-solving skills. The goal of this work is to emphasize the importance of nurses engaging in research, to highlight the impact on students, and to discuss how research can be more effectively integrated into nursing curricula.

Special category: Honors College

Efficacy of MVA-MUC1 Vaccine in MUC1.Tg Mouse Model of Pancreatic Ductal Adenocarcinoma

Mauricio Lopez
Mentored by: Pinku Mukherjee & Arjun Tiwari, Klein College of Science

Pancreatic ductal adenocarcinoma (PDAC) is characterized by poor treatment outcomes due to its invasiveness and resistance to standard chemotherapy. While combination therapies have been explored, vaccine-based immunotherapies remain underutilized. This study evaluates the efficacy of a MUC1-targeted vaccine (MVA-MUC1) in combination with gemcitabine, a standard chemotherapy for PDAC, using a human MUC1 transgenic mouse model (MUC1.Tg) implanted with Panc02.MUC1 tumors. Mice were assigned to three treatment groups: saline control, gemcitabine alone, and combination therapy. Results showed that 80% of mice receiving the combination therapy responded positively, compared to only 20% in the gemcitabine-only group. Mice treated with gemcitabine and MVA-MUC1 exhibited higher serum MUC1 antibody levels, suggesting enhanced immune response and disrupted tolerance to the MUC1 antigen. This combination therapy led to slower tumor growth, likely due to increased activation of immune effector cells such as natural killer (NK) cells and macrophages. Our findings indicate that MVA-MUC1 combined with gemcitabine significantly enhances anti-tumor immunity, offering a promising strategy to improve treatment outcomes for PDAC patients.

Research team: Dr. Pinku Mukherjee, Arjun Tiwari, & Mauricio Lopez

Special category: Honors College

Identifying Changes in Communication Consultant Confidence Across the Years
James Meanor, Kaitlin Ferguson, Sridula Vardireddy, & Shreya Sridher
Mentored by: Heather Bastian, University College

Research has found that peer mentorship can play a valuable role in a student's personal growth and development. At UNC Charlotte, the Communication across the Curriculum (CxC) program trains communication consultants to serve as peer mentors and provide one-on-one support to students within select classes. This study investigates how consultants' experiences as peer mentors in CxC relate to and influence confidence levels. Specifically, this study asks: How has consultant confidence and experience changed over time? Consultants from Fall 2019, 2020, 2021, and 2024 (n = 40, n = 35, n = 33, and n-34, respectively) completed an online survey consisting of a Likert scale and open-ended questions that asked them to reflect on their roles as consultants. The surveys used multiple-choice demographic information questions, a five-point Likert scale of agreement, and open coding of free-response questions to categorize and determine perceived confidence levels. and whether consultant confidence levels vary across the years. Additionally, consultant survey results from all four years were compared to identify how consultant confidence, experience, and needs changed over time. The findings suggest that communication consultants consistently report favorable perceptions of how their work affects their confidence levels. However, quantitative data revealed that Fall 2024 consultants reported slightly lower confidence levels compared to those from the three previous years. Although limited to one year, these finding highlights opportunities to proactively strengthen specific areas of consultant support and enhance future program effectiveness.

Who Is This Genius Child?

Monisha Moore
Mentored by: Jay Grymes, College of Arts + Architecture

Within my research project, I have sought to define what it means to be a genius child. This noun is mostly known according to one definition. I, however, have found that a genius child can come in many forms. A child with aspirations bigger than those that align with standards, a child at its lowest crying out to God, a child seeing the beauty in all things around them, and a child seeking joy. This imagery emerged during my analysis process of 4 pieces by Ricky Ian Gordon that were set to Langston Hughes' text. They are as follows, “Genius Child”, “Prayer”, “My People”, and “Joy”. For this project, I wanted to paint the imagery of how I originally interpreted these four pieces while studying them. They each have contrasting features such as their style, tempo, meter, and range, and I wished to describe how each of these factors tells the meaning of a genius child through Ricky Ian Gordon’s composition style. According to Ricky Ian Gordon, the setting of the entire “Genius Child” cycle is during the Harlem Renaissance. The unique styles and emotions present in music then, were incorporated in his compositions. From his personal internalization of this into his style, the arching story of the genius child is told. In conclusion, from my research I found that with most things in life, society tries to place us in a box to keep us from being different and stepping outside the norms. A Genius Child is quick to step outside of this box and explore the different possibilities of life around them through fear, loneliness, and pain. In the end, if they become true to themselves, they will surely find joy.

Developing an Oral Tolerization Therapy for Multiple Sclerosis Using Genetically Engineered Soybeans Expressing MOG-Sigma1 Fusion Protein

Meenu Murugan
Mentored by: Daniel Nelson & Kenneth Piller, Klein College of Science

Multiple Sclerosis (MS) is a progressive autoimmune disorder where the immune system mistakenly attacks the myelin sheath, a protective layer around nerve fibers in the central nervous system. While current immunomodulatory therapies help manage MS symptoms, there is still no cure. In this study, we investigated an innovative oral tolerization approach using myelin oligodendrocyte glycoprotein (MOG) fused with Reovirus Sigma1 protein. Sigma1 targets M cells in the gut epithelium, which promote immune tolerance, making them an ideal antigen delivery route to suppress autoimmune responses. To overcome the challenge of producing large quantities of antigen needed for effective oral tolerization, we used genetically engineered soybeans to express the MOG-Sigma1 fusion protein. Soybeans were chosen for their modifiability, dietary use, and scalability. Multiple transgenic lines were developed, and protein expression was confirmed via ELISA and Western blotting. Fluorescence microscopy, FACS analysis, and a cell binding assay demonstrated that the trimeric MOG-Sigma1 protein successfully bound to mouse epithelial cells in vitro, highlighting its potential to promote immune tolerance. We tested the efficacy of MOG-Sigma1 protein in a mouse model of experimental autoimmune encephalomyelitis (EAE). Oral doses of soymilk containing MOG-Sigma1 were administered before disease onset to see if we could significantly delay the progression and reduce the severity of MS-like symptoms. This experiment was performed as planned, at five different doses, with appropriate control mice, but the fusion protein did not alter the progression of MS in the mouse model. We discuss similar experimental protocols that might successfully ameliorate the development of the disease.

Special categories: Globally Focused Research, Honors College, Urban-Charlotte Focused Research

Predicting Protein Contributions to Carbon Fixation in Autotrophic Freshwater Microbes Using Statistical and Machine Learning Models

Courtney-Grace Neizer
Mentored by: Elaine Luo, School of Data Science

Microbes play a crucial role in Earth's biogeochemical cycles, yet linking microbial proteins to carbon fixation remains challenging due to fragmented datasets and limitations in protein annotation. This study analyzed microbial DNA fragments from Siders Pond in Falmouth, Massachusetts, a salt-stratified meromictic lake. This study analyzed microbial DNA fragments recovered through metagenomic sequencing of environmental samples linking the microbial activity to carbon cycling using the LASSO regression statistical model. Environmental samples were incubated with 12C- or 13C-labeled dissolved inorganic carbon to track microbial carbon incorporation, followed by metagenomic sequencing. Contigs were annotated using the Protein Families Database (PFAM, bitscore > 30) and linked to excess atom fraction (EAF) values representing microbial carbon assimilation. LASSO regression identified key proteins potentially involved in carbon cycling. The approach resulted in identifying K00142 (acyl-CoA synthetase), K00118 (glucose-fructose oxidoreductase), and K06182 (23S rRNA pseudouridine2604 synthase), as key features associated with microbial metabolic processes potentially influencing carbon cycling. Additionally, PF18582, a domain within hydrazine synthase, plays a role in anaerobic ammonium oxidation (anammox), linking the nitrogen and carbon cycles by converting ammonium and nitric oxide into hydrazine. This suggests a potential role for hydrazine synthesis in microbial carbon metabolism under anoxic conditions. Using DNA-SIP correlated with statistical methods, this study contributes to a better understanding of microbial roles in carbon cycling and explores new ways of using statistical models to study environmental systems. The findings could help expand knowledge on how microbes influence global carbon cycles. Identifying novel carbon-fixing pathways, crucial for climate and sustainability research.

Special category: Honors College

Exploring allele frequencies and copy number variation of HLA pseudogenes in Amerindian Populations

Jana Obeid
Mentored by: Danillo Augusto, Klein College of Science

Human leukocyte antigen (HLA) genes are important for immune system function because they encode proteins that help the cells of the immune system to recognize and respond to pathogens. The genomic region encoding HLA genes is located on chromosome 6, which also includes several HLA pseudogenes. Pseudogenes are inactive gene copies that have lost their ability to code for functional proteins due to mutations. It is suggested that pseudogenes may have a role in genomic stability and evolution, and some might be transcribed. HLA pseudogenes have allelic variability, and they can vary in the number of copies (CNV or copy number variation), but their diversity is not well known in human populations . Therefore, we will analyze their diversity in the South American Amerindian populations. These populations have remained mostly isolated throughout time, creating creates a specific genetic structure within the populations. This study focuses on assessing CNV in HLA pseudogenes in specific South American Amerindian populations. We will quantify the number of copies of HLA-U, HLA-V, HLA-P, and HLA-Y pseudogenes in 50 individuals of Guarani and 50 of Kaingang using droplet digital PCR (ddPCR). The RPP30 gene is present in two copies in all individuals, and it will be used as copy reference. The CNV will be quantified comparing the amplicon concentrations of HLA targets and a gene that is known to have two copies. By examining the HLA pseudogene copy numbers in these populations, we expect to discover patterns that provide an understanding of the genetic diversity of these populations while also providing insights into how the immune system functions.

Keywords: HLA pseudogenes, copy number variation, droplet digital PCR, Amerindian populations, genetic diversity

Research team: Jana Obeid, Luciana de Brito Vargas, Hellen C. Issler, Maria Luiza Petzl-Erler, Ticiana Della Justina Farias, and Danillo Augusto

Special category: Honors College

A Conversation about Conversion: Catawba Religious and Cultural Evolution to Mormonism and the Mormon Conversion of the Catawba Nation

Neha Panajkar
Mentored by: Peter Ferdinando, College of Humanities & Earth and Social Sciences

Since contact with European settlers in 1540, the Catawba nation, whose ancestral lands extended from regions in North and South Carolina to parts of Virginia, has undergone a series of cultural and religious transformations. Their conversion from Polytheism to Mormonism in the 1880s and their continued affiliation with the Mormon Church into the 21st century represents a major transformation. Many different religiously affiliated groups have attempted to convert the Catawba, but none such group has succeeded in mass like the Mormons. The specific evolution of Catawba religious and cultural practices up to the 1880s made them more open to converting to Mormonism. This research will analyze the evolution of Catawba religious and cultural beliefs from pre-contact to post-contact and how changes in their belief system led to their conversion to Mormonism in the 1880s. As such, it will also analyze the role of the Mormon Church and Mormon missionaries in the conversion of the Catawba nation, specifically their motivations and what they gained from the conversion of the Catawba nation. The Mormons underwent their own series of changes, such as relocation due to religious persecution from local populations and the federal government. Studying the Mormon's motivation in converting the Catawba is something other research lacks. Therefore, analyzing their history remains an integral part of the story of why the Catawba converted to Mormonism. Analyzing how the Mormons convinced the Catawba to convert, who had so far resisted majority conversion, can help us understand how cultural changes strike when they do.

Special categories: Community Engaged Research, Globally Focused Research, Honors College, North Carolina Focused Research

Exercise is Medicine: Enhancing p53 Tumor Suppression through the AMPK Pathway
Naiya Roberts
Mentored by: Ellen Wisner, College of Health & Human Services

Millions of people are affected by cancer each year, with half of these cases linked to mutations in the p53 tumor suppressor gene (TP53). Mutations in TP53 encode dysfunctional p53 proteins that cannot function as effective tumor suppressors, thereby enhancing the risk of cancer. This literature review focuses on papers published since 2005, investigating how exercise inhibits tumor development through the activation of a signaling pathway known as AMPK which aids in the function of p53 tumor suppressor protein. To further understand this relationship, AMPK and p53 have been studied in mice. Results showed that Mouse Embryonic Fibroblasts (MEFs) activated AMPK in a low glucose environment. Further, AMPK was able to phosphorylate p53 and inactivate a protein found in mice called Mouse Double Minute X (MDMX), that degrades the p53 protein and inhibits its tumor suppressor abilities. Effective phosphorylation of the p53 protein activates p53-REs, or response elements. These elements aid in regulating cell cycle arrest and apoptosis which are crucial in responding to abnormal and uncontrolled cell growth. The AMPK pathway can be activated through participating in aerobic exercise. By using submaximal exercise testing, an individual's aerobic capacity can be determined and used to create a personalized exercise prescription. With its ability to activate the AMPK pathway, exercise is an accessible and promising intervention for tumor development and combating cancer.

A Tale of Two Cities: Bosnian War Aid Discrepancy in the Face of Occupancy
Berina Rucic
Mentored by: Jill Massino, College of Humanities & Earth and Social Sciences

During the Bosnian War (1992-1995), the United Nations (UN) and the North Atlantic Treaty Organization (NATO) were tasked with providing humanitarian aid and maintaining peace, yet its intervention was marked by inefficiency, political constraints, and uneven aid distribution. While Sarajevo, a designated “safe zone,” received at least some level of international attention, towns like Prijedor - fully under Serb occupation - were left to suffer atrocities with little to no UN assistance. This thesis explores this stark discrepancy, arguing that the UN’s aid was not only insufficient but also selectively distributed, disproportionately favoring Bosnian-controlled areas while neglecting occupied areas. Through a combination of historical analysis and firsthand survivor testimonies, this research delves into the human cost of international inaction. Interviews with survivors from Sarajevo and Prijedor reveal the lived experiences of deprivation, fear, and abandonment, painting a more personal picture of the war’s realities. While Sarajevo endured relentless shelling and sniper fire despite its “safe zone” status, the people of Prijedor faced mass executions, forced displacement, and the horrors of concentration camps - entirely without international protection. By comparing these two regions, this thesis highlights the failures of international peacekeeping and questions the ethical and political motivations behind selective humanitarian aid. It challenges prevailing narratives of the UN’s role in Bosnia and underscores the long-term consequences of geopolitical decision-making on vulnerable populations. Ultimately, this research calls for a critical reassessment of international intervention strategies to prevent similar failures in future conflicts.

Special categories: Community Engaged Research, Globally Focused Research, Honors College

Gamification in Early Educational Learning
Kathryn Russell
Mentored by: Jessica Burke, College of Arts + Architecture

Game based learning holds great potential in communicating complex ideas to a young audience in a way that is engaging and fun. *Passerine Park* introduces the concepts of ornithology and wildlife conservation to school age audiences in the format of an interactive board game. Gamification in early educational learning not only facilitates the absorption of content, but it also necessitates the advancement of critical thinking skills. Traditional learning methods inhibit critical thinking and creativity by having only one correct answer and encouraging conformity of thought. Games require the development of problem-solving skills based on the choices made within the game and immediate feedback to the learner. *Passerine Park* requires the player to make decisions about the best path to take to gain points. Not only are players engaging in the content by collecting species-specific informational cards, but they are actively employing problem solving skills as they move through the game. *Passerine Park* focuses on birds that can be found specifically in Central North Carolina, introducing regional identification and awareness of local bird species. This game introduces children to the wider field of ornithology, wildlife conservation and biology that they can experience in their own backyards. *Passerine Park* sparks curiosity and an increased awareness of local wildlife and conservation in a traditional learning environment.

Special category: North Carolina Focused Research

Temporal Variability of Viruses During Freshwater Harmful Algal Bloom
Heven Siyum
Mentored by: Elaine Luo, Klein College of Science

The occurrence of harmful algal blooms (HABs) is increasing rapidly due to human activities and climate change. These recurrent HABs have significant public health, ecological, and socioeconomic consequences due to the development of oxygen depletion in water bodies and toxin production. While cyanobacteria are known to affect HABs, the role of cyanophages that infect these bacteria is not well understood in freshwater environments. Here, we hypothesize that cyanophages help control HABs by killing their hosts, contributing to the natural decline of blooms. In this study, water samples were collected during bloom events from the Don T. Howell Reservoir in Charlotte, North Carolina, between July and December 2024. The number of viral-like particles (VLPs) in the samples was measured using flow cytometry, a method that detects and counts microscopic particles with a laser-based instrument. These virus counts were compared to cyanobacteria levels using the Environmental Protection Agency's satellite data to assess a potential relationship. This research will enhance our understanding of virus-cyanobacteria interactions and their potential use in HAB management. While we expect to see a correlation between viruses and cyanobacteria, additional investigation is needed to determine whether viruses can naturally control blooms. If validated, viruses could offer an eco-friendly alternative to chemical HAB treatments.

Special category: Honors College

MHV Induced Tau Hyperphosphorylation in the Hippocampus

Erik Sopiqoti
Mentored by: Kristen Funk, Klein College of Science

Dementia includes various types of neurocognitive disorders, including Alzheimer's disease and frontotemporal dementia. Describing a range of symptoms, dementia is characterized by a decline in cognitive abilities. More than 55 million individuals worldwide suffer from dementia, and the total burden of cost associated with dementia is projected to increase to nearly 1 trillion dollars in 2050. A hallmark of Alzheimer's disease and frontotemporal dementia is the aggregation of a protein called tau. These neurodegenerative diseases are categorized as Tauopathies. I hypothesized that MHV induced tau hyperphosphorylation in the hippocampus. To test this hypothesis, I used the PS19 mouse model of tauopathy, which overexpresses a mutant tau protein that is prone to aggregate. Transgenic mice were infected with the Mouse Hepatitis Virus, which causes inflammation in the brain called encephalitis. I utilized immunohistochemistry to stain for the hyperphosphorylation of tau in infected mice compared to mock-infected mice. Following the staining of the hippocampus utilizing various antibodies and stains, I imaged regions of the hippocampus to analyze tau hyperphosphorylation at 6 and 9 days post-infection (dpi). My results did not show significantly more tau hyperphosphorylation in transgenic MHV-infected mice compared to the transgenic mock-infected mice following viral infection in 6 dpi. Ongoing experiments are testing the effects of infection on tau phosphorylation at 9 dpi.

Tourism, Security, and Sacred Space at Bethany Beyond the Jordan
Olivia Stockwell
Mentored by: Eric Hoenes del Pinal, College of Humanities & Earth and Social Sciences

Based on first-person ethnographic observation, this project provides a semiotic analysis of tourism and security at Bethany Beyond the Jordan (the UNESCO World Heritage site believed to be the place of the baptism of Jesus Christ), and the ways in which these processes interact and mediate access to the site. Bethany Beyond the Jordan lies on the Jordanian side of the Jordan River and borders the Israeli-occupied West Bank and the Israeli baptismal site. The history, related political tensions, and geographical positioning of the site have led it to be militarized and demilitarized several times. Now, the site is patrolled by armed guards, sectioned by military checkpoints, and blocked off by barbed wire. These processes mediate tourist engagement with the site and work to create perceptions of security and protection. In addition, they serve to exclude certain people from accessing the site. Working in tandem, these security operations work to ensure the safety of the tourists while also protecting the site and the border from tourist interference. Processes of tourism and pilgrimage at Bethany Beyond the Jordan rely on a political and material reality to exist while simultaneously shaping that reality and methods of sacralization.

Special categories: Globally Focused Research, Honors College, Phi Kappa Phi (PKP) Member

Bondage to Business in the Bull City: Booker T. Washington and the National Negro Business League's Impact on the Development of Black Capitalism in Durham and Other NC Cities

Lee Queveon Tate
Mentored by: Willie Griffin, College of Humanities & Earth and Social Sciences

This honors thesis analyzes the intersection between the National Negro Business League (NNBL) and Durham, NC's Black business enterprise, and how this relationship manifested opportunities in other NC cities between 1900-1930. This thesis's research question is: What impact did the connection between the National Negro Business League and Durham have on the development and success of Black businesses in other notable NC cities, like Charlotte? Black business historians and economists like Juliet E.K. Walker, Robert Eric Weems Jr., and Anne R. Hornsby have extensively mined secondary literature exploring the turbulent history of Black entrepreneurship in America. My research/project methodology is chronological and topical to showcase Black economic progress. This research contributes to the study of Black business history in NC but creates a new precedent showcasing the relationships between the NNBL and NC cities. The goal of this research is to highlight narratives of African American agency that challenge conventional Jim Crow stories perpetuating Black victimhood. The expected finding is that, due to the interconnectedness of the NNBL and Durham, Black economic activity in North Carolina thrived, giving Black people confidence to pursue more entrepreneurial endeavors. As a result, Black business leaders and their institutions, like North Carolina Mutual Life Insurance Company and Mechanics & Farmers Bank, helped build the city into a thriving model of economic success for Black communities in other cities across the state. Through their connections to the NNBL, these individuals discovered more avenues to achieve social, economic, and political success through business operations.

Special categories: Honors College, North Carolina Focused Research

Weather Communications: The Relationship between Generations and Information
Zachary Tolman
Mentored by: Terry Shirley, College of Humanities & Earth and Social Sciences

Severe weather disregards a person's background knowledge in Atmospheric Sciences or whether they reside in an urban, suburban, or rural environment. For Meteorologists, a portion of the job is conducted via social-science based communication to get the best, most timely information about conditions to members of the public to save lives. This study aims to investigate how members of the general public from multiple backgrounds and varying demographics receive weather information while measuring their trust in the source(s) in which they receive their information from. Ideally, 100+ participants across multiple demographics and backgrounds will participate; this will prove to be insightful across the field of meteorology from broadcasting to government. Another goal of this research is to explore and potentially eliminate any communication barriers that are present between atmospheric scientists and nonscientists. With the emergence of AI and uncertainty surrounding the future of government entities, it is highly important to understand how the public is accessing weather information, which is vital to their safety. This project will use a fifteen question survey to gather data from random volunteer participants. This data will then be analyzed to determine if patterns exist between key groups and how they are accessing weather data. This study has the potential to inform future scientists with direct and available feedback from members of the public in a decorum that is anonymous in order to eliminate trepidation from the consumer while also ensuring that the producer has a reference point as well as multiple metrics.

Special categories: Community Engaged Research, Sustainability Research

CXCL12 and CXCL4 Chemokine Heterodimerization and CXCR4 Signaling in Breast Cancer Cells

Zoe Vette
Mentored by: Didier Dréau, Klein College of Science

Chemokines are small signaling proteins crucial to various biological processes. They aid the body's immune system in fighting infections and other diseases, such as cardiovascular illness, autoimmune issues, and cancers. Chemokines promote tumor cell migration, leading to the formation of secondary cancers through metastasis. Specifically, the CXCL12 chemokine promotes cancer cell migration by activating the CXCR4 receptor. While signaling processes of monomeric chemokines have been well delineated, the homodimer and heterodimer forms of these chemokines remain largely unknown. To better understand the biological activities and mechanisms of chemokine heterodimers, our lab developed a non-dissociating CXCL4-CXCL12 heterodimer termed OHD4-12. This study aims to determine cancer cell migration and evaluate downstream calcium signaling driven by CXCL12. First, cancer cell migration was measured following exposure to CXCL12 and OHD4-12, highlighting that OHD4-12 led to reduced cell migration compared to CXCL12 alone. Furthermore, intracellular calcium concentrations significantly differed when assessed following CXCL12 and OHD4-12 treatment of breast cancer cells. Moreover, the involvement of both CXCR4 and ACKR3 receptors in the regulation of CXCL12-driven cell migration is supported by control experiments with CXCR4 and ACKR3 receptor inhibitors. Taken together, our results support a differential cell signaling and functional migration following CXCL12 alone and the obligate heterodimer CXCL12-CXCL4 involving both CXCR4 and ACKR3 receptors.

Exploring the Relationship Between BMI, Age, and HbA1c in Active Older African American Women

Samantha Webb
Mentored by: Trudy Moore-Harrison, College of Health & Human Services

BACKGROUND: Glycosylated hemoglobin (HbA1c) is an assessment of glucose stability over time with a value less than 5.7 m/mol% considered normal and a value greater than 6.5m/mol% considered diabetic. Effective diabetes management requires a comprehensive understanding of the risk factors affecting older African American (AA) women. The study's purpose was to examine the relationship between HbA1c, age, and BMI in older AA women. METHODS: Participants were (N = 73) older AA women who participated in health risk assessments at senior recreational centers in Charlotte, NC. The women were members of active physical activity programs at these centers with weekly involvement. They were measured for blood glucose, HbA1c, and BMI. A blood sample was collected in a small blood collector after a lancet pricked the participant's finger. It was then lightly shaken with a premixed solution and placed into the A1CNow + Professional Multi-Test HbA1c System. The Omron HBF-306C Handheld Body Fat Loss Monitor was used to calculate BMI. Participants held the monitor with both hands after the appropriate demographics were input into the machine. RESULTS: The participants ranged from 60 to 91 years with a mean age of 74.9 ± 8.2 years and were obese with a BMI of 30.2 ± 5.8 (kg/m2). HbA1c values averaged 5.8 ± .84. There was no significant relationship between age and weight (r= -.16) or between age and HbA1c (r= -.07). A significant positive relationship (r=.21) was observed for HbA1c and BMI. CONCLUSION: In active older obese AA women, no relationships were observed between age and HbA1c. However, there was a positive correlation between HbA1c and BMI suggesting that adiposity contributes to predicting diabetes in older obese active AA women.

Special categories: Community Engaged Research, Honors College, Urban-Charlotte Focused Research

Opportunities for Relevant Work Experience: Perceptions of Undergraduate Psychology Students

Ethan Wilkins
Mentored by: Kim Buch, College of Humanities & Earth and Social Sciences

Due in part to relevant job requirements, students coming out of college with a bachelor's degree are likely to experience difficulty in acquiring a paid position aligned with their career choice. Research also shows that internships are not nearly as effective at mitigating this issue as they are often perceived to be. This study aimed to explore undergraduate psychology students' perspectives on these challenges and assess the potential of Behavioral Technician (BT) positions as a means of acquiring relevant job experience. A comprehensive questionnaire was utilized in this study to collect both quantitative and qualitative data from psychology students enrolled in the University of North Carolina at Charlotte during the Fall of 2024. The questionnaire was designed to reflect both participants' perception of their situation within the labor market and the degree to which they would consider taking on a position as a BT to gain relevant work experience. Results showed that 97.1% of respondents were interested in acquiring this type of experience, while 91.2% expressed interest in a temporary position as a BT. These findings aligned with previous research, which stressed the difficulty students face in obtaining relevant job experience and suggested that BT positions could serve as a valuable tool for psychology students in bridging this gap.

Special categories: Community Engaged Research, North Carolina Focused Research, Urban-Charlotte Focused Research

American 19th Century Songs

Andrew Williams
Mentored by: Jay Grymes, College of Arts + Architecture

Wade in the Water is known as a black spiritual that is deeply rooted from the African American culture. It comes from the 19th century American songs. *Wayfaring Stranger* is a white spiritual which interpretated as a spiritual journey towards a heavenly home.
This paper will discuss these two genres of *Wade in The Water* and *Wayfaring Stranger*. The significance of Wade in the Water was a freedom song during the Civil Rights Movement. It was used in religious settings as a baptismal song. It has transformed into other genres such as the concert spiritual and gospel. The spiritual song Wade in the Water is also known as an African American jubilee song meaning that it was created and first sung by enslaved blacks. The message in song (escape in the river). The song *Wayfaring Stranger* is known to be a white spiritual. Which is a type of folksong that had originated in American revivalist that was active between 1740 and at the end of the 19th century. The term comes from the biblical spiritual songs which includes the folk hymn, religious ballad and the camp meeting spiritual. *Wayfaring Stranger* comes from the Civil War Era American, folk gospel. It is a possibility that this song traveled to America with a German immigrant and was adopted into early Century American folk singing. In conclusion, the goal of this essay is to learn how two important musical genres arose form very different American experiences.

The effectiveness of Music Therapy for Treatment of Autism Spectrum in Children
Mahogany Williams
Mentored by: Jay Grymes, College of Arts + Architecture

Autism Spectrum Disorder is a Neurodevelopmental disorder that is a range of varying social and learning dysfunctions. Around 1% of the world, or around 100 million people, currently has this disorder. A form of treatment that is a newer type of psychology is Music Therapy. Music Therapy is a form of treatment that uses the creation, Listening, and performing of music as a way to help address social, emotional, and cognitive difficulties. Since this is a new form of treatment, many doubted its effectiveness. This Study examines the effectiveness of Music Therapy as a form of treatment for the Social and Communication Skills of Children on the Autism Spectrum. The research comes from a meta-analysis of Quantitative experiments on the effectiveness of many forms of treatment, including but not limited to Psychotherapy, cognitive-based Therapy, and Applied behavior therapy. These studies were primarily done on children aged 5-14 and ranged from 30-minute to 1-hour sessions trying out each form of treatment. These studies were done in group sessions with other children as well as solo therapy sessions. Music Therapy has been seen as the most successful treatment for helping Children of the Autism Spectrum learn better social skills and communication. These Results show the power of music in connection to the mind and how music is an influential form of treatment for this particular disorder.

Analyzing the Response of the Immune System in Males vs Females that Occurs after Mouse Coronavirus Infection

Luke Williams
Mentored by: Kristen Funk, Klein College of Science

SARS-CoV-2 (COVID-19) is an airborne virus that causes acute respiratory distress, but it also shows a variety of neurological symptoms. Patients with long COVID experience memory impairments, brain fog, depression, and mood disorders. Prior research suggests that females exhibit a stronger antiviral immune response than males, which may increase susceptibility to post-infection autoimmune disorders. There is evidence to suggest that cytokines and the innate immune system increase risk of post-acute sequelae. My honors thesis has examined the difference in the response in the immune system between male and female mice following coronavirus infection. To understand this, the Funk lab developed a mouse model of respiratory coronavirus infection using Mouse Hepatitis Virus strain A59 (MHV-A59). I hypothesized that there will be a greater infiltration CD8+ T cell immunoreactivity in the hippocampus of female mice following infection, which may contribute to the greater cognitive sequelae that are seen in females compared to males. To test this, I performed immunohistochemistry for CD8+ T cells in male and female mice at 30 days post-infection. Following staining, I imaged the slides using fluorescence microscopy, the results of which are still being analyzed. Results of these experiments will help us to better understand the difference in the response of the immune system in male vs female mice following infection and long-term complications.

Special category: Honors College

Exploring the Dispersal of Fungal Species by Bees

Taylor Yonemura
Mentored by: Morgan Carter, Klein College of Science

It is widely known that bees are essential in the distribution of pollen, but did you know they can spread disease as well? Fungal pathogens cause the loss of up to 20% of crops across the globe each year. Ecological surveys can help document the prevalent fungal species in a community to further assess which pathogenic groups are present. By identifying fungi carried on bees, we can estimate what species are being distributed between plants. The UNC Charlotte Botanical Gardens has over 2,000 plant species under their care and is an ideal location to study insect-led spore dispersal. We collected fungal spores from the bodies of three different species of bees in the Harwood Garden – *Bombus impatiens*, *Bombus pensylvanicus*, and *Xylocopa virginica* – with two biological replicates each. A methodology for collecting insects, harvesting spores from specimens, and isolating fungi on malt extract agar was optimized based on literature. Afterwards, the bodies of the bees were pinned for taxonomic identification. We observed 55 morphologically unique fungal species via photography and microscopy and are amplicon sequencing diagnostic regions of DNA to identify fungal taxa. The taxa will then be surveyed for known plant pathogens to determine their prevalence in the area and whether they pose significant risk to the Botanical Gardens' flora. Research on the transfer of phytopathogenic fungi through insects capable of long-distance travel will aid in the understanding of the spread of phytopathogenic disease and identify unknown threats in our communities.

Special categories: North Carolina Focused Research, Sustainability Research

Panel Presentation Abstracts

Note: Abstracts organized in alphabetical order by lead author's last names. All presentations can be viewed on https://symposium.foragerone.com/urc2025/presentations

Thriving Together: Sustainable Solutions for Women's Health
Meenu Murugan, Divya Agarwal, and Mia Jammal
Mentored by: Erik Jon Byker, Office of Undergraduate Research and Honors College

Women's health is deeply interconnected with environmental sustainability, yet the impact of climate change, pollution, and resource scarcity on women's well-being is often overlooked. From reproductive and maternal health to chronic disease risks, environmental factors play a critical role in shaping health outcomes, especially for women. The purpose of this panel is to discuss how these factors disproportionately affect women, emphasizing the urgent need for equitable and sustainable solutions in healthcare. The discussion will highlight innovative, eco-friendly practices that enhance women's health, such as sustainable menstrual and reproductive health products, and policies that promote healthcare access. Panel members will examine initiatives to address gender disparities in health, ensuring that women, especially those in vulnerable communities, receive the care and resources they need. By fostering dialogue on the global, local, and personal impact of sustainability on women's health, this panel aims to raise awareness and inspire action toward a healthier, more sustainable future for all women.

Panel moderated by: Krish Karri, Abby Cameron, Tori Teague, and Maylis Pickering, representing the Charlotte Youth Climate Coalition (CYCC)

Special category: Globally Focused Research, Honors College, Sustainability Research

Poster Presentation Abstracts

Note: Abstracts organized in alphabetical order by lead author's last names. All presentations can be viewed on https://symposium.foragerone.com/urc2025/presentations

Climate Change and Infectious Diseases
Eleanor Ahdieh
Mentored by: Jack Scheff, College of Humanities & Earth and Social Sciences

The relationship between climate change and infectious disease transmission is multifaceted. Extreme weather events and an ever-changing climate, the physiology of vectors and pathogens, and human characteristics all contribute to the relationship between infectious disease transmission and climate change. These relationships aren't yet fully understood but ongoing research is being done on climate-sensitive diseases such as malaria and cholera to provide more insight. Studies have shown shifts in geographic ranges of disease vectors due to global warming, worsening public health implications due to climate changes, and the disruption of ecosystems leading to potentially harmful interactions between humans and other species. Understanding this dynamic relationship is vital for developing, proposing, and implementing effective strategies and interventions.

Special category: Globally Focused Research

LLM-Powered Vulnerability Detection
Peter Akintunde-Yale
Mentored by: Marco Viera, College of Computing & Informatics

This research project explores the use of large language models (LLMs) to detect critical web vulnerabilities, leveraging the OWASP Benchmark as a foundational dataset. The project comprises the following tasks: (1) Focusing on Three Key Vulnerabilities. The project targets Injection, Broken Access Control, and Security Misconfiguration, which are among the most prevalent and impactful vulnerabilities in the OWASP Top Ten. The task involves identifying and isolating relevant examples within the OWASP Benchmark dataset (or other datasets, if Benchmark is not ideal) to inspect these vulnerabilities effectively. (2) Developing an LLM-Based Detection Process. The methodology involves creating a process to use LLMs for detecting vulnerabilities in the dataset. This includes: Crafting prompts tailored to each vulnerability type; Applying prompt engineering techniques to refine the detection process and improve performance; Comparing the effectiveness of prompts across 1–3 LLMs (e.g., GPT-4, CodeLlama), evaluating their strengths and weaknesses. (3) Analyzing Detection Results. Conduct a detailed analysis of the detection results, incorporating the following aspects**: Performance Metrics:** Evaluate precision, recall, and false positive/negative rates for each vulnerability type; **Vulnerability History:** Analyze when each vulnerability was detected by the LLM, how long it had existed in the code, and its exposure window; **Impact Analysis**: Assess the relevance of each vulnerability to the program's integrity, focusing on factors like exploitability and potential damage; **Model Comparison:** Highlight differences in detection accuracy and contextual understanding across the selected LLMs.

Special category: OUR Scholars

Individual Factors Affecting the Relationship Between Job Autonomy and Work Outcomes

Sahara Al-Wajeh, Layna Hubbard, Tasmia Ashrafi, and Catlyn Auton
Mentored by: Meghan Davenport, College of Humanities & Earth and Social Sciences

Features of jobs, such as autonomy, play a role in determining whether workers feel satisfied and competent (McGonagle et al., 2015). However, work does not affect everyone in the same manner: individual differences may moderate these effects, influencing how workers experience job flexibility and control (Niess & Zacher, 2015; Torres et al., 2024). This study looks at what individual factors affect whether workers in more autonomous roles report higher levels of job satisfaction and perceived work ability. The positive relationship between job autonomy and work outcomes will be stronger for workers high in openness because they can leverage their adaptability in the flexible work environment. Workers high in conscientiousness, conversely, may prefer structured settings, and not benefit as much from flexibility. Caregiving obligations may also mean that workers benefit more from autonomy, which supports their ability to balance work and personal responsibilities. The relationship between job autonomy and work outcomes will be stronger for workers with social support, which can buffer work-related stress and help them capitalize on flexibility. The subsample of participants we will use for this study is the roughly 1000 working participants who completed the HRS Leave-Behind Questionnaire in both 2018 and 2022. All study variables were measured in the HRS, except for job autonomy, which will be matched via occupation data from O*NET. Regression will be used to test our moderation hypotheses. Findings can inform workplace policies that enhance job design, improve work-life balance, and support aging workers in staying in the workforce longer.

Aggregating Data on Viral Hosts of H5N1 in North America

Rachel Alexander
Mentored by: Daniel Janies, College of Computing & Informatics and School of Data Science

The price of eggs in the United States has been undergoing a steep upsurge as of 2022, with a marked increase beginning in 2024. One of the primary reasons for this is the outbreak of bird flu, or H5N1 influenza, which is a strain of influenza A virus and commonly referred to as highly pathogenic avian influenza (HPAI). Many birds across North America, wild and domestic, have fallen victim to bird flu. Beyond birds, mammals and even humans have been impacted. This impact on viral hosts has been quantified and logged in databases across the North American continent. This research will be focused on data collected from the United States, Canada, and Mexico. The governments of each respective country have provided data within databases, namely the CDC and the USDA's joint HPAI reporting, the Canadian Animal Health Surveillance System (CAHSS), and the Mexican National Service of Health, Food Safety, and Food Quality. The purpose of this research is to implement data aggregation techniques (data cleaning and standardization methods) to analyze recorded cases of HPAI in North America in order to better understand the viral promiscuity and replication abilities of the virus across hosts. This research has important implications within public health, animal health, and food safety, like preparation and understanding for potential human infections of bird flu, maintenance of health and safety of North American birds, and consumption of poultry products.

Special category: Globally Focused Research

Aware and Share: A Visual Guide to Phishing Scams Targeting International Students
Eesha Alla
Mentored by: Cori Faklaris, College of Computing & Informatics

According to recent statistics, over 1.1 million international students migrated to the U.S. for higher education, with UNC Charlotte hosting 1986 students in the Fall 2024 semester alone. These students are often exposed to scams, particularly through phishing, or fraudulent attempts to access personal information under the guise of a trustworthy individual/institution. While many studies and university security pages have discussed the characteristics and impacts of such scams on the international student body, few have offered clear visual examples to guide readers' understanding of these scams. This project builds on Tabassum, Faklaris, and Lipford's 2024 study on SMiShing/SMS-phishing by breaking down five types of phishing attacks that international students have been encountering recently: Nigerian 419, Gift Card, Google Docs, Social Media, and SMSiShing scams. Information about these scams and recommendations for stronger privacy and security will be disseminated through a public webpage hosted by the SPEX (Security and Privacy Experiences) group at UNCC. The page will also include five visual mockups created using a design software tool, Figma. For future research, we suggest incorporating the DAE (Describe, Analyze, and Evaluate) method to empathize with international students and understand how they perceive, dissect, and feel about phishing scams. DAE, often used in the Intercultural Studies, asks participants to view a photograph of an unfamiliar idea/action and then walk through the process of detailing their observations at first glance (describe), break down the relationships between these observations (analyze), and express their judgments about the idea shown (evaluate).

Special category: OUR Scholars

The Effect of 4-Hydroxy-TEMPO on the Photochromism of Thiazolothiazole films

Aboud Alshatat, Naz F. Tumpa, Tyler Adams, and Dr. Michael G. Walter
Mentored by: Michael Walter, Klein College of Science

4-Hydroxy-TEMPO (4-HT) is a stable free radical that has gained attention for its potential to influence the photochromic properties of various materials. In this study, we investigate the effect of 4-HT on the photochromism of Thiazolothiazole (TTz) films, a class of materials known for their reversible photoinduced color changes. The standard absorbance readings of TTz begins at absorbance readings at 400 nm at the TTz2+ state, then it transitions to the TTz1+ state at 610 nm, and finally the TTz reaches the neutral state at 710 nm. Films containing 4% PVA, 14% Borax, and 1.7% TTz, were tested with varying ratios of (4-HT). The films were prepared by adding the TTz and (4-HT), then adding PVA. Then, UV absorbance readings would be taken. At high concentrations of (4-HT) the TTz0 state was lowered in comparison to films prepared without (4-HT). The transition to TTz1+ state was kept constant across all samples. However, increased concentrations of (4-HT) lowered the TTz0 peak. A possible hypothesis is because the TTZ0 state is easily reduced and (4-HT) is competing for an electron from the TTZ. This leads to the objective of this research to determine if TTz can be kept at the TTz1+ state with high concentrations of TEMPO.

Explainable Distributed Machine Learning for Outlier Detection

Rowan Amanna
Mentored by: Qiong Cheng, College of Computing & Informatics

Anomaly detection systems have been widely applied across various fields, including security, healthcare, and environmental monitoring. However, in tracking fish species in underwater ecosystems, anomaly detection models suffer from low accuracy, poor precision, inefficiency, and an inability to scale. These challenges stem from erratic movement of fish, environmental variability, and antiquated methods still in use to track fish. Our research focuses on providing updated machine learning methods to improve this system's accuracy and precision, while also utilizing PySpark as a tool to make this whole system more efficient and allow for scalability. Using machine learning would help the entire system be widely available to use, regardless of computational complexity required to run the system. We plan to use various unsupervised learning techniques to achieve this, including the Local Outlier Factor algorithm, Isolation Forest, and Chauvenet's Criterion. These methods are highly compatible with real-time tracking and large-scale tracking with PySpark, which makes it a highly viable tool. To evaluate this approach, we plan to compare the accuracy and precision of these methods against existing models in prior research on underwater species tracking. By leveraging deep learning and distributed computing, this study develops a more robust and scalable detection system that can function across diverse aquatic environments.

Special categories: Community Engaged Research, Globally Focused Research, Sustainability Research

Genetic Diversity of *HLA* and *KIR* genes in the Ashanti Tribe of Ghana.

Ishmael Ayalingo
Mentored by: Danillo G. Augusto, Klein College of Science

Human leukocyte antigen (HLA) and killer-cell immunoglobulin-like receptor (KIR) molecules are essential components of the human immune system, playing a crucial role in disease regulation and susceptibility. Both *HLA* and *KIR* genes exhibit extensive structural and allelic variation, yet their genetic diversity remains largely uncharacterized in African populations, particularly among ethnically distinct groups such as the Ashanti tribe of Ghana. As one of the largest ethnic groups in Ghana, the Ashanti exhibit significant unexplored genetic diversity. Characterizing human genetic diversity is critical to understand the basis of human diseases. This study aims to explore *HLA* and *KIR* variation within this population to better understand their immunogenetic diversity and potential implications for human health. Peripheral blood samples were collected from 170 individuals and centrifuged at 1,000g for 15 minutes. DNA was extracted from the buffy coat using the MagMAX DNA Multi-Sample Kit, a bead-based extraction method. For sequencing, hybrid capture libraries enriched for *HLA and KIR* were sequenced using Illumina NovaSeq X and allele calling using specific pipelines. Next step is to perform a library preparation for these samples and analyze the *HLA* and *KIR* genetic variability. This study seeks to characterize both the structural and allelic variability of *HLA* and *KIR* between the Ashanti population and other African populations, which will provide a deeper understanding of the immunogenetic variability within the African continent.

Special categories: Community Engaged Research, Globally Focused Research

Bridging Employment and Childcare Gaps: A Research Project on Charlotte's Growing Community

Katie Benitez Diaz
Mentored by: Stephanie Potochnick, College of Humanities & Earth and Social Sciences

Charlotte is struggling to keep up with the increase in the Latino population–particularly its growth in Latina mothers with young children. This project examines Charlotte Latina mothers' employment and the challenges Latina mothers face with childcare services. The primary aim is to help improve the employment prospects of Latina mothers in Charlotte, NC. The secondary aim is to give research practice, training, and mentorship to UNC Charlotte students by involving the students with the experience of being on a research team. This is a collaborative community-university research project that links two separate projects that are currently being conducted in Charlotte. The first is the Values and Aspirations of Latino Employees and Advancing Latino Early Care and Education project conducted by Camino Health Center, a holistic community health center for Latino immigrants. The second one is the UNC Charlotte Child and Family Development lab. Together, these two research projects are using mixed methods to find Charlotte Latina mothers' job experiences and the opportunities and barriers Latina mothers face. Also, the mixed methods help put into perspective how Latina mothers' employments are shaped by available childcare options and what Latina mothers believe would help them improve their employment rates. The research program looks at data collected by the "VALE survey" distributed by "Camino's *Arriba* employment program" as well as surveys and focus group interviews with Latina mothers which makes it a mixed data project. The research project will help Charlotte keep up with the rapid growth of the Latino population. It will provide a representation of Latina mothers in employment rates. The research lab will also allow students from the University of North Carolina at Charlotte to gain skills and experience in working with a research team. In particular, as part of the OUR program, I will be learning to transcribe, translate, and analyze Latina mother focus group data. This experience will give me the practice and knowledge to understand different perspectives for my future career in clinical psychology.

Special categories: Community Engaged Research, OUR Scholars

Investigating and Comparing Sustainable Development Goal #13 in Germany and the United States.

Russell Beyer, David Henriquez, Lama Abdelrahman, Felix Beck, and Kim Wendland
Mentored by: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Our research investigates and compares aspects of the Sustainable Development Goal (SDG) #13. The main research questions for our international comparative study are: What are the similarities among Germany and the United States related to target goals for Sustainable Development Goal #13, which is to take urgent action to help combat climate change and its impact on our earth's environment? What are the differences? To what degree are the countries on track to make progress on SDG #13 by the 2030 goal year? To conduct this research, we each wrote a Research Memo paper based on a literature review methodology. The Research Memo included international reports and peer-reviewed journal articles. The Research Memo was framed by Bereday's (1964) Comparative Model. To sharpen our critical thinking skills, we also engaged with an Artificial Intelligence (AI) Debate Bot to further strengthen our findings. This collaborative study was part of a semester-long Global Networked Learning (GNL) research collaboration among students at UNC Charlotte and students at the PH Ludwigsburg in Germany. A GNL project is a collaborative approach to learning that enables students and instructors from different locations around the world to participate in learning and creation of knowledge together. In our research, we report on the comparative findings of our GNL project. The research includes an examination and discussion of the challenges and possibilities in meeting SDG #13: Climate Action by the 2030 goal year.

Special categories: Globally Focused Research, Sustainability Research

Assessing Neuronal DNA Damage Induced by CD8+ T Cells During Viral Infection Using an Optimized Comet Assay

Aayush Bhatt
Mentored by: Kristen Funk, Klein College of Science

Neurons are highly susceptible to DNA damage due to their extended lifespans and reliance on non-mitotic DNA damage repair mechanisms. We hypothesized that this vulnerability may be exacerbated during viral infection due to either the direct effects of the virus or from inflammatory immune cells. To test this hypothesis, we investigated the DNA damage response induced by viral infection and activated CD8+ T cells. Gene expression analysis pointed to CD8+ T cells inducing DNA interstrand crosslinking (covalent bonds formed between complementary DNA strands) and intrastrand crosslinking (within the same DNA strand), which are particularly deleterious, as they impede essential cellular processes such as transcription and often promote apoptosis. To assess DNA damage directly, I optimized a version of the Comet assay for this purpose. The Comet assay is a single-cell gel electrophoresis technique used to assess DNA migration as a measure of crosslinking events, where reduced migration indicates increased lesion formation. Primary mouse neurons were cultured alone, in the presence of unstimulated CD8+ T cells, or in the presence of stimulated CD8+ T cells. Our findings revealed that unstimulated CD8+ T cells promoted crosslinking damage in co-cultured neurons, but the extent of DNA lesions was significantly elevated in neurons co-cultured with stimulated CD8+ T cells. Given the critical role of neurons, persistent DNA damage in neurons may contribute to neurodegeneration or cognitive decline, particularly in conditions of chronic immune activation, such as neuroinflammation. Further research is needed to elucidate the mechanism by which CD8+ T cells induce neuronal genomic instability.

Reddit (as) Therapy?: Online Disclosures and Help-seeking Among Intimate Partner Violence Survivors

Madilyn Blackmon and Carrie Gorman
Mentored by: Dr. Jennifer Langhinrichsen-Rohling, College of Humanities & Earth and Social Sciences

Intimate partner violence is a public health concern and in recent years more people have been turning to online sources of support such as Reddit. (O'Neill, 2018). This is likely due to the anonymous nature of these sites, allowing many survivors to disclose their experiences, seek advice, and connect to communities of support (Aldkheel et al., 2021; Gueta et al, 2023). While emerging literature shows an increase in this trend, less is known about the type of support requested and the responses to these requests on online forums. The current study completed a thematic analysis of online disclosures of intimate partner violence (IPV) on Reddit between May 2017 to May 2024 (n = 394). Posts were coded using an iterative process by two coders and achieved an interrater reliability score of .94. Posters reported experiencing a variety of forms of intimate partner violence (physical abuse: 48.7%, emotional abuse: 35.6%, sexual violence: 13.0%; stalking: 6.5%; coercive control: 21.6%), the majority of which were at the hands of a current partner (60.7%). The majority of posters requested emotional support (77.6%), followed by informational support (41%), and seeking opinions (33%). A little over half of the violence reported was ongoing (52.6%) at the time the poster was seeking support. To examine differences in support requested by individuals based on whether the violence was ongoing or in the past, a series of chi-squared analyses were conducted. Results indicated that posters were more likely to request informational support if the violence was ongoing (*p*

Special categories: Community Engaged Research, Globally Focused Research

Turning Research into Networking Opportunities

Shaina Bothra
Mentored by: Erik Jon Byker, Office of Undergraduate Research and Honors College

The purpose of this poster research presentation is to explore the benefits of undergraduate research for Business majors. The research method is based on an autoethnography of a Pre-Business major at UNC Charlotte, and I am also the Undergraduate Research Conference (URC) Student Leader Intern. My research focuses on three key questions: 1) How many Business majors have participated in the URC since its inception? 2) What is the value of participating in undergraduate research as it relates to networking? 3) How can networking opportunities contribute to career growth? The URC has grown significantly, from 59 presentations in 2012 to over 225 presentations in 2024. This growth not only underscores the importance of research but also highlights the opportunities for collaboration, innovation, and networking that the Office of Undergraduate Research fosters among students, faculty, and professionals. However, Business majors have been underrepresented in the URC, with only 3 oral presentations and 28 poster presentations over the past 13 years. To increase Business major participation in the URC, I recommend two strategies: First, the URC should expand its social media presence, particularly on LinkedIn, where Business majors are most likely to connect with one another professionally. Second, the URC should emphasize the networking opportunities available to Business majors by hosting targeted tabling events or workshops. These initiatives can help raise awareness and demonstrate how participation in the URC can open doors to valuable professional connections and career growth.

Special category: Community Engaged Research

The Roles of Anticipated Stigma and Social Support Processes in the Disclosure of Mood Disorders: A Study of Freshman Roommates

Gabriella Boutte, Kristin Willson, Brett Connell, Aine Sotillo, and Luke Adams
Mentored by: Amy Canevello, College of Humanities & Earth and Social Sciences

Mood disorders are increasingly common among college students (Lipson et al., 2022). Discussing mental health can help relieve symptoms and build relationships. Close relationships include social support and interpersonal trust (Crocker & Canevello, 2008), which positively influence disclosure. Anticipated stigma regarding mental health can make disclosure difficult. The goal of this study is to examine how social support processes interact with anticipated stigma to predict disclosure. We hypothesized that roommates' compassionate goals to be supportive would lead to their greater social support given to roommates with mood disorders (MD roommates). MD roommates should then report receiving greater social support, and in turn, disclose their mental health status. Further, we predicted that the link between social support received, and disclosure would be stronger for those who anticipated less mental health stigma. College freshman roommate dyads (*N*=245), in which at least one person reported a mood disorder diagnosis, completed measures of compassionate goals, social support given, and social support received across the fall semester. Roommates with a mood disorder diagnosis also completed measures of anticipated mental health stigma and disclosure of their diagnosis to their roommate. Results from mixed modeling indicated that roommates' compassionate goals were related to their greater support given, which in turn predicted MD roommates' reports of support received. MD roommates' support received, in turn, predicted their greater disclosure, but only when their anticipated stigma was higher. These findings suggest that roommates' supportive behaviors alleviated MD roommates' concerns that their MD status would be a source of negative judgment.

Special category: Community Engaged Research

Lyapunov Functions in Deep Reinforcement Learning

Craig Bowman
Mentored by: Scott Kelly, William States Lee College of Engineering

Reinforcement learning is a type of machine learning where an agent learns to make decisions by interacting with its environment and receiving feedback based on its actions. This project investigates the role of Lyapunov functions in deep learning-based control systems for nonlinear robots. The goal is to investigate how Lyapunov functions can be applied to improve the stability and performance of nonlinear systems using deep reinforcement learning. While Lyapunov functions have been widely used in nonlinear control theory, their integration with deep learning methods is still a developing area. This project seeks to bridge this gap, contributing new insights into their use in robotic control. The project involves learning the basics of control design using Lyapunov functions and applying deep reinforcement learning techniques in simulated environments. By developing and comparing simulations with and without the use of Lyapunov functions, the results highlight the benefits of using Lyapunov functions to achieve a stable and optimal controller. This project offers new perspectives on improving robotic control strategies, with potential advancements in autonomous systems.

Special category: OUR Scholars

Hidden Pollutants Within the Catawba River Basin

Sean Brule
Mentored by: Missy Eppes, College of Humanities & Earth and Social Sciences

The science world is desperate for an effective approach to communicating environmental urgency in ways that resonate emotionally with the public to combat coordinated efforts to downplay the impacts of corporate pollution and manipulate public opinion through greenwashing, lobbying, and funding of biased research. The infusion of art and science is crucial to visualizing invisible threats to public health and the environment. To better understand and practice Earth science communication through art, the goal of this project is to expand my knowledge of local point source pollution and its known impacts on public health while exploring how it relates to the neglect of corporate accountability amongst the growing trend of individual conservationism. Focusing on the Catawba River Basin, I will review the EPA's EnviroAtlas map data, as well as NC Department of Environmental Quality GIS data to map areas impacted by coal ash, PFAS, and heavy metal discharges. Then, I will create a drawing to demonstrate the idea that corporate industrial waste is an exponentially larger threat to Earth and humanity than household waste. I seek to gain an understanding of what, where, and how pollutants enter the environment and use that information to display the severe damage to air, water, and soil located within proximity to residential zones. Through this process, I expect to develop the necessary skill of using imagery, color, and scale to convey a sense of urgency and a need for a switch from personal guilt to systemic change.

Special categories: North Carolina Focused Research, Sustainability Research, Urban-Charlotte Focused Research

Weather Modeling and Visualization Using Cluster Computing

Kaitlyn Brunhaver
Mentored by: Erik Saule, College of Computing & Informatics

This research aims to highlight the critical role of distributed computing for weather modeling and how it can reduce compute time for high-resolution models that are necessary for small-scale weather phenomena. Using distributed computing across a cluster of 9 single-board computers, we are running the Weather Research and Forecasting Advanced Research (WRF-ARW) model and visualizing its output with VAPOR, a 2D/3D weather visualization software. To quantify the benefits of distributed computing, we compare the model and visualization software's execution time on a single computer versus a distributed system. The ability to rapidly process and visualize weather data at a high resolution to allow more responsive weather models underlines the importance of high-performance computing (HPC) in meteorological research.

Special categories: Globally Focused Research, North Carolina Focused Research

Exploring the role of Tumor-Intrinsic Interferon Signaling in Chemotherapy-Induced Pancreatic Cancer Cell Death

Kaitlyn Bruno
Mentored by: Youjun Wu, Klein College of Science

Pancreatic cancer is currently the 3rd leading cause of cancer-related death in the US, with an estimate of 67,440 new cases and 51,980 new deaths in 2025. The poor prognosis is primarily due to late detection and acquired resistance to chemotherapy. Therefore, finding ways to break the resistance is key to improving pancreatic cancer prognosis. Interferons are a group of cytokines that are important for fighting viral infections and for regulating the immune system. They also play crucial roles in cancer by modulating immune responses against tumor cells and attuning signaling within cancer cells, which can further cause apoptosis or promote cell survival. We previously found that activating type-I interferon signaling with recombinant IFN-β and type-II interferon signaling with recombinant IFN- γ can dramatically enhance the efficacy of chemotherapy in killing HPAF-II cells, a chemo-resistant pancreatic cancer cell line, with minimal effects in killing MiaPaca-2 cells, a sensitive cell line. These results suggest that boosting interferon signaling can break the resistance to chemotherapy. To further understand the underlying molecular mechanism, we will knock out interferon receptors by CRISPR/Cas9 in MiaPaca-2 and HPAF-II cells to test if interferon signaling is required for chemo-sensitivity. Preliminary results showed that knocking out $IFNAR_1$, the receptor of type-I interferon in the sensitive MiaPaca-2 cells, is not required for killing by chemotherapy. In future studies, we will test if type-II interferon is required for chemo-sensitivity in MiaPaca-2 cells and dissect the molecular mechanisms of how interferon signaling combats chemoresistance in the resistant HPAF-II cells.

Implementation Facilitators and Barriers of School-Based Health Centers

Yazi Bulluck
Mentored by: Victoria Scott, College of Humanities & Earth and Social Sciences

Introduction: Despite the increasing mental health needs of youth, there are vast barriers in accessing behavioral healthcare. School-Based Health Centers (SBHCs) have emerged as a health-promoting intervention by providing accessible primary and mental health care that is coordinated with educational environments. Although SBHCs hold promise, less is known about how to promote successful and sustainable implementation. This literature review leveraged existing research to identify key facilitators and barriers of implementation of SBHC services across ecological levels and contexts.

Methods: Relevant studies (not limited to the US) were identified from existing literature by the team plus a search across 4 databases (PubMed, Google Scholar, PsycNET, CINAHL) between 2002-2024. Key words included “strength”, “barrier”, “implementation”, “integrated care”, and “SBHC”. Of the 17,500 results returned by the keyword search, 81 abstracts were scanned, and 27 papers were selected for comprehensive review and analysis.

Results: Key implementation facilitators included forming inter-organizational partnerships, hosting program champions, having a full-time coordinator on staff, investing in marketing and outreach events, conducting pre-implementation steps, and supporting an innovative culture within staff. Key implementation barriers included information sharing, consent laws, conflict between state and district policies, and sustainability.

Conclusion: This literature review provides key insights for SBHCs and implementation practitioners invested in the sustained success of SBHCs. Results indicate that leveraging interorganizational partnerships and community engagement may be particularly helpful for enhancing information sharing and service utilization, and attending to consent laws and conflicting regional policies may be an important way to anticipate barriers to implementation.

Special category: Honors College

Using Art to Communicate Landslide Risks in Puerto Rico

Rose Casillas
Mentored by: Missy Eppes, College of Humanities & Earth and Social Sciences

There is a substantial population of people who are unaware that they live in areas susceptible to landslides, especially those who live in Puerto Rico. The lack of education, resources, and awareness around landslides inhibits Puerto Ricans from understanding the danger of the land around them. To better understand and practice Earth science communication through art, the goal of this project is to build my knowledge of landslide susceptibility in Puerto Rico while exploring how it relates to how people adapt to Earth's danger. Using art and a 3-D model, it is easier to demonstrate the dangers of these landslide susceptible areas. The population of people living in landslide susceptible areas will be determined through Google Earth and digital terrain maps of highly populated areas. A 3-dimensional terrain map will be made to showcase the danger that some of these people are unaware of and create an understanding of why these areas are susceptible to landslides. While conducting this project, I will expand my mapping and zoning skills. Using Google Earth and articles, such as "Rainfall-induced landslide susceptibility zonation of Puerto Rico" by Chiara Lepore, I hope to learn how the people of Puerto Rico adapt or live through these geographical danger zones, observing how they live around these steep slopes and take precautions around landslides. I intend to use the information from this project to construct a 3-dimensional terrain map from recycled materials of Adjuntas, Puerto Rico, showcasing the dangers that these landslides pose.

Special category: Globally Focused Research

Apartheid's Lasting Effects on Shaping Psychological Health in Black South African Communities

Noorkaran Chima
Mentored by: Heather Smith, College of Humanities & Earth and Social Sciences

In recent years, researchers and psychologists have increasingly focused on identifying the underlying causes of the global mental health crisis. South Africa continues to rank as the most unequal country in the world, with the top 10% owning over 85% of the nation's wealth. Interestingly, the country also has one of the lowest mental health rankings globally, with a Mental Health Quotient 20 points lower than the global average in 2022. While mental health struggles are evident worldwide, South Africa's history of apartheid offers a unique lens for understanding this crisis. The racially divisive policies of apartheid created deep social and economic divides, with ostracizing effects on black South African communities. This study critically evaluates multiple scholarly works and conducts a meta-analysis of peer-reviewed research to explore the psychological impacts of apartheid's policy on black South Africans. Findings suggest that apartheid's racially-oppressive policies contribute to the higher prevalence of mental health disorders. These findings are organized into two main categories: financial inequities and social experiences. First, financial inequity, which concentrates the majority of South Africa's wealth within the white minority, produces chronic financial stress for black South Africans. This limits access to resources, reduces upward mobility, and hinders the pursuit of self-actualization. Second, social experiences such as racism and discrimination cause identity stress, exacerbating psychological strain and increasing anxiety. This research highlights the intersection of oppressive policies and psychological health, illustrating how historical injustice provides crucial context for understanding mental health within marginalized communities. Its implications are essential in urging mental health providers, policymakers, and community leaders to consider the role of systemic injustice when addressing mental health disparities, both in South Africa and globally.

Special categories: Community Engaged Research, Globally Focused Research

Matrix Effects on ZNR Removal of PFAS

Maren Clark
Mentored by: Jordan Poler, Klein College of Science

PFAS are a group of synthetic chemicals resistant to water, oil, and heat, which provide a variety of applications, however, these properties contribute to their environmental persistence. They bioaccumulate in our blood and organs, when consumed, causing cancer, and disrupting reproductive hormones. The Poler Research Group is developing a natural and sustainable material designed to adsorb PFAS from water. The material used is Zeolite Nano Resin (ZNR) made by attaching a synthetic anion exchange polymer to a natural zeolite. The adsorption capacity of ZNR was calculated to be 0.007 mg of PFAS per gram ZNR. This material is promising, and its research could significantly advance the field of water purification. Additionally, confirming that this material is effective in the presence of other contaminants is crucial. Testing ZNR to remove other common water contaminants including NO_3^-, SO_4^{2-}, Ca^{2+}/Mg^{2+}, and Mn^{2+} is the focus of this research, along with how the presence of these ions and Cl^- affects ZNR's ability to remove PFOA and PFOS. It has been determined that ZNR can remove water hardness (as $CaCO_3$) from 383 to 39 ppm. It can remove NO_3^- from 200 to 63.6 ppm in the presence of 5 ppb PFOS, while also removing PFOS from 5 to 0.2 ppb.

Special categories: Honors College, Sustainability Research

Shinbutsu Bunri: The Material Effects of Forced Shinto and Buddhist Separation on Japanese Religious Culture

Jack Corning
Mentored by: Janna Shedd, College of Humanities & Earth and Social Sciences

This research explores the material and cultural impacts of *shinbutsu bunri* government policies on Japanese worship sites, which forced the separation of Buddhism and Shinto during the Meiji Restoration. How did *shinbutsu bunri* affect the physical culture of religious sites and what lasting effects can be observed today? The research focuses on material impacts rather than the associated ideological motives that prior studies have emphasized. The methodology follows a case study approach as we examine specific sites that underwent significant change during the *shinbutsu bunri* movement. Key examples include the removal of Buddhist architecture and iconography from the Tsurugaoka Hachimangu Jinja complex, along with the stripping of Aizu Sazaedo and the lost history of its origin. The research consists of visual documentation and historical materials obtained by the author from on-site studies and official shrine authority sources coupled with analysis of previous publications detailing other notable examples. The findings indicate that the enactment of *shinbutsu bunri* had profound physical effects on temples and shrines across Japan, ranging from the relocation of artifacts spurred by doctrinal separation of syncretized deities to the destruction of historical architecture and relics because of anti-Buddhist sentiment. This research is essential in understanding the circumstances which led to modern iterations of Shinto and Mahayana Buddhism and serves to emphasize the severe impact of *shinbutsu bunri* on material culture. Alongside these findings, I conclude that Meiji government policies were overall ineffective as a long-lasting strategy to divide the two syncretized facets of Japanese religious identity.

Special category: Globally Focused Research

Visualizing Water Contamination Through Art

Balmore Corvera
Mentored by: Missy Eppes, College of Humanities & Earth and Social Sciences

Using art to communicate scientific ideas allows those ideas to reach a wider audience than science journals, providing this audience with information that affects their daily lives. To better understand and practice Earth science communication through art, the goal of this project is to build my knowledge of using maps as a multi-scale tool by exploring patterns between industrial runoff sources and water contaminant concentration and transport. As someone who values the beauty and importance the natural environment and its water systems provide, I have always wanted to understand how certain areas can end up in a state of decay. Using these personal observations as inspiration, I plan on using tools such as the EPA's interactive EnviroAtlas map, surficial geological maps provided by the USGS, thematic maps provided by the Department of Energy, and referring to peer reviewed literature about hydrological processes, to create a gouache painting that helps visualize the consequences of neglecting our water sources. Through this project, it is my hope that I can learn how to use maps as a resource for identifying potential hazards to water systems and the adverse effects these potential hazards come with, as well as using these maps as an important consideration for future human development.

Special categories: Community Engaged Research, Globally Focused Research, North Carolina Focused Research

Using an LLM to Enhance Source Code Documentation Generation in Doxygen

Robert Craig
Mentored by: Yonghong Yan, College of Computing & Informatics

Complete and correct documentation of source code is integral to any project, no matter the size. To help create good documentation, Doxygen scans the comments in the source code of a project and creates the necessary documentation automatically. We want to update Doxygen so it interfaces with a large language model so that it can generate comments for code that has no documentation.

Comparison of Voltage Sensitive Asymmetric Thiazolothiazole Dyes for Cellular Imaging Applications

Charlie Darby and Joy Amuzu
Mentored by: Michael G. Walter, Klein College of Science

In our research, we focus on the synthesis and photophysical properties of voltage sensitive asymmetric Thiazolothiazole (TTz) dyes. TTz dyes are synthesized from dithiooxamide and various aromatic aldehyde groups. These asymmetric dyes are referred to as push-pull dyes due to the presence of electron-donor and acceptor groups on opposite sides of a pi-conjugated TTz core. This variety of dyes have changes in fluorescence in response to voltage fluctuations in their environments due to a very strong excited-state dipole moment. Two dyes that are exemplary in this application are 2-(N,N-dibutyl-4-aminophenyl)-5-(4-carbo [3- (trimethylammonio) propoxy] phenyl) thiazolo [5,4-d] thiazole bromide, [Bu2N-TTz-CO2(NPr)], and 2-(N,N-dibutyl-4-aminophenyl)-5-(pyridyl [1-trimethylamonium]) thiazolo [5,4-d] thiazole dibromide, [Bu2N-TTz-Py(NPr)]. [Bu2N-TTz-CO2(NPr)] is a TTz dye that has excellent cell membrane localization due to its positive charge interacting with the negatively charged cell membrane exterior and a high dipole moment for voltage sensitivity. It also demonstrates voltage sensing by a twisting mechanism about the TTz core in the excited state, quenching the fluorescence. Due to the conjugated bond resonances of [Bu2N-TTz-Py(NPr)] we expect to see an opposite effect due to its planarity. [Bu2N-TTz-Py(NPr)] has demonstrated a red shift that we believe could be used for deeper tissue penetration when imaging. Dyes that exhibit these properties have the potential for protein tagging and other pharmaceutical/drug screening applications.

Investigating and Comparing Sustainable Development Goal #10 in Germany and the United States

Jazmin Darwin, Tuba Durmus-Ispahi, Hailey Morritt, Zionah Davis, Jamari Young, and Sophie Besten
Mentored by: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Our research investigates and compares aspects of the Sustainable Development Goal (SDG) #10: reduced inequalities: The main research questions for our international comparative study are: What are the similarities among Germany and the United States related to target goals for Sustainable Development Goal #10? SDG #10 seeks reduced inequalities and to achieve economic and political inclusion of all. It aims to eliminate discriminatory laws and policies, as well as making sure developing countries get a say in global international economic and financial institutions decision-making for it to be more effective and credible. What are the differences? To what degree are the countries on track to make progress on SDG # 10 by the 2030 goal year? To conduct this research, we each wrote a Research Memo paper based on a literature review methodology, which included international reports and peer-reviewed journal articles. The Research Memo was framed by Bereday's (1964) Comparative Model. We used an Artificial Intelligence (AI) Debate Bot to further strengthen our findings. This collaborative study was part of a semester-long Global Networked Learning (GNL) research collaboration among students at UNC Charlotte and students at the PH Ludwigsburg in Germany. GNL is a collaborative approach to learning that enables students and instructors from different locations around the world to participate in learning and creation of knowledge together. In our research, we report the comparative findings of our research and discuss the challenges and possibilities in meeting SDG 10 by the 2030 goal year.

Special categories: Globally Focused Research, Sustainability Research

The Impact of Soil Characteristics on Biodiversity: A Visual Depiction

Nate Davis
Mentored by: Missy Eppes, College of Humanities & Earth and Social Sciences

Scientific data can often be difficult to comprehend; using visual arts to bridge this gap is imperative for increasing scientific understanding to a larger audience. Whether it be in mapmaking, diagrams, or fine art, the use of visually appealing and representative depictions can reshape the way your audience perceives your data or focus. To better understand Earth science communication through art, this study aims to convey how the many diverse soil classifications shape ecosystems across the globe. The main topics discussed will be geomorphological elements, specifically focusing on riparian forests and soils near fluvial systems. To better understand this topic, two soil survey areas with various streams were chosen. The areas are near our University, in Union County and, on the Hawaiian island of Kaua'i respectively. These maps are courtesy of the United States Web Soil Survey and are full of diverse soil classifications all across the country. By showing these visuals, alongside my artwork of common native plants of each area, I hope to communicate the diversity of our planet as well as the risk of pollutants in streams with weakening or riparian forests.

Special category: Globally Focused Research

Synthesis of Antimicrobial Peptide Analogs for DNA Conjugation

Dhairya Desai
Mentored by: Eva Ge, Klein College of Science and Honors College

Antimicrobial resistance (AMR) is a global health crisis projected to cause over 10 million deaths annually by 2050. Many current antibiotics which target bacterial proteins are increasingly ineffective due to resistance mechanisms arising from genetic mutations and horizontal gene transfer. This study investigates the use of peptide-DNA conjugates as a novel strategy to combat AMR, leveraging the modularity and versatility of nucleic acids to assemble into nanostructures with the broad-spectrum activity of antimicrobial peptides (AMPs). LL-37 is a well-characterized human AMP that acts by disrupting bacterial membranes, reducing the chance of developing resistance. In this study, we use LL-37 as a proof of concept to assemble into peptide-DNA conjugates. LL-37 is synthesized using Fmoc-based Solid Phase Peptide Synthesis (SPPS) with a propargyl glycine residue at the C-terminus for click-chemistry conjugation with DNA. Liquid Chromatography-Mass Spectrometry (LC-MS) data shows we were able to obtain our desired product. Current efforts focus on improving peptide purity, providing a basis for exploring diverse AMPs to enhance therapeutic options with peptide-DNA conjugates.

Special categories: Honors College, Phi Kappa Phi (PKP) Member

Deploying Fast Centrality Algorithms in Gephi

Reece Devenney
Mentored by: Erik Saule, College of Computing & Informatics

High performance computing is an important area of study in modern computer science. There is sometimes a gap between this research and how it can be used by a wider audience. One application of HPC is in graph analysis to be able to study things such as computer and traffic networks. To see how we can close this gap, we are implementing high performance code related to graph analysis to the open-source project, Gephi.

Investigating and Comparing SDG #2: Zero Hunger in Germany and the United States

Madiouma Diawara, Evan Lewis, John Bonilla Cabrera, Sebile Özdemir, and Franziska Buchenroth
Mentored by: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Our research investigates and compares aspects of the Sustainable Development Goal (SDG) #2: Zero Hunger or Kein Hunger (in German). The main research questions for our international comparative study are: What are the similarities among Germany and the United States related to target goals for Sustainable Development Goal # 2 End Hunger? What are the differences? To what degree are the countries on track to make progress on SDG # 2 by the 2030 goal year? To conduct this research, we each wrote a Research Memo paper based on a literature review methodology. The Research Memo included international reports and peer-reviewed journal articles. The Research Memo was framed by Bereday's (1964) Comparative Model. To sharpen our critical thinking skills, we also engaged with an Artificial Intelligence (AI) Debate Bot to further strengthen our findings. This collaborative study was part of a semester-long Global Networked Learning (GNL) research collaboration among students at UNC Charlotte and students at the PH Ludwigsburg in Germany. A GNL project is a collaborative approach to learning that enables students and instructors from different locations around the world to participate in learning and creation of knowledge together. In our research, we report on the comparative findings of our GNL project. The research includes an examination and discussion of the challenges and possibilities in meeting SDG #2 Zero Hunger/ Kein Hunger by the 2030 goal year.

Special categories: Globally Focused Research, Sustainability Research

Optimizing Fungal-bacterial Association Protocol to Study Plant Health

Paola Diaz-Matamoros
Mentored by: Morgan Carter, Klein College of Science

Fungi and bacteria can individually impact plant growth by either promoting or suppressing it. *Fusarium oxysporum* f.sp. *niveum* is a common fungal pathogen in soil that infects and causes wilting watermelon plants. In contrast, *Paenibacillius* is a bacterial genus often found in soil that has been linked to promoted plant growth. Analyzing how a *Paenibacillus* isolated from inside of *Fusarium oxysporum* f.sp. *niveum* interacts with its fungal host in different nutrient or stress conditions and will reveal how the partners influence each other. This endohyphal interaction could be a facultative mutualistic relationship if it occurs in stressful environments as a way to overcome challenges together. Optimizing their reassociation provides a foundational protocol that can be used to investigate their symbiosis establishment as well as their effect on plants together and separated. To evaluate the effectiveness of these associations we used a GFP-tagged bacterial strain that fluoresces and is easily identified under the microscope. Localization of more bacteria inside the hyphae suggests that the method used is successfully facilitating the relationship. We examined how different ratios of bacteria to fungi affect reassociation success within an environment that stresses both fungi and bacteria to promote interaction. We co-cultured the microbes on different media types to analyze which low-nutrient media would lead to increased interaction. Testing stability provides insight on if these associations are able to persist symbiotically and can stay intact regardless of environmental stressors.

Fat Liberation and Menopause: Redefining Health and Challenging Stigma

Wissal Dkhir
Mentored by: Margaret Quinlan, College of Humanities & Earth and Social Sciences

Body size and weight-related socialization shape how girls and women perceive and experience their bodies, influenced by media, family, peers, and societal messages that reinforce the idea that ‘fat is bad, and thin is good.’ This stigmatization affects self-image, mental health, and overall well-being, with unique pressures emerging at different life stages, particularly during menopause. During this period, societal expectations emphasize weight control and youthfulness while overlooking the hormonal changes that contribute to weight fluctuations. This study examines how weight-related ideas evolve from childhood through older adulthood, focusing on weight stigma during menopause and its intersection with developmental and psychological needs. By analyzing academic research, books, and media messages through feminist and fat liberation frameworks, this study clarifies how dominant health narratives marginalize menopausal bodies. Fat liberation, as a movement advocating for the acceptance of all body sizes and challenging harmful weight-based stereotypes, critiques these narratives, particularly in the context of menopause. Findings reveal that weight stigma during menopause worsens medical bias, contributes to body dissatisfaction, and reinforces limiting health ideals that overlook the physiological role of body fat, which, after menopause, becomes the primary source of estrogen production, highlighting its importance in menopausal health. These results underscore the harmful effects of weight-based discrimination on mental health, particularly in menopause, where health and beauty standards are influenced by societal norms. The study highlights the urgent need for inclusive health frameworks that challenge weight stigma and promote a balanced understanding of menopause and body diversity.

Special category: OUR Scholars

Changes in Political Animus Among College Students During the 2024 Election
Natalie Doerfler
Mentored by: Jason Giersch, College of Humanities & Earth and Social Sciences

Tensions between political parties are to be expected in democratic societies, but especially hostile or negative feelings towards members of the opposing political party are described as political animus (Iyengar et al., 2019), which can threaten social trust (Kingzette et al., 2021). The purpose of the present study was to measure political animus among college students and to see whether elections make partisan animus worse among young people. The 2024 presidential election provided the opportunity to collect a unique data set. Political animosity is heightened around election seasons, especially during close races such as this one. For many young people, their entire experience with politics and political identities could be defined by a single election. To see how college students' feelings toward political outgroups change with the results of an election, we conducted online surveys of more than 100 UNC Charlotte students in introductory political science courses immediately before and after the election. We had expected to find that Trump's re-election would increase animus directed toward Republicans and decrease the animus directed toward Democrats. Instead, we found that the measures of animus remained stable after the election. We also found that slightly more animus was directed toward Republicans than toward Democrats, both before and after the election. These findings support current findings in political science that students who identify with the Republican party are uncomfortable disclosing their political identity in a university setting due to the fear of being negatively perceived by their peers (Grady & Lewis, 2024).

Special categories: Community Engaged Research, Globally Focused Research, North Carolina Focused Research

Investigation of the chemical properties responsible for antibacterial activity of the stingless bee honey from Costa Rica

Natalya Drapievskaya, Noor Elhalabi, and Kaustubh Tiwari
Mentored by: Joanna Krueger, Klein College of Science

For centuries, honey has been used as a natural antiseptic and antibiotic to dress wounds, prevent infection, and promote healing. The honey from the stingless bee Mariola species in Costa Rica is particularly valued for treating skin and eye infections. In this study, Mariola honey samples are tested for their hydrogen peroxide (H_2O_2) levels and antibacterial properties against gram-positive and gram-negative bacteria, with the aim of contributing to understanding the healing properties of stingless bee honey, creating potential insights for medicinal uses. H_2O_2 is a major antibacterial component in many honeys. The total peroxide levels in three honey samples—a wildflower honey from Hudson, NC, and two Mariola honey from Guanacaste, CR—were assessed using a modified ferrous oxidation (FOX-1) method (Li et al., 2017 Food Chemistry). Hydrogen peroxide standards (0.0136–0.68 µg/L) were used to prepare a standard curve, and absorbance measurements were taken with a Thermo Scientific NanoDrop One using a 10 mm cuvette. The peroxide levels in the wildflower, Mariola 1, and Mariola 2 honey samples were determined to be 0.115 ± 0.008 µg/L, 0.280 ± 0.018 µg/L, and 0.229 ± 0.017 µg/L, respectively. Future experiments will involve replicating the experiment in the presence of catalase, an enzyme that breaks down H_2O_2, to distinguish hydrogen peroxide from total peroxide levels, and conducting antibacterial and sugar detection assays.

Special category: Globally Focused Research

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

Gracyn Dwyer
Mentored by: Abbey Thomas, College of Health & Human Services

Total knee arthroplasty (TKA) is the most common type of total joint replacement surgery. An estimated 3.5 million TKAs will be performed annually 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, interferes with post-operative rehabilitation, impairing mobility and quality of life. Individuals are at greater risk of developing this condition if they have preoperative deformities, postoperative joint stiffness, and insufficient rehabilitation protocols. Current treatments to combat knee flexion contracture, like manipulation under anesthesia and revision surgery, are invasive. By exploring non-invasive interventions that could mitigate this condition, this study guides clinicians in optimizing post-surgical treatment protocols. Our purpose is to evaluate the effectiveness of an anterior heel wedge in altering gait patterns, specifically promoting a straighter knee, and reducing knee flexion contracture in individuals post-TKA. This study involves 20 participants, male and female and over 18. Each individual will complete a series of assessments: baseline, 2 weeks, and 4 weeks. After baseline, participants will receive an anterior heel wedge to wear on their shoe continuously for 4 weeks during daily activities. The intervention's efficacy will be assessed through online surveys that collect patient-reported outcomes regarding pain, ADL performance, and perceived functional improvement. Furthermore, strength evaluations and 3D biomechanical assessments during walking will be used. 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 recovery processes.

Special category: Honors College

The Physiographic Evolution of the American Southwest

Jazmine Ellis
Mentored by: Missy Eppes, College of Humanities & Earth and Social Sciences

Science communication through art is important as it showcases another form of conveying information. Not everyone is able to comprehend data through numbers and equations, so the visual representation through an art form may be more ideal. In order to better understand and practice Earth science communication through art, the goal of this project is to build my knowledge of physiographic provinces while exploring how they relate to the ways humans have impacted and changed Earth, both positively and negatively, over the geologic period of a few thousands of years. Physiographic provinces struck my interest as we first spoke about them in class. I find it fascinating to learn about how each region, their landforms, and topography have evolved over time and how they define the region. I plan to use topographic maps and geologic maps to research the Basin and Range area of the United States. I am going to use the drawing and/or painting techniques to convey this visually with elements such as lines, color and texture. I hope to learn more in general about different physiographic provinces and their usefulness in mapmaking, as well as how to depict real life geology through implied art expression. From this project I plan to gain a better understanding of artistic strategies to get a point across visually instead of relying solely on written or spoken words.

A Deep Dive into Singular Value Decomposition's Utility for Noise Reduction in Audio Signals and Language Processing

Julian Evans
Mentored by: Xingjie Li, Klein College of Science

Audio signals, especially speech and music, are deeply integrated into our everyday experiences, influencing communication, entertainment, and social interactions. These same daily experiences also create noise, such as babbling cafes, busy offices, or noisy home spaces, which diminishes audio quality. Traditional noise suppression techniques like Wiener filtering and spectral subtraction offer effective solutions, yet my research covers a different avenue: utilizing Singular Value Decomposition (SVD), a common yet under explored linear method, for noise reduction. Stemming from a personal interest with linear algebra, I implemented SVD, commonly used for image compression and data reduction, and investigated how effectively it removes noise from speech and music audio. The study evaluates SVD's performance through mathematical metrics such as Perceptual Evaluation of Speech Quality (PESQ), Short-Time Objective Intelligibility (STOI), Signal-to-Noise Ratio (SNR), and Cepstral Distance. As the research evolves, it expands beyond numerical metrics to real world significance by employing transcribed accuracy evaluations using Word Error Rate (WER), connecting the mathematical with practical usability. Theoretically SVD's strength lies in its ability to capture a signal's linear low-rank structure in a small number of dominant singular values, while unstructured or random noise disperses across numerous smaller singular values. Ideally, speech and music signals correlate strongly with these dominant singular values, allowing effective noise separation. By carefully exploring SVD's capabilities and limitations, this research aims to uncover new insights into how effectively a straightforward linear method can contend with varying noise conditions.

Deep Learning for Adaptive Gait Rehabilitation: Integrating sEMG, IMU, and Pose Keypoint Data

Eric Fackelman
Mentored by: Minhaj Alam, William States Lee College of Engineering

Asymmetric gait, often observed in individuals with neurological impairments such as hemiplegia or foot drop, poses significant challenges to mobility and rehabilitation. Functional Electrical Stimulation (FES) systems offer a promising approach to assist gait by stimulating muscle contractions, yet traditional open-loop systems struggle to adapt to dynamic motion and individual variability. This study proposes a closed-loop FES system that uses deep learning to improve gait rehabilitation for individuals with asymmetric gait. We hypothesize that integrating surface electromyography (sEMG), inertial measurement units (IMUs), and pose keypoints will enhance EMG prediction and optimize rehabilitation. Data were collected from 20 healthy participants during walking, turning, and stair climbing. Key kinematic features from pose, such as joint angles and symmetry, were extracted to predict EMG activity. Several model architectures and training configurations are to be evaluated, with the goal of enhancing predictive performance of real-time FES systems.

Special category: OUR Scholars

Exploring *Rhizopus* and *Mycetohabitans* Relationships Through Genome Sequencing

Sara Field
Mentored by: Morgan Carter, Klein College of Science

Bacteria live in close relationships with fungi, sometimes even inside them, presenting a snapshot of how eukaryotes evolved from ancient symbioses. *Mycetohabitans* spp. are endohyphal bacteria (EHB) that live inside the hyphae of *Rhizopus microsporus*, a pathogenic fungus that causes rice seedling blight and opportunistic human infections. *Mycetohabitans* bacteria must be present in their host for the fungus to reproduce through sporulation. Genome sequencing of *Mycetohabitans* spp. can help us to look deeper into the genomic trends enabling an endohyphal lifestyle and gain a better evolutionary understanding, but we need genome assemblies from many strains for useful comparisons. We used bacteria- and *Mycetohabitans*-specific primers to confirm the symbiont status of fungal accessions from culture collections. If a fungus was confirmed to contain symbionts, we performed bacterial extractions using an optimized protocol and then extracted genomic DNA from cultured bacteria. Nanopore sequencing was performed on the extracted *Mycetohabitans* gDNA, followed by genome assemblies. Assembled genomes were checked to assess the number of replicons, genome completeness using BUSCO, and the GC content, an indicator of genomic stability. We extracted and sequenced sixteen strains, including two previously unknown *Mycetohabitans* strains, B10 and B203. The sequenced genomes were of high quality, with BUSCO scores falling in the range of 98.8%-99.6%, and GC%s from 60.0-61.0%. Further research on this larger set of *Mycetohabitans* strains will enhance our understanding of the evolution of host-symbiont relationships, ultimately impacting agriculture, healthcare, and biotechnology applications.

Investigating and Comparing SDG #1: No Poverty in Germany and the United States
Robbie Flanagan, Sa'Rya Parker, Ahmed Abdullatef, Marie Preger, and Matti Knoll
Mentored by: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Our research investigates and compares aspects of the Sustainable Development Goal (SDG) #1: No Poverty. The main research questions for our international comparative study are: What are the similarities among Germany and the United States related to target goals for Sustainable Development Goal # 1 - No Poverty? What are the differences? To what degree are the countries on track to make progress on SDG #1 by the 2030 goal year? To conduct this research, we each wrote a Research Memo paper based on a literature review methodology. The Research Memo included international reports and peer-reviewed journal articles. The Research Memo was framed by Bereday's (1964) Comparative Model. To sharpen our critical thinking skills, we also engaged with an Artificial Intelligence (AI) Debate Bot to further strengthen our findings. This collaborative study was part of a semester-long Global Networked Learning (GNL) research collaboration among students at UNC Charlotte and students at the PH Ludwigsburg in Germany. A GNL project is a collaborative approach to learning that enables students and instructors from different locations around the world to participate in learning and creation of knowledge together. In our research, we report the comparative findings of our GNL project. The research includes an examination and discussion of the challenges and possibilities in meeting SDG #1 by the 2030 goal year.

Special categories: Globally Focused Research, Sustainability Research

Stress-Specific Regulation of Yeast BiP Through Multisite Phosphorylation

Erica Flores
Mentored by: Chathura Paththamperuma and Andrew W. Truman, Klein College of Science

Approximately one-third of all protein synthesis takes place at the endoplasmic reticulum (ER) and depends on ER-localized molecular chaperones and co-chaperone proteins. The ER-resident Hsp70 ortholog, Kar2, is crucial for protein folding and the degradation of misfolded proteins. Post-translational modifications (PTMs) on chaperones, referred to as the “Chaperone Code,” modulate their activity and specificity. This study examines the role of Kar2 phosphorylation in budding yeast. We generated 42 yeast strains carrying phosphomimetic and phospho mutant variants at known Kar2 phosphorylation sites and identified one mutant, T538E, that was unable to provide essential Kar2 function. Phenotypic fingerprinting of the remaining 41 strains under various stress conditions revealed that T59A and T538A mutants exhibited slow growth even in the absence of stress, suggesting a role in global Kar2 activity. Several mutants demonstrated stress-specific phenotypes: T60A, T60E, S385A, and S643D were highly sensitive to hydroxyurea, while S385A also showed sensitivity to oxidative stress. Additionally, T60E exhibited sensitivity to tunicamycin, suggesting involvement in ER stress, and S493D displayed heat shock sensitivity. To further investigate heat sensitivity, we used a luciferase reporter assay to assess the activation of the heat shock response (HSR). Interestingly, the mutants exhibited hyperactive HSR, which we plan to explore further for better understanding. Future studies will include additional assays, western blots, and proteomic analyses to determine whether phosphorylation impacts Kar2 stability, activity, or interactions during heat stress.

From Science to Civil Rights: Examining Teachers' Experiences Conducting Site-Based Professional Development

Kendall Fording and Madelyn Torkelson
Mentored by: Scott Gartlan, College of Humanities & Earth and Social Sciences

Previous research identified seven features of effective teacher professional development: is 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. However, less evidence exists for *how* these features interact to foster this kind of growth. This study utilizes a grounded theory approach to understand how these seven features relate to and support student learning outcomes. Three summer professional development programs designed for public school classroom teachers were reviewed in this study: (1) a chemist-led program at a large, urban research university for two public school teachers with a graduate student mentor, (2) a similar program at a small liberal arts institution for two public school teachers, and (3) a history-focused program led by a retired history teacher for 35 public school teachers who visited historical American southern cities and museums. Eight participants were interviewed using a semi-structured protocol. Findings aligned with previous research, emphasizing active learning, coaching, content focus, and feedback as critical components. Additionally, results suggest that teachers thrive in an environment that requires knowledge slightly outside their current knowledge, fostering inquiry and experiential learning. Collaboration with mentors and professionals outside their grade levels allows teachers to step into new learning environments. This emergent theory, through the evidence, suggests that school districts are likely to benefit by providing opportunities for teachers to step into new learning environments to provide opportunities for collaboration with other professionals outside their grade levels.

Special categories: Community Engaged Research, North Carolina Focused Research

Optimizing Stormwater Infrastructure Decisions with Machine Learning

Amanda Fye
Mentored by: Nicole Roberts and Michael Smith, William States Lee College of Engineering

Retroactive stormwater infrastructure management proves costly for both providers and beneficiaries. Existing data driven solutions in stormwater infrastructure applications contend with limited data availability, additional equipment requirements, and geographically unique challenges. A prior case study demonstrates an asset classifying machine learning (ML) model as the first step in a stormwater system decision-making framework. Utilizing existing data collection methods, this project aims to design a ML model to identify vital stormwater assets in Charlotte, NC, based on their potential cost-of-failure. Evaluating assets based on potential cost-of-failure aids infrastructure managers in optimizing services, prioritizing repairs, prolonging asset lifespan, and projecting long-term maintenance expenses. This research rests on the strength of the related ML model's cost-feature formulations, utilizing regionally specific values to calculate an asset's cost-of-failure. Incorporating a novel urbanization cost feature enhances the model’s applicability to rapidly growing cities like Charlotte. This approach anticipates the impact of development needs on system demand, providing a more comprehensive analysis for stormwater infrastructure planning and maintenance. In this adapted classification model, culvert assets are labeled as "major" or "minor" based on cost features accounting for repair costs and disruption to service for the surrounding community. Assets exceeding a cost-of-failure threshold are classified as "major," indicating they risk significant interruption to the service area upon failure. This case study could provide Charlotte's infrastructure managers with a ML model advancing maintenance prioritization, cost reduction, and enhanced service quality while anticipating infrastructure development. Future model adaptations could extend to interdependent utility systems to explore cross-asset influences.

Special categories: North Carolina Focused Research, OUR Scholars

Novel Solvers for Sparse Generalized Linear Models

Sindhu Gadiraju
Mentored by: Christian Kuemmerle, College of Computing & Informatics

Imagine you're using a health app that predicts whether someone is at risk for a condition based on dozens—or even hundreds—of health indicators. To be trustworthy, that prediction model needs to be not only accurate, but also transparent about which factors matter most. This is where sparse logistic regression models come in: they help make sense of complex data while highlighting only the most important features. However, training these models efficiently—especially on large or noisy datasets—can be difficult. Our research tackles this problem by introducing a new way to train sparse logistic regression models using a technique called Iteratively Reweighted Least Squares (IRLS). While IRLS is commonly used in other areas of statistics, it hasn't been widely explored for logistic regression tasks. We designed a custom IRLS-based optimization approach and tested it on both synthetic and real-world datasets. Our method incorporates regularization to reduce overfitting and includes a feature called Huber loss, which helps the model stay stable even when the data contains outliers. We then compared our results to those from a widely used method in Scikit-learn, evaluating performance on classification accuracy, computational speed, and model interpretability. Our findings show that the regularized IRLS approach can offer better accuracy and robustness, especially on larger datasets. This work lays the groundwork for applying this method in fields like healthcare, finance, or marketing—where reliable, interpretable predictions matter and data can be large, noisy, or hard to work with.

Special category: OUR Scholars

Investigating and Comparing Sustainable Development Goal #1 in Germany and the United States

Daniel Gamez, Aya Zedan, Ashley Antonio, Celine Javsan, and Anneli Schäfer
Mentored by: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Our research investigates and compares aspects of the Sustainable Development Goal (SDG) #1: No Poverty. The main research questions for our international comparative study are: What are the similarities among Germany and the United States related to target goals for Sustainable Development Goal # 1: End poverty in all manifestations by the year 2030? What are the differences? To what degree are the countries on track to make progress on SDG #1 by the 2030 goal year? To conduct this research, we each wrote a Research Memo paper based on a literature review methodology. The Research Memo included international reports and peer-reviewed journal articles. The Research Memo was framed by Bereday's (1964) Comparative Model. To sharpen our critical thinking skills, we also engaged with an Artificial Intelligence (AI) Debate Bot to further strengthen our findings. This collaborative study was part of a semester-long Global Networked Learning (GNL) research collaboration among students at UNC Charlotte and students at the PH Ludwigsburg in Germany. A GNL project is a collaborative approach to learning that enables students and instructors from different locations around the world to participate in learning and creation of knowledge together. In our research, we report on the comparative findings of our GNL project. The research includes an examination and discussion of the challenges and possibilities in meeting SDG 1 in order to eradicate poverty in all its forms in various target areas using multiple effective strategies by the 2030 goal year.

Special categories: Globally Focused Research, Sustainability Research

Investigating and Comparing Sustainable Development Goal #11 in Japan and the United States

Andy Garcia and Hinata Asada
Mentored by: Erik Jon Byker, Cato College of Education

Our research investigates and compares aspects of the Sustainable Development Goal (SDG) # 11: Sustainable Cities and Communities. The main research questions for our international comparative study are: What are the similarities among Japan and the United States related to target goals for Sustainable Development Goal #11? What are the differences? To what degree are the countries on track to make progress on SDG #11 by the 2030 goal year? To conduct this research, we wrote a Research Memo paper based on a literature review methodology. The Research Memo included international reports and peer-reviewed journal articles. The Research Memo was framed by Bereday's (1964) Comparative Model. To sharpen our critical thinking skills, we also engaged with an Artificial Intelligence (AI) Debate Bot to further strengthen our findings. This collaborative study was part of a semester-long Global Networked Learning (GNL) research collaboration among students at UNC Charlotte and students at Sophia University in Japan. A GNL project is a collaborative approach to learning that enables students and instructors from different locations around the world to participate in learning and creation of knowledge together. In our research, we report on the comparative findings of our GNL project. The research includes an examination and discussion of the challenges and possibilities in meeting SDG #11 by the 2030 goal year.

Special categories: Globally Focused Research, Sustainability Research

Investigating and Comparing Sustainable Development Goal #4 in Germany and the United States

Ryan Gee, Kyla Teamer, Landon Griffin, Mick Keough, Lena Bader, and Henriette Lenhof
Mentored by: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Our research investigates and compares aspects of the Sustainable Development Goal (SDG) #4: Quality Education. The main research questions for our international comparative study are: What are the similarities among Germany and the United States related to target goals for Sustainable Development Goal #4, which is to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all? What are the differences? To what degree are the countries on track to make progress on SDG #4 by the 2030 goal year? To conduct this research, we each wrote a Research Memo paper based on a literature review methodology. The Research Memo included international reports and peer-reviewed journal articles. The Research Memo was framed by Bereday's (1964) Comparative Model. To sharpen our critical thinking skills, we also engaged with an Artificial Intelligence (AI) Debate Bot to further strengthen our findings. This collaborative study was part of a semester-long Global Networked Learning (GNL) research collaboration among students at UNC Charlotte and students at the PH Ludwigsburg in Germany. A GNL project is a collaborative approach to learning that enables students and instructors from different locations around the world to participate in learning and creation of knowledge together. In our research, we report on the comparative findings of our GNL project. The research includes an examination and discussion of the challenges and possibilities in meeting SDG #4: Quality Education by the 2030 goal year.

Special categories: Globally Focused Research, Sustainability Research

Leveraging Large Language Models to Enhance Learning Outcomes in Undergraduate Software Engineering

Jason Gianni
Mentored by: Mohsen Dorodchi, College of Computing & Informatics

Generative artificial intelligence (genAI) in the classroom is a reality that future educators and students will have to accept. AI chatbots have the potential to enhance the learning experience of students, particularly those who study software engineering. This project will explore the impact of genAI on students' success in a software engineering undergraduate course by: 1) focusing on using AI to develop course contents that students need more practice on such as user stories, use case modeling followed by 2) assisting students working within an agile environment for task identification and planning. The following research questions will be used to guide this study 1) What are the strengths/weaknesses of developing a LLM algorithm for genAI for Software Engineering learning environments? 2) Which human-made artifacts are most/least beneficial to a LLM algorithm to learn from and create more useful activities? 3)Will the use of genAI in education translate into success in learning Software Engineering concepts? 4) Will educators require additional work to better implement Artificial Intelligence for content development in courses? As a part of the study, we explore how students interact with genAI to complete coursework which are either developed by humans or by genAI. We expect to explore the impact of this work on students and educators in software engineering using genAI to assist in modeling larger projects. The findings of this research may bleed into other courses in computer science, and into other fields of study at the University of North Carolina at Charlotte (UNCC).

Special category: Honors College

Effect of KRAS Inhibitors on Replication of Oncolytic Vesicular Stomatitis Virus in Pancreatic Cancer Cells

Aroosh Goje
Mentored by: Valery Grdzelishvili, Klein College of Science

Pancreatic Ductal Adenocarcinoma (PDAC) is a highly lethal and aggressive cancer that is usually diagnosed late, making it difficult to treat. Oncolytic virotherapy (OV) is a novel form of treatment that has shown promise. OV therapy uses genetically modified viruses to selectively infect and kill cancer cells while leaving healthy cells relatively unaffected. Vesicular stomatitis virus (VSV) is a promising OV agent currently in use in clinical trials, that can also be used in combination with other forms of treatment against PDAC. KRAS is an oncogene that is mutated in over 90% of PDACs and promotes tumorigenesis, immune evasion, and therapy resistance. KRAS inhibitors are drugs that target the oncogenic KRAS protein. In this project, we used three different KRAS inhibitors to see how pathways activated by KRAS affect VSV replication in PDAC cell lines. Based on previous literature, we hypothesize that inhibition of KRAS will increase antiviral signaling, therefore decreasing VSV replication in PDAC cells. Through viral kinetics, we demonstrate that specific KRAS inhibitors decrease viral replication in cell lines containing the targeted mutation. In addition, through *de novo* particle production, we demonstrate that KRAS inhibitors increase antiviral signaling, as we observe a decrease in viral titer in cell lines with intact antiviral signaling, but not in cell lines with defective antiviral signaling. While effective separately, our research suggests that OV therapy and KRAS inhibitors should not be used in combination. Our study demonstrates a novel mechanism of virus-host interactions determined by abnormal activities of a mutant KRAS protein.

Scaling Art Classification Models: Enhancing Binary Classifiers and Tackling the Challenge of AI-Generated Art

Brendan Gorman
Mentored by: Todd Dobbs, College of Computing & Informatics

This paper discusses the creation of a binary classification2 model that can efficiently classify artwork by artists, building on previous research in the area [2]. The research topic here is to streamline current multiclassification models by using a binary classifier in assessing its performance compared to conventional multiclassification systems. Deep learning5 methods, specifically ResNet-10112, were employed to distinguish between non-Monet and Monet paintings in the first study, and between Vincent van Gogh and non-van Gogh paintings in the second. The article also discusses the implications of AI-generated pieces of art, briefly delving into the difficulty of identifying if artworks are genuine or not to a computing system. The results show that it is possible to develop a theoretical multiclassifier through the fusion of various binary classifiers, thereby creating an efficient and scalable approach for handling large datasets and many artists. Nonetheless, whereas binary classification proves to be effective for traditional art with respect to accuracy, it cannot differentiate AI paintings imitating artists, thereby representing the limitation of the method. The discussion goes further into these issues and highlights the potential for development in the classification of art, specifically with regards to the complications presented by the advent of AI-produced artworks in this field.

Dance and Communities: Scouts and Guides

Naiya Graham
Mentored by: Kaustavi Sarkar, College of Arts + Architecture and Honors College

This research investigates intergenerational pedagogy as practiced in Indian diasporic dance education. Situated in the context of community-based dance programs outside of a formal K12 setting, dance educators are more in tune with cultural education as opposed to standards-based teaching and learning in the field of dance provided by the North Carolina Department of Public Instruction (NCDPI). This research is topical and important because it addresses the importance of dance education and how to make it more accessible in environments outside of the educational settings, as well as how dance education helps to foster more in-depth intergenerational pedagogy and expose learners to the diaspora of dance and increasing both their emotional and social skills. The following research questions are investigated in this project: 1) How does intergenerational pedagogy impact dance education? and 2) How can North Carolina dance education standards for grades K-12 be integrated into community-based dance programs that have no prior experience or understanding of education standards? The research method for this research is a project based durational assessment and feedback procedure developed for improving, standardizing, and creating more support for dance education in the diaspora. In relation to the questions and research methods, the research project reports on findings on dance education in the diaspora, intergenerational pedagogy, and integration of arts education standards into non-traditional school settings. The research project concludes with a two-day conference and final performance showing the dances that were taught using North Carolina education standards

Special categories: Community Engaged Research, Honors College, North Carolina Focused Research, OUR Scholars

Exploring Motivational Drivers of Physical Activity Engagement through Qualitative Coding of Physical Activity Related Social Media Posts

Jaidyn Graham
Mentored by: Sara Levens, College of Humanities & Earth and Social Sciences

Understanding the motivations behind physical activity (PA) engagement is crucial for developing interventions that promote healthier lifestyles. This study examines motivational tendencies in a large dataset of 2585 human coded Twitter posts about exercise engagement, with a focus on identifying intrinsic and extrinsic motivational factors. Coders on the project received qualitative coding training as part of a larger project to develop a machine learning-based recommendation system that encourages PA engagement on social media. Within each motivation type secondary coding was conducted to explore affective and goal oriented motivational processes, yielding 5 subthemes: 1) Positive affect/readiness/wanting, 2) Motivated by a goal, change, or perceived need, 3) Low/Amotivation/Dread and Avoidance, 4) Motivated by others, and 5) Motivated by things or places (external forces). A chi-square test of independence was conducted between motivation type and identified affective and goal-oriented process subthemes. Results show a statistically significant association between motivation type and subthemes, $\chi 2(4) = 1233.67$, p.

Using Analytic Rubrics to Assess Mathematical Writing Organization & Cohesion in Third Grade Students

Kylie Greenelsh
Mentored by: Madelyn Williams-Colonnese, Cato College of Education

Mathematics writing (MW) is one way that educators can assess student's understanding and reasoning about a certain topic in math. Rubrics are another way in which educators can analyze students MW. Specifically, analytical rubrics are a useful evaluation tool in MW to aid in analyzing a student's work across multiple unique criteria. There is limited research on MW, especially looking at student's mathematics writing quality. Studies conducted have shown that students enjoy MW to increase understanding, but teachers rarely use MW in their classrooms for a variety of reasons. The goal of this project is to create a rubric that would analyze 3rd grade students MW from a summer math intervention. The rubric was created specifically to assess sentence structure & grammar, punctuation, use of mathematics vocabulary, and overall evidence & correctness. These criteria were assessed on a scale of 1 (not evident) to 3 (proficient). After scoring each student's work across four different MW prompts, a peer scored the samples. The differences in scores allowed for re-clarification of criteria in the rubric. Following, there was a final scoring based on these changes. Results showed that students best performed in sentence structure, and struggled the most in their use of math vocabulary. This project may encourage future educators and researchers to utilize rubrics as a method to assess mathematics writing and to gain understanding in students' application of math content knowledge.

Special category: OUR Scholars

Super(efficient)computer: Using High Bandwidth CPU-GPU Memory Interface to Improve Efficiency and Performance

Andy Ha
Mentored by: Tyler Allen, College of Computing & Informatics

The goal of the research project is to determine the potential power and performance benefits to be found in NVIDIA's Grace Hopper superchip. Specifically, the chip's design of putting the CPU and GPU together with a 900 GB/s connection interface, allowing for the possibility of CPU applications using the GPU's high-bandwidth memory (HBM) and GPU applications using the CPU's low-power DDR (LPDDR) memory. The research aims to discover if one processing unit can benefit from the other's memory to what degree, and in what applications. By changing the memory used, an application could in theory produce different performance numbers, runtimes, and power consumption numbers, depending on what percentage of the memory used comes from which source. We hypothesize that, in at least some applications, this blending of memory types will result in improvements to both performance and power consumption. While the 900 GB/s is slower than what the processors would run with their native, we believe this speed penalty will be offset by the accessing of faster or lower powered memory.

An Analysis of the Coins Found in the Necropolis of *Sa Mitza Salida, Masullas*

Emma Harper
Mentored by: Dr. Luca Lai, College of Humanities & Earth and Social Sciences

This research investigates the Roman period necropolis of *Sa Mitza Salida*, located near the modern town of Masullas in west-central Sardinia in the Mediterranean. This research is an exploratory attempt to analyze the burial goods—specifically coins—by identifying trends and exploring what these trends may reveal about funerary customs, beliefs about death, and whether Romanization impacted these practices. The necropolis of *Sa Mitza Salida* has not been extensively studied, leading to a limited amount of readily accessible information. To conduct this research, data was collected using artifact catalogs, excavation reports, and published sources related specifically to the necropolis, as well as the understanding and interpretation of grave goods and funerary practices. The specific areas observed included the tomb chronology, coin placement in the tomb, and iconography of the coins. The predominant trends involved a correlation between the placement of coins and tomb chronology, as well as some correlations with the coins' iconography that can be expanded upon in future research. While this necropolis is smaller and less globally recognized than other archaeological sites, it still provides valuable insights into the history of Sardinia during the Roman Empire. This research can yield information that enhances the understanding of whether, and how Roman influence affected local burial rituals and overall beliefs surrounding death. Furthermore, the necropolis of *Sa Mitza Salida* holds significant value for the local community of Masullas, offering a sense of heritage and history.

Special categories: Globally Focused Research, Honors College

Investigating and Comparing Sustainable Development Goal #3 Good Health & Well Being in Germany and the United States

Isaiah Hartness, Karina Vilandrosa, Karol Moreno, and Bianca Rothenberger
Mentored by: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Our research investigates and compares aspects of the Sustainable Development Goal (SDG) #3: Good Health & Well Being. The main research questions for our international comparative study are: What are the similarities among Germany and the United States related to target goals for Sustainable Development Goal #3, which aims to ensure healthy lives and promote well-being for all at all ages by addressing key health issues, including maternal and child health, infectious diseases, and access to healthcare services? What are the differences? To what degree are the countries on track to make progress on SDG # 3 by the 2030 goal year? To conduct this research, we each wrote a Research Memo paper based on a literature review methodology including international reports and peer-reviewed journal articles. The Research Memo was framed by Bereday's (1964) Comparative Model. We also engaged with an Artificial Intelligence (AI) Debate Bot to further strengthen our findings. This collaborative study was part of a semester-long Global Networked Learning (GNL) research collaboration among students at UNC Charlotte and students at the PH Ludwigsburg in Germany. GNL is a collaborative approach to learning that enables students and instructors from different locations around the world to participate in learning and creation of knowledge together. In our research, we report on the comparative findings of our GNL project. The research includes an examination and discussion of the challenges and possibilities in meeting SDG #3, which is about ensuring healthy lives and promoting well-being for all at all ages by the 2030 goal year.

Special categories: Globally Focused Research, Sustainability Research

Developing an Indoor Marine Robotics Testbed for Multi-Robot Navigation and Control

Madison Hasley
Mentored by: Artur Wolek, William States Lee College of Engineering

Marine robotic swarms are valuable for scientific research, commercial work, and national security by providing a reliable and scalable approach to autonomous systems. Compared to larger vehicles, swarms can cover more area, adapt to changing conditions, and continue functioning if one unit fails. This project develops a low-cost indoor marine robotics testbed to improve how small autonomous boats communicate, navigate, and work together in a controlled water tank. Building on previous research in the Autonomous Robotics and Systems Lab (ARSL), a new surface vessel was designed in CAD, 3D printed using PLA, and fitted with foam around the hull to improve buoyancy and stability. The system uses XBee radio modules for wireless communication and AprilTags for tracking, operating within a water tank equipped with a multi-camera setup and a central computer. Current efforts focus on hardware improvements, refining wireless control, and constructing a durable electrical system with a soldered circuit. The overall goal is to demonstrate real-time control of multiple boats by sending simultaneous movement commands and recording their positions. AprilTags and the overhead camera system will track boat trajectories, validating movement accuracy and coordination. While centered on indoor testing, this research lays the groundwork for methods that can scale to outdoor systems for real-world applications such as search and rescue and environmental monitoring. Future improvements will include low-power communication, obstacle detection, and adaptive path planning to enhance system autonomy. The testbed will serve as a valuable tool for refining multi-robot algorithms before deploying them in larger, complex environments.

Special category: OUR Scholars

Palliative Care Readiness (PALCARE) Tool for Older Adults with Cancer and their Family Caregivers: Development and Validation

Liliana Hernandez, Savannah Norris, Regine Smith, Zhuo Job Chen, and Jyotsana Parajuli
Mentored by: Jyotsana Parajuli, College of Health and Human Services

Introduction: Older adults with cancer (OAC) experience high symptom burden and unmet needs and often require the assistance of family caregivers (FCG) to manage their disease. Providing complex care to OAC can cause poor physical and mental health among FCG. Therefore, they can benefit from palliative care (PC) to improve quality of life. However, PC is underutilized in this population. One potential approach to reduce barriers and improve PC use is to measure readiness for PC. However, no gold-standard tool exists to measure PC readiness.

Methods: Using a mixed methods approach and informed by community engaged research (CEnR) principles, we will develop and validate a Palliative Care Readiness (PALCARE) tool using two steps: 1) Create the initial items pool via semi-structured interviews with 20 OAC and their FCG 2) Establish the content validity via expert panel survey with 10 PC experts. Using CEnR principles, we formed a patient and family advisory board and sought feedback on recruitment materials and interview questions. Semi-structured interviews will begin late March of 2025.

Results: Our advisory group comprised 5 members (3 patients and 2 caregivers). Their feedback on the study materials centered around two themes: 1) Language sensitivity: using the term ‘supportive care’ instead of ‘PC’; using positive and less threatening interview questions; and 2) Cultural Awareness: acknowledging the heterogeneity of experiences (physical and psychological symptoms; social experiences).

Conclusion: Assessing readiness for PC using PALCARE tool will allow oncology clinicians to provide tailored targeted PC that is congruent with OAC’s and FCG’s readiness.

Special category: Community Engaged Research

The phage discovery of "Magdalena"

Naw Hlaing
Mentored by: Sharon Bullock and Michelle Pass, Klein College of Science

This research aimed to isolate and characterize bacteriophages from soil samples to contribute to the expanding knowledge of phage diversity. Bacteriophages, viruses that infect and replicate within bacterial cells, are the most abundant organisms on Earth, yet many remain undiscovered. Using the Phage Discovery Guide, we collected environmental samples and performed both direct and enriched isolation assays to determine the presence of bacteriophages. Serial dilutions and plaque assays were conducted to isolate specific phages. Transmission electron microscopy (TEM) was used to determine phage morphology, revealing the presence of Siphoviridae and Podoviridae. DNA was extracted and analyzed using restriction enzymes, and our sample was prepared for next-generation sequencing. Challenges arose during lysate purification, requiring protocol refinement. Ultimately, we achieved a titer of 7.2×10^9 pfu/mL and measured a DNA concentration of 56.9 ng/µL. Gel electrophoresis confirmed genetic material integrity, and the findings enabled us to send our sample to the Howard Hughes Medical Institute (HHMI) for whole-genome sequencing. This research contributes to the understanding of bacteriophage diversity and their potential applications in microbiology and biotechnology.

Tailoring a Sexual Violence Intervention Towards Sexual and Gender Minority Young Adults

Rhoen Hoff, Itati Ramirez, Parth Vyas, Yasmine Paige, and Sage Rowe
Mentored by: Jessamyn Moxie and Annelise Mennicke, College of Health & Human Services

INTRODUCTION: Responses to sexual violence disclosures can positively or negatively influence survivors' health outcomes. Supporting Survivors and Self (SSS) is an intervention that aims to help young adults respond in appropriate and supportive ways when they receive a disclosure of sexual violence. While SSS is helpful, it doesn't focus on the needs of certain populations such as sexual and gender minority (SGM) individuals due to unique challenges they face (e.g., stigma and discrimination). Additionally, when SGM individuals hold multiple identities, the original SSS intervention may not be tailored enough to accommodate their lived experience. It is imperative to develop a peer support intervention directed towards the unique experiences of SGM young adults. This study examined how the intervention can be more inclusive for SGM young adults. METHODS: We conducted theater testing groups (N=7), targeting young adults in and outside of college, in which SGM young adults watched segments of SSS and provided insight and feedback about the intervention. Theater tests assessed acceptability and feasibility of content and approach to inform modifications. RESULTS: Data analysis is ongoing, but preliminary results reveal differing preferences of intervention approaches, as well as tailoring examples and the definition of sexual violence provided for SGM individuals. Participants also advocated for an intervention that was accessible and acceptable to all people, rather than only SGM individuals. DISCUSSION: Findings will be implemented into an adapted SSS+ intervention program, that resists heterocentric assumptions of sex and relationships, with enhanced accessibility.

Special category: Community Engaged Research

Manufacturing Education and Training Using Immersive Digital Twins

Jia Holt
Mentored by: Jose C.M. Outeiro, William States Lee College of Engineering

The manufacturing sector faces a pressing need to address skill gaps, improve productivity, and ensure effective training for a dynamic workforce. The purpose of this research is to develop solutions for the education and training of the workforce in manufacturing. Manufacturing processes are complex and require a deep understanding of the physics, mechanisms, and technologies specific to each application. To gain a better understanding of these manufacturing processes, hands-on experience is the best method of instruction. However, physical processes and systems can be quite expensive and time consuming to train students and employees effectively. Digital engineering solutions such as Immersive Digital Twins (IDTs) can contribute to reducing the cost and learning curve. An IDT is an integration of Digital Twins (DT) and extended Reality (XR). It is an interactive digital replica of a physical product/process/system designed for simulation within an XR environment, offering users a more immersive, engaging, and realistic experience. This research uses Blender, Unity, and MQTT communication software to build IDTs of CNC machines and Intelligent Robot-Assisted Finishing System (iRAFS). These IDTs are used to simulate and establish bidirectional communications between the physical system and the digital counterpart. XR devices such as the Meta Quest 3 and Apple Vision Pro headsets were integrated in the IDTs to create truly immersive environments. The expected results of this research are to broaden solutions for education and training of the manufacturing workforce, making it an accessible and engaging experience for everyone involved.

Special category: OUR Scholars

Data Visualization for the CS1 Compendium for Improving Personalized Education
Kento Hopkins
Mentored by: Razvan Bunescu, College of Computing & Informatics

Visualization is critical in various data science applications because it helps us to understand complex data, identify patterns, and communicate insights effectively regardless of the technical background. One powerful example of this is the visualization of domain data as a knowledge graph, where nodes represent key concepts within a field of study, and edges correspond to important relationships between them. In this research, we focus on data visualization for the CS1 Compendium (CS1C), the first heterogeneous, densely linked knowledge graph of programming language (PL) concepts and basic programming course materials. CS1C represents not only basic relationships between PL concepts, such as prerequisite and similarity, but also common misconceptions that students develop when learning to code. We create meaningful visualizations to facilitate the analysis of programming concepts, eventually converging to Neo4j Bloom functions, filtering tools, and Cypher queries to highlight various patterns of using CS1C. Additionally, with this interactive visualization, we aim to enable users to engage with CS1C by allowing them to improve its accuracy and the coverage, such as by adding new PL concepts or misconceptions. Building on CS1C, we extend our visualization framework to Mathematics and introduce the Math 1 Compendium (M1C), a similarly structured knowledge graph for entry-level mathematics concepts and coursework. Overall, the CS1C and its visualization will facilitate the development of explicit knowledge tracing applications that infer a student's knowledge state in terms of PL concepts and misconceptions. Since these technologies are crucial steps in improving personalized education, our goal is to apply these technologies across multiple fields, not just computer science.

Special category: OUR Scholars

The Effects of Social Support on Prisoner Reentry Outcomes in Emerging Adulthood
Mia Huffman
Mentored by: Shelley Johnson, College of Humanities & Earth and Social Sciences

The United States is the world leader in incarceration with nearly a quarter of the global prison population. However, high recidivism rates demonstrate a lack of adequate support in successfully reintegrating formerly incarcerated individuals back into society. Additionally, despite well-documented links between age and crime as well as social support and rehabilitation, research on social support and reentry outcomes typically neglects an age group breakdown. Emerging adulthood, which describes a distinct developmental period characterized by self-discovery, change, and exploration in ages 18-25, has not been subject to comprehensive criminological research, particularly with regard to incarceration and reentry. The current study aims to address the lack of research examining the impact of age as it relates to prisoner reentry outcomes in the context of social support. This study will focus on the factors that impact emerging adults returning home from a period of incarceration.

Special category: Honors College

Phylogeny as an Indicator of Gene Transfer in Bacteriophages

Harrison Huffmon, Anngiselle Vallejo, Zeel Desai, and Nathaniel Foret
Mentored by: Tonya Bates, Klein College of Science

Viruses require a host to provide the machinery and resources for viral proliferation. Viruses affect all domains of life, and those that infect bacteria are known as bacteriophages or phages. Once inside the host, the bacteriophage can be replicated, which can result in changes to the genome. The two broad categories are vertical gene transfer (VGT), in which genes are passed from parent to progeny, and horizontal gene transfer (HGT), or transfer within a generation. HGT mainly comes from two sources: the host genome or another phage that simultaneously infects the same host. Since the phage genome is very susceptible to change, it's common to see the addition/deletion of genes rapidly between even closely related phages. Phage research, sparked by the potential therapeutic benefits, suggests understanding the relationship between phages and how genes are transferred could present previously unknown benefits for future therapies. We are working to elucidate the evolutionary relationship between genes within our *Arthrobacter* phage Powelldog and other phages. Using protein sequences from PhagesDB, and software such as MEGA11 and DNAMaster, we aim to find an evolutionary relationship and if the cause of gene transfer is a result of HGT or VGT. The difference can be detected via observations when proteins of closely related phages share a node or if proteins of distantly related phages share a node, indicating vertical or horizontal transfer respectively. Since phages have an ever-changing genome, we expect to find examples of both horizontal and vertical gene transfer across multiple proteins.

Special category: Globally Focused Research

Diversity of Epigeic Spider Species in Different Ground Cover Types in the UNC Charlotte Botanical Gardens

Hope Hulse
Mentored by: Sarah Stellwagen, Klein College of Science

Spiders are generalist predators and inhabit nearly all terrestrial habitats. They play a key role in regulating insect populations which contributes to ecological balance. Environmental factors such as type and structure of ground cover can influence their diversity and abundance. Understanding how different ground covers within the UNC Charlotte Botanical Gardens affect spider populations and biodiversity will allow for better implementation of habitat management. We installed pitfall traps within three monoculture ground cover habitats: moss (no cover), Virginia creeper (medium cover), and sensitive fern (high cover). Over the course of a full year (September 2024 - September 2025), data on spider biodiversity and abundance will be assessed through a weekly schedule of trapping and identifying specimens. We expect to find a greater amount of diversity within heavier ground covers due to shelter accessibility, foliage that contributes to mating communication and prey habitat, and protection from predators. Current data collected supports the hypothesis for increased insect diversity, however currently there is a lack of data on spiders due to cooler seasons and inclement weather.

Special categories: Community Engaged Research, Sustainability Research, Urban-Charlotte Focused Research

A Multifaceted Nature: an Art-Science Exploration of Identities and North Carolina Geology

Maya Hutagalung
Mentored by: Missy Eppes, College of Humanities & Earth and Social Sciences

Art is an effective tool in scientific communication since its emotional impact and accessible sensory experience increases the absorption and retention of knowledge. Effectively communicating science helps policy-makers and the public make informed decisions. To study earth science communication through art, this project aims to build my knowledge of the geological identities of North Carolina's main bedrock provinces while exploring how it relates to the multifaceted nature of personal identities. First, I will research North Carolina's bedrock geology via literature review. Then, I will plan my final art from that research. I will translate the research into simple visuals and use these as the starting points for the final art. The final art is currently planned to be a mixed-media painting. With this project, I expect to learn about the where and why of bedrock geology across North Carolina. I will also learn to cross-reference bedrock geological maps with physiographic provinces maps. With my art, I aim to explore my personal multifaceted identity as mirrored by North Carolina's geological identity. I've struggled with finding one thing that identifies me. However, we shouldn't limit ourselves and instead embrace our multitudes. I aim to strengthen my skills in scientific communication using my studies in both fine arts and earth sciences. My end goal is to foster an understanding of the diverse geology of North Carolina. Audiences will also reflect on their own identities and how they are not limited to just one trait.

Special category: North Carolina Focused Research

Filtration of PFAS through Ion Exchange Resins and Tetrachloride Metals

Rachel Irving
Mentored by: Mei Sun, William States Lee College of Engineering

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 into ten portions and five different washing solutions were applied to two portions of resin each. Samples were collected each step of the process 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.

Special category: OUR Scholars

Using AI Generated Humor to Boost Student Engagement during Assessments

Krish Iyer
Mentored by: Razvan Bunescu, College of Computing & Informatics

Keeping students engaged can be a challenge, especially with traditional teaching methods. In this project, we develop a tool that makes quizzes more engaging by turning quiz questions into jokes. For example, to evaluate understanding of a target concept, traditional assessment methods ask students to provide a definition for that concept or to select the correct definition from a set of confounding definitions. Instead, we propose to develop a tool that first generates a joke whose humor depends on understanding the target concept. The joke is presented to the student, who is asked to explain why it is funny. Then the tool scores their explanation based on how well they demonstrate an understanding of the concept. If their response doesn't make sense, they get zero. If they grasp part of the idea but miss key details, they score fifty. A full understanding earns them a hundred. By adding humor and AI-driven feedback, this approach encourages critical thinking and helps reinforce learning in a fun and engaging way.

Analyzing Total Suspended Solids (TSS) in Urban Stormwater and Beaver Ponds
Safiyyah James
Mentored by: Sandra Clinton, College of Humanities & Earth and Social Sciences

After a period of decline beaver populations are on the rise resulting in an increase in beaver ponds across the landscape. In urban environments these ponds could function as a natural way to manage stormwater and improve water quality. Urban stormwater ponds, designed to mitigate runoff, tend to have high concentrations of total suspended solids (TSS) due to inputs from nearby impervious surfaces and high algal production that often do not allow sediments to settle. In contrast beaver ponds create unique pond and wetland habitats which can enhance sedimentation leading to lower TSS concentrations in water leaving the pond. We collected TSS from an urban stormwater and a beaver pond biweekly over the span of 2 years. Data were collected from multiple sites, including inflow, pond, and outflow points. Overall, the average TSS across all sites for the urban stormwater pond was 21.80 mg/L and 16.46 mg/L for the beaver pond. Both ponds had high TSS levels upstream, however, TSS showed a greater decrease downstream in beaver ponds compared to stormwater ponds. Although beaver ponds did have higher TSS levels within the pond, TSS decreased by 21 mg/L downstream, which shows their effectiveness of reducing TSS levels. Stormwater ponds only dropped by 1 mg/L downstream. This research highlights the potential for beaver ponds near urban environments to function as an effective natural solution for mitigating excess stormwater and water quality improvement.

Special category: OUR Scholars

Extracting Nanocellulose Fibers from Plant Matter to Make Biocomposites
Bhagavanth Mehul Jammannagari
Mentored by: Roger Tipton, William States Lee College of Engineering

Plant-derived cellulose nanomaterials (CNMs) offer a sustainable alternative to petroleum-based plastics, with exceptional strength, thermal stability, and biodegradability. Processing challenges, including CNM's hydrophilicity and dispersion, are being addressed through improved extraction techniques and composite formulations. These advancements enhance CNM compatibility with polymers, enabling durable, biodegradable biocomposites for packaging, automotive, and construction applications. Our research focuses on optimizing CNM-based materials to balance sustainability and performance in practical applications. Overall, this project aims to make biocomposites with the hope of slowly replacing petroleum-based plastics.

Special category: OUR Scholars

Reclaiming Fat and Disabled: Discourses of Fatness and Disability in Women's Health
Grayce Jeter
Mentored by: Margaret Quinlan, College of Humanities & Earth and Social Sciences

The discourse surrounding societal expectations related to women's weight inclusivity and disability has been increasingly recognized in women's health studies, spanning from childhood to adulthood. Historically, society has marginalized and discriminated against fat and disabled bodies in discussions about women's health. My research integrates conversations from the fat acceptance and disability liberation movements to connect these cultural discourses. This study aims to examine the narratives surrounding fat, disabled bodies in relation to women's experiences from girlhood through menopause. I conducted a literature review, gathering peer-reviewed research articles, essays, book chapters, and books from online databases and libraries pertinent to disability, fatness, and their intersections. After compiling these references, I analyzed them for relevant information and themes, such as the history and the effects of various cultural aspects on these liberation movements. I extracted quotes and created an outline with section headers to organize my findings and clarify the overall narrative. This comprehensive analysis deepened my understanding of the current scholarship surrounding fatness and disability within women's health contexts. Additionally, it helped me identify critical research in the field and create connections between fatness and disability in women's health discussions. Through the information gathered in this literature analysis, I aim to highlight the complexities of how we approach the social structures of women's health concerning fat and disabled bodies. From a fat liberation perspective, I aim to show the need for healthcare professionals and scholars to communicate in a more productive and sensitive way with fat and disabled bodies in women's health through suggestions from activists and researchers within the fat and disability liberation movements.

Special category: OUR Scholars

Mapping the Impacts of Transportation Infrastructure Development on Health Outcomes in Charlotte

Catherine Jones
Mentored by: Fushcia Hoover, College of Humanities & Earth and Social Sciences

A person's overall health and access to healthy choices is largely determined by the zip code they live in. There is a need for further consideration not only of the social and economic pressures present in zip codes with greater health disparities, but also for the features of the landscape and built environment that impact access to healthy choices. This project analyses different walk scores across Charlotte and compares them with health outcomes from the Charlotte-Mecklenburg County Quality of Life Assessments, with a focus in Black neighborhoods. We anticipate that the findings of this study will show that regions that have retained or developed walkable, green spaces show improved health outcomes overall. However, we also expect regions that have lost greenspace accessibility and overall mobility have greater negative health outcomes such as increased rates of obesity and heart disease. These anticipated findings may reveal areas in need of infrastructural changes to support positive health outcomes.

Special categories: Community Engaged Research, North Carolina Focused Research, Sustainability Research, Urban-Charlotte Focused Research

Data collection and preparation of molecular datasets for studies of biomedicine.
Venus Kajangu
Mentored by: Daniel Janies, College of Computing & Informatics

Brittle stars, marine animals related to starfish, can change the stiffness of their body tissues, a process called Mutable Collagenous Tissue (MCT). This ability helps them quickly adapt to their environment, such as shedding and regenerating an arm when injured or attacked by predators. This change in stiffness is controlled by juxtaligamental cells (JLCs), which release chemicals that activate or deactivate specific genes in the MCT. We study the genes responsible for regulating this process.

In my work, I analyzed the genetic sequences of 16 candidate genes potentially involved in regulating MCT stiffness. I organized 50 FASTA sequences related to the candidate genes and used tblastx, a tool that compares unknown gene sequences to known genes in other species, to predict their functions. This search revealed 26 sequences with matches, and I compiled these results into a spreadsheet with the gene names, their possible functions, and associated species.

I also used Google Gemini to further analyze the tblastx results, verifying the data and summarizing each gene's function. The goal is to combine the results and create a Gene Regulatory Network (GRN), a diagram that shows how these genes interact and control MCT stiffness.

This research is important for understanding how biological tissues can change their properties and has the potential to inspire the development of dynamic biomaterials for biomedical applications, such as prosthetics, tissue engineering, wound healing, and surgical implants that can adjust stiffness to enhance healing and functionality.

Special category: OUR Scholars

Extracting Image Descriptions from Biomedical Papers

Patrick Kengsoontra
Mentored by: Razvan Bunescu, College of Computing & Informatics

Biomedical articles often contain images. Information about these images is given in figure captions; further information is provided whenever the corresponding figure is mentioned in the text of the article. In this project, we build an LLM-based tool that takes as input a biomedical article and maps each image from the article to a description that is extracted from the two sources of information about the image: the figure caption and the text of the article. Such a tool could be used to mine large amounts of papers to create a data lake of images and their description, which could be used to train deep learning algorithms to find previously unknown patterns.

A Radiation Treatment Planning System From a Browser

Adrian Khlim
Mentored by: Yonghong Yan, College of Computing & Informatics

Treatment Planning Systems (TPS) are essential software tools used for radiation and proton therapy, which allow for radiation simulation, image processing, segmentation, plan optimization, and treatment plan assessment. OpenTPS is a Python-based, open-source TPS designed for innovation and acceleration in the fields of proton therapy and cancer research, available as a desktop application. However, existing TPS solutions, including OpenTPS, lack browser-based and implementations with cloud-access, limiting accessibility. This project aims to adapt OpenTPS into a web-based application while maintaining, updating, or adding to its core functionalities and also providing a friendly user interface for researchers and users. The goal of the web application is to provide remote access, cloud accessibility and enhance collaboration with other software, products, and researchers. Using modern web frameworks, tools, and libraries, we will provide a user friendly interface for all users to explore treatment planning without installing extra software. Browser-based medical imaging software exists, thus a browser-based TPS will allow for ease of operations between software, pushing the potential for innovation in radiation therapy and TPS software. The result of the project will be a scalable, accessible, and optimized web application that functions similar to the GUI from OpenTPS, and enables treatment planning systems and powerful simulations and calculations to be performed on any modern computer.

Special categories: Community Engaged Research, Globally Focused Research

Investigating and Comparing Sustainable Development Goal # 3 in Germany and the United States

Mikayla King, Teagen Johnson, Daniela Betancourt, and Milane Iwanow
Mentored by: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Our research investigates and compares aspects of the Sustainable Development Goal (SDG) #3: Good health and Well-Being. The main research questions for our international comparative study are: What are the similarities among Germany and the United States related to target goals for Sustainable Development Goal #3, which is to ensure healthy lives and promote well-being for all at all ages? What are the differences? To what degree are the countries on track to make progress on SDG #3 by the 2030 goal year? To conduct this research, we each wrote a Research Memo paper based on a literature review methodology. The Research Memo included international reports and peer-reviewed journal articles. The Research Memo was framed by Bereday's (1964) Comparative Model. To sharpen our critical thinking skills, we also engaged with an Artificial Intelligence (AI) Debate Bot to further strengthen our findings. This collaborative study was part of a semester-long Global Networked Learning (GNL) research collaboration among students at UNC Charlotte and students at the PH Ludwigsburg in Germany. A GNL project is a collaborative approach to learning that enables students and instructors from different locations around the world to participate in learning and creation of knowledge together. In our research, we report the comparative findings of our GNL project. The research includes an examination and discussion of the challenges and possibilities in meeting SDG #3 ensuring healthy lives and promoting well-being for all at all ages by the 2030 goal year.

Special categories: Globally Focused Research, Sustainability Research

Public Perception of Reproductive Rights

Ana Krstanovic
Mentored by: Erin Basinger, College of Humanities & Earth and Social Sciences

In the United States, obtaining full and free reproductive rights has come with a variety of obstacles and hardships. From a historic battle for birth control access to very recent abortion bans, reproductive healthcare access has proven to be an ongoing challenge for people across the nation. These access buffers have arisen from years of national divide, healthcare inequity, and changing political ideologies. Broadcast news media coverage can persuade, influence, and sway public perception of issues. The impact of words and discourse regarding reproductive health has spanned across multiple channels, trickling into a variety of news outlets and social media platforms. The consistent polarization and politicization of a medical matter within broadcast news media coverage has left many questions to be asked and answered. From current research, we are still unsure of what educational, informational, and societal gaps this news media coverage has created. Does the public interpret this polarized information differently depending on what news they consume and where they turn for news? How does that affect their perceptions of birth control, contraception, and healthcare services? When women are not in the conversation, health professionals do not dictate medical advice, and the issues at hand are more polarized with diverging news coverage, how does that influence how people approach political behavior and legislation, particularly regarding reproductive health? My goal in the current study is to determine how and why this broadcast news media coverage impacts public perception of reproductive health.

Special category: Honors College

Creating an AI Assistant Prototype to Improve Mobile Security

Tyler LaFramboise
Mentored by: Cori Faklaris, College of Computing & Informatics

Introduction: This research focuses on developing an application to help users identify and manage potential phishing scams in mobile messages. Phishing is a growing issue, with 76% of businesses experiencing smishing attacks, leading to a 328% rise in reported incidents (Keepnet). This application is built around an AI-powered assistant that will guide users through identifying scams and answering phishing-related concerns. Given the widespread use of smartphones, phishing poses significant risks to privacy and data security, making effective solutions crucial.

Research Questions:

1. How can we develop a simple yet effective anti-phishing prototype?
2. What techniques can the LLM teach users to prevent future phishing attempts?
3. What usability challenges arise with a chatbot assistant for phishing detection?

Findings: This study aims to collect feedback on improving the application's usability and inclusivity. It will explore user needs and accommodations to enhance the experience, ensuring the app is accessible and practical for diverse users.

Contribution: By helping users recognize phishing scams, this research contributes to cybersecurity awareness and personal data protection. The application will not only assist users in identifying scams but also educate them on preventive measures. By promoting digital security, this study seeks to empower mobile users with the knowledge to avoid phishing attempts, ultimately reducing the risk of fraud and exploitation.

Special category: OUR Scholars

Sorority and Self Study

Alexis Libardi
Mentored by: Hannah Peach, College of Humanities & Earth and Social Sciences

College-aged women are the gender and age group who display the highest levels of poor body image and disordered eating habits, however, there is minimal research studying college-aged women's levels of involvement in Greek life, such as a sorority, in association with their self (Aparicio-Martinez et al., 2019). The present study examined any relationship between sorority member involvement, self-esteem, body image, and disordered dietary habits. The sample included undergraduate students (N=34) who were active, initiated members of a Panhellenic Sorority from the University of North Carolina at Charlotte, between the ages of 18 and 21. Participants completed an online survey, provided as a Google Form. The relationship between sorority member involvement and disordered dietary habits trended in the expected direction of a moderately strong positive correlation. The experimental hypotheses were rejected as a significant correlation between sorority member involvement and self-esteem (M=36.94, SD=7.66), body image (M=17.68, SD=4.15), and disordered dietary habits (M=22.71, SD=10.60) were not indicated. Although the hypotheses were not supported by the findings, results from this study are crucial in expanding existing literature and their part in future research preventing poor self-esteem and body image as well as disordered dietary habits in college-aged sorority women.

Special category: Community Engaged Research

Serial Ultrasound Imaging of Ankle Cartilage in Athletes

Samuel Limparis
Mentored by: Abbey Thomas Fenwick, College of Health & Human Services

Regular physical activity is crucial to maintaining a healthy lifestyle, yet the intense, high-level training performed by athletes can risk joint health. Elite-level athletes are subject to training at high intensity and volume throughout their athletic season which may lead to decline in joint health, including the ankle. Ultrasound assessment provides valuable data on the thickness and composition of cartilage which may provide insight into the health of an athlete's cartilage over the course of a competitive athletic season. Forty-three student-athletes at UNC Charlotte were followed at 3 distinct time points during the athletic season (i.e. pre-season, mid-season, and post-season). Three ultrasound images of each participant's ankle cartilage were obtained at each session to assess ankle joint health. Cartilage thickness was obtained using ImageJ software to assess thickness (mm) along the talar dome. The echo intensity (the darkness of the image) was used to assess the water content of the cartilage. Darker images signify less water content which may indicate less healthy cartilage. Cartilage thickness and echo intensity were averaged across all images from each participant and time point and analyzed using repeated measures ANOVAs. Results will provide data on the effects of rigorous athletics on talar cartilage thickness and composition beyond acute loading, perhaps establishing ultrasound's ability to proactively identify asymptomatic declines in cartilage health as well as informing training to optimize health. I hypothesize that the intense, frequent loading done by athletes will result in a reduced thickness of talar cartilage, subsequently reducing the water content.

Development of a Slip-Ring Swivel-Based Mooring System Prototype for a Wave Energy Converter (WEC)

Justin Logan
Mentored by: Michael Smith, William States Lee College of Engineering

In the renewable energy sector, there is considerable interest in devising an economically viable way to capture useful energy from ocean waves. One factor currently limiting the utility of such marine energy devices is the tendency of mooring system failures due to line twist and high tensile loads during extreme sea states. Thus, mooring solutions which can mitigate line twist failures and provide load-damping capability for extreme weather events are an active area of research. In this study, a prototype mooring solution is developed to address the issues of line twist and axial loading for a combined fluid and electrical transmission line. Component devices for each subsystem are selected based on cost and similarity to proposed full-scale prototype components. To join the components into a complete assembly, a 3D-printed enclosure is designed and modelled in Solidworks. The enclosure consists of a stator side and a rotor side. Each enclosure component is made of two 3D-printed halves that assemble into one cylindrical body after printing. The development, fabrication, and testing of the conceptual prototype is expected to lead to important process knowledge development that will be used to inform the design of a more robust deployment-ready prototype. It is expected that the successful development and characterization of such a prototype will encourage adoption of this mooring strategy by the marine energy industry. Adoption of a mooring connection which mitigates the failure modes of line twist and extreme axial loading should lead to improved reliability and longevity of marine energy devices.

Special category: OUR Scholars

Building Annotated Datasets for AI-Enhanced Cybersecurity Education

Melody Long
Mentored by: Cori Faklaris, College of Computing & Informatics

In our digital age, many individuals lack knowledge of essential security and privacy practices and resources to access this information. This poses significant risks to end users and the networks they are connected to, such as workplaces and social media platforms. To address this issue, our goal is to develop a mobile-targeted app that delivers situationally relevant, credible, and on-demand advice. With this app, we will combine the expertise of near-peer interactions with the advanced capabilities of AI models. We conducted two studies to gather data to train the app's model. In the first study on Amazon Mechanical Turk, 500 participants answered 10 prompts about security and privacy and created their own questions using Google Gemini. The second study on Prolific involved another 500 participants who made up wrong answers to accurate security-related question and answer pairs. This approach helps us build the annotated datasets needed to train our Large Language Model (LLM) with knowledge graphs showing important cybersecurity concepts and how they connect. Since there are no standardized datasets in AI-powered education in end-user cybersecurity, we aimed to fill this gap using our research. By organizing this knowledge, we can make obtaining security and privacy advice more easily accessible and help end users become more aware of cybersecurity issues. Our AI-driven app intends to make a real difference in how people understand and handle online safety, giving us valuable insights into improving AI models in the cybersecurity field.

Mental Health and Child Development: An Analysis of Maternal Well-Being as a Predictor of School-Age Children's Cognitive Development

Sierra Lowery
Mentored by: Stephanie Bradley, College of Humanities & Earth and Social Sciences

Research finds that maternal mental health impacts the cognitive development of children, broadly speaking. However, little is known about the relationship between maternal mental health and school-age children (ages 6-17 years) specifically. To complement extant literature, this study asks: How does maternal mental health impact school-aged children's cognitive development? Drawing upon data from the 2022 National Survey of Children's Health (NSCH), this project examines the relationship between maternal mental health levels and three measures of school-age children's cognitive development: developmental delay, intellectual disability, and learning disability. We discovered that all three measures of cognitive development follow a similar pattern and correlate with maternal mental health levels. For all three, a greater percentage of children of mothers with poor or fair mental health had these negative outcomes, whereas children of mothers with good, very good, and excellent mental health levels did not have these same outcomes. That is, poor maternal mental health is associated with greater levels of negative cognitive development outcomes for school-age children. Future research focused on risk factors for children's health, including cognitive development, and the mechanisms through which these patterns occur is important to produce solutions that positively impact both the child and mother.

Special category: Honors College

Gene Therapy: How Effective is It?

Gaella Malembi
Mentored by: Aimee Smith, College of Humanities & Earth and Social Sciences

Sickle cell disease (SCD) is a group of inherited hemoglobin disorders that affect the major oxygen-carrying protein in red blood cells. This abstract explains why gene therapy is a viable therapeutic approach for SCD, particularly when patients are being transitioned from pediatric to adult care. Gene therapy treats the genetic cause of SCD rather than managing symptoms, with potential advantages over traditional therapies like blood transfusions and hydroxyurea. For teenagers with SCD, recognizing these advantages becomes essential as they transition to adult healthcare systems. Transition from pediatric to adult care represents a pivotal transition for SCD patients in light of gene therapy. Treatment availability, candidacy in clinical trials, and specialist access all tend to differ significantly in these care settings. While pediatric care tends to offer comprehensive, family-based plans with pre-formed treatment protocols in place, adult care requires more patient autonomy regarding treatment choices, e.g., whether to pursue gene therapy. Gene therapy protocol and inclusion/exclusion criteria might vary across pediatric and adult programs, causing continuity of care interruption upon transfer. Insurance status for gene therapy likewise might change when patients become adults and are discharged from pediatric programs. This abstract highlights the necessity of educating teenagers about the options of gene therapy in a timely manner and in advance, allowing them with SCD to make informed decisions in pursuing potentially life-changing therapy after reaching adulthood.

Special category: OUR Scholars

Dynamic Studies of Fluorescently Labeled APE1 Protein in Liquid-Liquid PhaseSeparation and its Role in Genome Integrity

Anthony Malone
Mentored by: Shan Yan, Klein College of Science

Apurinic/apyrimidinic endonuclease 1 (APE1) is a multifunctional enzyme that plays a pivotal role in the DNA damage response (DDR) and genome maintenance through its endonuclease and exonuclease activities. APE1 is well-documented for its involvement in the repair of apurinic/apyrimidinic (AP) lesions, nucleotide excision repair (NER), and other DNA repair pathways. However, its function in liquid-liquid phase separation (LLPS) and the formation of biomolecular condensates remains poorly characterized. The limited understanding of APE1's role and dynamics in LLPS represents a critical knowledge gap, the resolution of which could inform the development of targeted cancer therapies. This study aims to investigate the spatiotemporal dynamics of APE1 in DDR pathways and its contribution to biomolecular condensate formation via LLPS. To achieve this, we will construct an APE1 fusion protein with a histidine (His) tag and a fluorescent tag (e.g., eGFP or Halo) using molecular cloning techniques. The recombinant APE1 plasmid will be amplified in DH5α E. coli and subsequently transformed into Rosetta (DE3) competent cells for protein expression via IPTG induction. The recombinant protein will be purified through affinity chromatography via the His tag, followed by validation and characterization using Western blotting and Coomassie blue staining. To explore APE1’s role in LLPS, in vitro phase separation assays will be optimized under varying conditions (e.g., pH, ion concentration and protein concentration) to assess its involvement in biomolecular condensate formation and DDR regulation. By employing fluorescent tagging and tracking techniques, this study seeks to elucidate the dynamic interplay between APE1, LLPS, and DDR events, providing insights that may inform future therapeutic strategies.

Design, Manufacturing, and Testing of a High-Speed Loading Device for Material Characterization

Sebastian Mares
Mentored by: Qiuming Wei and Jose C. M. Outeiro, William States Lee College of Engineering

A material's mechanical properties and performance can vary significantly depending on the rate and direction at which a force is applied. For example, a paper cut will only occur when the paper is quickly slid against a finger. Understanding this behavior is paramount for educated material selection, where improper selection may lead to critical component failure. Studying material behavior at high strain rates experienced in modern engineering applications, such as the impact of kinetic energy penetrators, high-speed machining, and the impact of extraterrestrial objects, is of particular interest. Existing test methods for quasi-static and intermediate strain rates exist but are insufficient for high-strain-rate applications. The Kolsky bar or split-Hopkinson pressure bar (SHPB) can produce strain rates one-hundred times higher than those exhibited in intermediate strain rate testing equipment. UNC Charlotte houses two Kolsky bar systems in a compressive configuration but are not configured for tensile testing. This project aimed to design, simulate, manufacture, and test components to transform one of the systems from its existing compressive configuration into a tensile configuration. The existing system was measured and then modeled in CAD. The components were then imported into the ABAQUS FEA software to simulate and verify the feasibility of the design. Once validated, the components were machined, and the system was assembled and tested. The outcome was the successful fabrication and design documentation involved in modifying the SHPB system to perform high-strain rate tensile tests. The hope is that the design documentation will support the system's successful future operation and maintenance and, if published, serve as a reference for others to create similar modifications.

Special category: OUR Scholars

Co-Designing Solutions Using AI to Improve Digital Safety and Connectivity with Participation from International Students

Nishka Mathew
Mentored by: Sarah Tabassum and Cori Faklaris, College of Computing & Informatics

In the 2023-24 academic year, the total number of international students at U.S. colleges and universities reached an all-time high of more than 1.1 million, a 7% increase from the previous year. These students face challenges with cultural and academic integration in their host country, language barriers (with English typically being their second language), and increased pressure to maintain transnational ties to their home country through social media. Specifically, they may encounter online security risks related to scam detection and secure information sharing. While existing privacy tools offer general protection, they often fail to address the sociocultural and linguistic factors that shape educational migrants' digital practices. As a result, educational migrants may struggle to navigate digital risks effectively, leaving them vulnerable to exploitation. To address this gap, we are using a participatory design approach to developing privacy and security tools tailored to international students' needs. We first conduct and report on a pre-survey to assess the prevalence and impact of key privacy concerns, user confidence in managing these risks, and preferences for potential solutions. Findings from the survey will inform the design of the workshop where educational migrants will collaborate with researchers to ideate, prototype, and evaluate user-centered privacy tools. Anticipated outcomes include prototypes of privacy-enhancing features such as adaptive security controls and culturally informed scam-detection mechanisms. This research has broader implications for improving digital security for vulnerable populations and developing inclusive AI-driven privacy tools that empower users to protect their information across diverse migration contexts.

Special categories: Community Engaged Research, OUR Scholars

Mechanical Properties of Planar Polymer Additive Manufacturing

Gabriel McAnuff
Mentored by: Taner Tunc, William States Lee College of Engineering

Additive manufacturing (AM) of plastics is gaining prominence due to its application in light-weighting. Traditionally, AM is conducted layer-by-layer; however, recent advancements propose alternative methods for AM of plastics, such as non-planar, directional, which offer several advantages. These include better material utilization through a decreased weight-to-strength ratio and enhanced conformity for manufacturing complex shapes. The generation of the tool path, process parameters, and machine tool configuration critically impacts product quality and product mechanical properties.This project examines 3-axis directional AM of plastics, emphasizing tool path generation using Siemens NX software, process parameters, and the tensile properties of plastic dogbones. It explores the impact of key factors, such as infill, toolpath geometry, and orientation, on the performance and geometrical conformity of polymer samples. The research aims to analyze the effects of varying patterns and orientations on 3D specimens, comparing the mechanical differences between planar and non-planar printing through tool path generation, specimen design, fabrication, and mechanical testing.

Special category: OUR Scholars

Investigating and Comparing Sustainable Development Goal #16 in Germany and the United States

Emily McDaniel, Jayvone Green, Sam Trajano, and Elena Schank
Mentored by: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Our research investigates and compares aspects of the Sustainable Development Goal (SDG) #16: Peace, Justice, and Strong Institutions. The main research questions for our international comparative study are: What are the similarities among Germany and the United States related to target goals for Sustainable Development Goal #16, which seeks to promote peaceful and inclusive societies, provide access to justice for all, and build effective institutions at all levels? What are the differences? To what degree are the countries on track to make progress on SDG #16 by the 2030 goal year? To conduct this research, we each wrote a Research Memo paper based on a literature review methodology. The Research Memo included international reports and peer-reviewed journal articles. The Research Memo was framed by Bereday's (1964) Comparative Model. We also engaged with an Artificial Intelligence (AI) Debate Bot to further strengthen our findings. This collaborative study was part of a semester-long Global Networked Learning (GNL) research collaboration among students at UNC Charlotte and students at the PH Ludwigsburg in Germany. A GNL project is a collaborative approach to learning that enables students and instructors from different locations around the world to participate in learning and creation of knowledge together. In our research, we report on the comparative findings of our GNL project. The research includes an examination and discussion of the challenges and possibilities in meeting SDG #16, which is about peace, justice, and strong institutions to make a safer place for everyone by the 2030 goal year.

Special categories: Globally Focused Research, Sustainability Research

Not Sold on AlphaFold? An Exploration of Unknown Protein Functions Using New AI
Lily McGuirt, Sarah Wigren, Jessica Robles Gonzalez, and Skylar Godwin
Mentored by: Ellen Wisner and Tonya Bates, Klein College of Science

This study seeks to explore proteins with no known functions (NKF) of *Arthrobactor* bacteriophage, PowellDog, through advanced computational tools, specifically AlphaFold 3 and FoldSeek. Proteins play a major role in life processes by regulating biochemical reactions, adding stability to cell structures, and controlling gene expressions. Interestingly, seventy percent of phage proteins are NKF proteins. Annotating the function of proteins can be accomplished through machine learning, such as AlphaFold 3 and FoldSeek. AlphaFold 3 will be employed to predict the three-dimensional structure of these proteins based on their amino acid sequences that will be pulled from databases such as PhagesDB. Once the protein structures are generated, FoldSeek will be utilized to identify similar protein structures across different organisms. This comparative analysis aims to assign potential functions to the NKF proteins by examining structural similarities. This project aims to uncover any protein similarities with other phages or organisms, thereby enhancing our understanding of their potential functions. Orphams are groups of genes with no known similarities to other bacteriophage genes. Using new computational technology, we hope to find homologous protein structures to better classify and group orphams into larger phamilies. This research will enhance our understanding of NKF proteins by discovering more about bacteriophage proteins and how they infiltrate and evolve in bacteria. A better understanding of how bacteriophage function could help with future research on phage therapy, evolutionary studies, and enzyme discovery.

Assessing stream restoration success: Dissolved inorganic carbon as a metric of water quality and watershed function in pre- and post-restoration streams (Reedy Creek, Charlotte, NC)

Charles Mckinnon
Mentored by: David Vinson, College of Humanities & Earth and Social Sciences

This project aims to appraise the success of stream restoration by analyzing changes in water quality before and after restoration in Reedy Creek, a 2.5 mi² watershed in northeast Charlotte that underwent whole-watershed restoration from 2017–2019. Specifically, this study investigates dissolved inorganic carbon water samples (DIC), their isotopic composition ($^{13}C/^{12}C$ ratio), and pH to assess soil-water interactions. The goal of the study is to analyze the changes in both metrics of pH pre-restoration vs. post-restoration to determine whether restored streams can mimic natural forest streams effectively.
Water samples were analyzed using a Picarro G2201-i carbon analyzer to measure DIC concentration and carbon isotopic composition. To illustrate results pre- and post-restoration data was plotted on a time series graph to assess changes over time. Tributaries D1 and D2, representing highly urbanized streams, were contrasted with control streams C1 and C2, which flow into R2, a mixed land-use stream. Preliminary results suggest that urban watersheds exhibit elevated DIC concentrations and seasonal variation by a factor of 2–3. While control streams show groundwater-like isotopic signatures with lower ^{13}C content. The $^{13}C/^{12}C$ ratio serves as an indicator of biogeochemical processes, where a higher proportion of ^{13}C suggests instream respiration and a higher proportion of ^{12}C reflects greater soil carbon absorption. These findings indicate that restoration may influence urban stream carbon cycling and soil-water interactions. This research enhances our understanding of how stream restoration affects biogeochemical processes and whether restored streams can replicate natural hydrological processes. At the end of this study, we will have a deeper knowledge base that will provide valuable insights for scientists and urban planners in designing more effective watershed restoration projects, while contributing to a broader understanding of urban watersheds.

Special category: OUR Scholars

Using Art to Visualize Saltwater Intrusion

Robbie McLaughlin
Mentored by: Missy Eppes, College of Humanities & Earth and Social Sciences

Wetlands are an incredibly important ecosystem, sustaining high levels of biodiversity, while also helping with water purification, denitrification, and shore protection. Despite this, they are rapidly diminishing in size and quantity. One cause of this is the process of saltwater intrusion. As the ocean continues to rise, seawaters salinize freshwater wetlands, killing the native plant life, and turning them into saltwater wetlands. These leave behind what are called ghost forests; ghastly scenes where tall lively trees stand pale and dead in the water. While these can help mitigate storm protection, they come at the cost of our freshwater wetlands. The problem is this process is gradual, and it's hard to visualize the impact. I wanted to make an art piece that helped visualize that impact and spread awareness to the threat these forests face. By exaggerating elements like the color of the water, and the transition from life to death, I could instill a feeling of dread that isn't quite captured in a photograph. I wanted to share the feelings I had when I researched this topic, and hopefully make others care about something they might not have thought about before.

Biodiversity in Urbanizing Forests: An Assessment of Vertebrate Wildlife at UNC Charlotte

Hannah Meador
Mentored by: Jennifer Warner, Klein College of Science

It is well documented that urban development and land use changes often lead to significant alterations in biodiversity, particularly in forested areas that serve as critical habitats for various species. Studies show that urbanization often leads to habitat fragmentation, degradation, and the introduction of pollutants, which disrupts ecosystems and endangers wildlife. This research aimed to assess the vertebrate biodiversity of a forested area on UNC Charlotte's campus over a one-year period, with the intention of establishing an ongoing monitoring program to track biodiversity trends and understand the long-term impacts of potential development. This field study was driven by the concern that construction and urbanization may negatively affect campus wildlife populations, especially birds, which constitute the majority of the species observed. Surveys were conducted through both visual observations and the use of bird song recognition technology. The findings indicate a diverse range of vertebrate species, including birds, mammals, and reptiles. The goal of this study is not only to document current biodiversity, but also to establish a baseline for future studies on how biodiversity changes over time through continued monitoring by students. The presence of human disturbances, such as foot traffic and noise, may threaten species richness on UNC Charlotte's campus, emphasizing the importance of preserving these habitats for local wildlife conservation and ecosystem health. Ultimately, this research aims to raise awareness of the importance of forested areas as biodiversity hotspots and the need for thoughtful conservation efforts amid urban expansion, contributing to sustainable campus development decisions.

Special categories: North Carolina Focused Research, Sustainability Research

The Political Economy of Policing

Yasmin Moaf
Mentored by: Martin Shuster, College of Humanities & Earth and Social Sciences

Discussions on city resource allocation highlight the importance of understanding the political landscape shaping our economy. This research investigates policing through the lens of political economy, aiming to contextualize law enforcement within broader social and political structures. By examining the economic components such as city budgeting and settlements that govern law enforcement, this study seeks to create a concrete and comprehensive data set that can be used for theory development and policy recommendations.

Through quantitative analysis and extensive data collection by submitting public record requests to various city departments, this project compiles a comprehensive dataset entailing police misconduct settlement payouts over the past five years across the five most populous cities in each U.S. state. Additionally, it scrutinizes the varied regulatory mechanisms each city employs to mitigate liability, including the purchase of insurance policies that protect both the cities and police departments. The research process thus far offers critical insights into the complex dimensions of law enforcement accountability, which are essential for addressing systemic issues in policing.

This data set, the first of its kind, will serve as a foundational resource for subsequent phases of research and for public and academic use, enabling future scholarly work in various fields. Conducted within a critical theory framework, this project assesses the impact of existing structures and their constraints to better be able to critique and dismantle it. The interdisciplinary nature of this research makes it a significant groundwork contribution to future scholarly work in a multitude of disciplines, some of which could be economics, politics, and sociology.

Special category: OUR Scholars

Connecting Erosion, Landscape Evolution, and Tourism.

Madeline Montemurro
Mentored by: Missy Eppes, College of Humanities & Earth and Social Sciences

Connections between art and science are vital to deepening our understanding of complex scientific concepts because art can translate abstract ideas into visual forms that are accessible and engaging. To better understand and practice Earth science communication through art, the goal of this project is to build my knowledge of the Appalachian Plateau while exploring how erosion and landscape evolution relate to tourism. To research the Appalachian Plateau and its relationship to erosion and landscape evolution, I will analyze topographic maps, geological surveys, and satellite imagery while incorporating historical data to understand how the landforms have changed. This work will be created using visual art that communicates the dynamic processes that shape this region. I chose this topic because as a raft guide, my whole job is driven by tourism. I am curious to see how tourism impacts the environment in the form of erosion. I will investigate areas with high rates of tourism and link them to increased erosion if such links exist. From this research, I expect to gain a deeper understanding of the geological history and processes shaping the Appalachian Plateau, particularly the role of erosion in landscape evolution. By studying topographic maps, geological surveys, and visual data such as GIS maps, I will identify key patterns of landform development, such as river incision, sediment deposition, and weathering effects. This research will offer an artistic explanation by visually conveying the connection between erosion and tourism, ultimately improving the public's understanding of Earth's complicated systems.

A Rural Success Story: Rowan County's Public Health Response to the 1918 Spanish Flu Epidemic

Madison Morgan
Mentored by: Heather Perry, College of Humanities & Earth and Social Sciences

The 1918 Spanish Flu devastated communities across the United States, overwhelming public health systems and exposing widespread infrastructural weaknesses. However, Rowan County, North Carolina, mounted an unusually effective response. This research investigates how Rowan County's well-developed public health system, led by Dr. A.J. Warren, and its active American Red Cross chapter coordinated efforts to mitigate the pandemic's impact. Previous studies on the 1918 influenza have highlighted the importance of public health infrastructure, community mobilization, and emergency preparedness. Scholars have analyzed how cities like St. Louis effectively implemented early interventions, while studies on North Carolina's response reveal that most rural counties lacked the infrastructure to contain the virus. This research builds on that scholarship by identifying Rowan County as an outlier—one of the few rural communities with an established health system that facilitated an organized and largely successful pandemic response. Using primary sources such as newspaper accounts, public health reports, and Red Cross records, this study reconstructs Rowan County's approach and assesses its effectiveness relative to other rural areas. Findings suggest that early preparation, strong public trust in health authorities, and coordinated relief efforts helped minimize mortality and alleviate suffering. By examining this case, the study underscores the critical role of proactive health policies, pre-existing public health infrastructure, and community cooperation in managing pandemics. These insights contribute to broader discussions on rural public health preparedness and offer valuable lessons for future crisis management.

Special category: North Carolina Focused Research

Performance Evaluation of Bifacial Solar Photovoltaic Modules with Various Ground Materials

Michael Murphy
Mentored by: Jaewon Oh, William States Lee College of Engineering

Perceptions of efficiency may prevent wide-scale adoption and utilization of modular, rooftop solar generation technologies which would supplement grid infrastructure during peak load times for commercial, industrial, and residential applications. Small improvements to output versus cost ratios can adjust prevailing opinions and accelerate market shifts toward renewable energy and distributed generation. Bifacial solar modules may be able to increase energy output given the same space, while costing less per module per unit area. This study focuses on gathering data to determine which roofing material shows the highest output for bifacial solar panels. The bifacial solar panels were fabricated in-house using glass, and an ethylene vinyl acetate (EVA) encapsulant to prevent environmental contamination during operation. A control group was also fabricated using a backing material that blocks light transmission. Reflective properties strongly affect the available light, and thus the potential energy gains of bifacial solar panels. Three materials were chosen by color to present a simple comparison that can be easily understood and further refined through additional constraints and study. Data was gathered for various roofing materials in-situ, with common mounting angles. Voltage was measured using a datalogger over three minute intervals, under clear skies, on the rooftop of Smith building on the University of North Carolina, Charlotte campus, located approximately at latitude: 35.306742, longitude: -80.731538. This data provides information to architects, designers, maintenance professionals, and planners seeking to choose roofing materials based on maximizing the energy output of solar photovoltaic systems using bifacial solar panels.

Special categories: OUR Scholars, Sustainability Research

Synthesis of Silver Nanoparticles for Elimination of Bacteria

Atqiya Nafisa
Mentored by: Juan Vivero-Escoto, Klein College of Science

In recent years, nanotechnology has made significant strides in developing effective methods for various biomedical applications, including bacterial elimination. Bacteria can rapidly evolve through mutations and horizontal gene transfer, developing many mechanisms to overcome the effects of antibiotics. This has led to the emergence of multidrug-resistant (MDR) strains like *Escherichia coli* (*E. coli*). This evolution poses a challenge for treating bacterial infections, as current antibacterial drugs are becoming less effective. Consequently, there is an urgent need for novel antimicrobials that can target bacteria through multiple mechanisms.

Silver nanoparticles (AgNPs) have shown potential to overcome many antibiotic resistance mechanisms in bacteria due to their unique optical and physicochemical properties. They act as a reservoir of silver ions (Ag^+), which contribute to their broad-spectrum antibacterial activity through localized release of Ag^+. AgNPs facilitate formation of reactive oxygen species, which disrupt bacterial cellular components and induce cell death by increasing oxidative stress placed within the bacterial cell. Studies have demonstrated that combining organic molecules, such as photosensitizers (PSs), with AgNPs results in a synergistic antimicrobial effect as PSs are also antimicrobial agents. This study demonstrated the application of silver nanoparticles as an efficient antibacterial agent against *E. coli,* which indicates the potential of light-activated AgNPs functionalized with PSs, specifically protoporphyrin IX (PpIX), conjugated on the AgNP surface (PpIX-AgNP) against drug-resistant bacteria in future studies. This research provides valuable insights into developing light-responsive, silver-based antimicrobials for potential medical applications.

Special category: Honors College

Political Economy of Policing

Sarah Nti
Mentored by: Martin Shuster, College of Humanities & Earth and Social Sciences

This research seeks to quantify the total amount U.S. police departments have spent on misconduct settlements from 2017 to 2022, a figure that has never been comprehensively calculated. The study aims to understand how these settlement costs reflect the effectiveness of the policing system, particularly whether high settlement figures indicate systemic failures within law enforcement practices. While the financial implications of misconduct settlements have been discussed in various studies, no research has fully aggregated the total amount spent by police departments nationwide. This project fills that gap by collecting data from public sources and directly contacting police departments across the U.S. to estimate the total spending on misconduct settlements. By focusing on settlements from 2017 to 2022, this study will provide a clearer picture of the financial impact of police misconduct and its connection to the overall effectiveness of law enforcement. Using a data-driven approach, the research will highlight trends in misconduct settlements across different states and departments. The expected outcome is that the total cost of these settlements will shed light on potential systemic issues within policing, informing future reform efforts and policy changes aimed at improving accountability and reducing misconduct. Ultimately, this research hopes to provide new insights into the political economy of policing and contribute to more effective and equitable law enforcement policies.

Special category: OUR Scholars

Analysis of the Relationship Between Marshallese English Learning Assessments and Other Testing Data Analysis of the Relationship Between Marshallese English Learning Assessments and Other Testing Data

Lori Aine O'Healy
Mentored by: Elise Berman, College of Humanities & Earth and Social Sciences

Marshallese children make up a large percentage of students in Barnestown, a town in the South-Central United States. As of 2022, Marshallese students made up over 20% of English Learners (ELs) and over 30% of Long-Term English Learners (LTELs) in Barnestown. Additionally, Marshallese students in Barnestown have the highest rate of EL retention than any other group. Most students in this research study have been held in EL status since kindergarten even though some were born and raised in the U.S. and use English as their primary language. However, there has been minimal research done on this subject. While there has been some research done on EL assessments and other EL student populations, no research that we are aware of has been done on Marshallese student populations. This research analyzes the relationships between the English Language Proficiency Assessment (ELPA21) and other standardized assessments scores. It seeks to examine what it means to be an EL student and how EL students are perceived. This research also aims to investigate possible reasons that these students are marked and retained in EL status. To accomplish this, we used qualitative data from interviews and classroom observations and quantitative testing data collected in 2022. Using graphs, we compared the students' ELPA21 scores with their MAP mathematics, reading, and ACT ELA assessment scores. Based on our results, there seems to be a potential relationship between the MAP mathematics and reading assessments, the ACT ELA assessment, and the ELPA21. This suggests that these EL students are usually good English speakers who struggle with literacy skills. Therefore, we suspect the students' literacy skills as assessed and evaluated in school are part of what is causing this subset of students to be marked and retained as ELs. We have concluded that there is an ideological misinterpretation of EL students and/or EL test scores, which suggests a change in English Language Development (ELD) class curriculum or testing material is needed. This research can lead to these educational changes and challenge the idea that Marshallese ELs are poor English speakers.

Special category: OUR Scholars

“It's a slip and slide down there:” Influencing Fertility; The Role of TikTok in Shaping Public Perceptions of Fertility Supplements

Erin Oakley and Alissa Mok
Mentored by: Margaret Quinlan, College of Humanities & Earth and Social Sciences

This qualitative research project investigates TikTok’s impact on public perceptions of fertility supplements and treatments through user-generated content analysis. With the rise of social media, TikTok has become an increasingly influential platform for discussions around health and wellness, particularly in fertility. The platform's unique algorithm and format make it an ideal space for information, often blending personal experiences with marketing content. Our research addresses two central questions: (1) How are fertility and infertility supplements marketed on TikTok? and (2) What are the implications of these narratives on public perceptions of fertility options? Using thematic analysis on a selection of TikTok videos, we identified three primary themes: (1) the marketing and discourse surrounding fertility and infertility supplements, (2) the portrayal and promotion of supplements, and (3) the targeting of specific demographics with reproductive health issues, and (4) shaping expectations for fertility treatment or fertility in general. Our findings reveal that social media, particularly TikTok, shapes public expectations regarding fertility treatments. The platform both reinforces and challenges traditional narratives about fertility, with some videos presenting success stories and others cautioning about potential risks. Additionally, TikTok includes content reflecting diverse perspectives, incorporating outlier groups whose experiences do not fit neatly into mainstream fertility themes. This study emphasizes the need for healthcare practitioners to understand how social media narratives influence public perceptions and develop policies promoting accurate, evidence-based information while combating misinformation. As social media grows as a space for health-related discussions, it becomes increasingly important to recognize its role in shaping public health decisions.

Special category: OUR Scholars

A Comparative Study of Error-Bounded Lossy Compression Techniques for Scientific Data using Machine Learning Model

Inkwon Oh
Mentored by: Jinzhen Wang, College of Computing & Informatics

With the explosive growth of scientific data generated by high performance computing applications, error bounded lossy compression has become a critical strategy for reducing storage requirements and input-output overhead while preserving essential data fidelity. This research explores the effectiveness of machine learning algorithms designed to improve the performance and usability of error bounded lossy compression. These algorithms aim to reduce data volume without compromising user defined accuracy constraints and include techniques for predicting data patterns, optimizing compression decisions, and estimating output quality metrics. One focus of the study is on online selection methods that dynamically choose the most suitable compression approach based on data characteristics and quality tradeoffs. Another aspect involves using deep learning models to predict the quality of compressed data, such as signal fidelity and structural similarity, without the need for repetitive compression trials. Our evaluation considers various scientific datasets and examines how machine learning based compression methods impact compression ratio, data accuracy, and computational efficiency. The results highlight the potential of integrating predictive models into compression workflows to support adaptive and intelligent data reduction in large scale scientific computing.

Developing items for measure of bystander intervention to prevent problematic alcohol use among college students

Justin Ohiaeri, Brianna Jones, Zihui Qiu, and Cristty Castillo
Mentored by: Annelise Mennicke and Erika Montanaro, College of Humanities & Earth and Social Sciences

Problematic alcohol usage (PAU) is a consistent and impactful issue among college students. Despite efforts to address PAU, effective intervention strategies regarding PAU remain underdeveloped. The Bystander Intervention for Problematic Alcohol Use Model (BIPAUM) provides a structured intervention approach to address PAU, consisting of five phases: Plan in Advance, Notice and Interpret Signs, Decide, Intervene, and Assess Outcomes. The current project aims to develop items for scales that will capture constructs for assessing the support and feasibility of intervening and evaluating the outcomes of bystander intervention. This study utilizes a secondary analysis of qualitative data collected from 20 focus groups with a total of N=78 demographically diverse participants. Participants discussed their perceptions of PAU, the barriers to intervention, and decision-making processes. Ongoing data analysis will involve coding, reliability testing, and identifying recurring themes about Assessing Support (the perceived support of others in one's intervention), Assessing Feasibility (the practical ability and confidence in intervening), and Assessing Outcomes (the effectiveness and impact of intervention efforts). Preliminary findings include social norms, friend reactions, institutional policies, and public nature of intervention. The items developed will undergo rigorous validation to ensure their accuracy and effectiveness in assessing PAU-related perceptions and reactions. This research is important as reliable measurement tools are crucial in improving the prevention and intervention efforts in college settings. By identifying how students perceive and react to PAU, this research contributes to broader efforts in promoting mental health and substance use awareness in college settings.

Special categories: Community Engaged Research, Globally Focused Research, North Carolina Focused Research

Investigating and Comparing SDG #6: Clean Water and Sanitation in Germany and the United States

Ginny Ohlhaut, Ann Maupin, Caleb Reid, Arlinda Sadiku, and Felix Eirmann
Mentored by: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Our research investigates and compares aspects of the Sustainable Development Goal (SDG) #6 Clean Water & Sanitation. The main research questions for our international comparative study are: What are the similarities among Germany and the United States related to target goals for Sustainable Development Goal #6? What are the differences? To what degree are the countries on track to make progress on SDG #6 by the 2030 goal year? To conduct this research, we each wrote a Research Memo paper based on a literature review methodology. The Research Memo included international reports and peer-reviewed journal articles. The Research Memo was framed by Bereday's (1964) Comparative Model. To sharpen our critical thinking skills, we also engaged with an Artificial Intelligence (AI) Debate Bot to further strengthen our findings. This collaborative study was part of a semester-long Global Networked Learning (GNL) research collaboration among students at UNC Charlotte and students at the PH Ludwigsburg in Germany. A GNL project is a collaborative approach to learning that enables students and instructors from different locations around the world to participate in learning and creation of knowledge together. In our research, we report on the comparative findings of our GNL project. The research includes an examination and discussion of the challenges and possibilities in meeting SDG #6, which is to ensure availability and sustainable management of water and sanitation for all by the 2030 goal year.

Special categories: Globally Focused Research, Sustainability Research

TickBusters: Investigating tick-borne diseases in North Carolina and Brazil
Wynn Oo
Mentored by: Rafael Felipe Da Costa Vieira, College of Health & Human Services

Ticks (Acari: Ixodidae) transmit various pathogens through blood feeding, causing underreported tick-borne diseases (TBDs) in the U.S. This research builds upon previous findings to improve our understanding of TBD spread and inform public health recommendations for exposure reduction and prevention strategies. We focus on tick species occurring in North Carolina: the Lone Star tick, *Amblyomma americanum* Linnaeus, 1758, and the Gulf Coast tick, *Amblyomma maculatum* Koch, 1844. The Lone Star tick is known for transmitting *Ehrlichia* spp., *Rickettsia* spp., Heartland Virus, and Bourbon virus. It has also been associated with the alpha-gal syndrome, commonly known as red meat allergy. The Gulf Coast tick, usually prevalent in the southeastern U.S., has been spreading north, and it is the vector of *Rickettsia parkeri,* which causes a mild form of Spotted Fever in infected humans. Our research involves the collection of ticks in public parks of Mecklenburg County, by using dragging and flagging techniques. We are also developing skills in both wet and computational labs to enhance our ability to identify ticks by species, gender, and developmental stage. We use taxonomical keys in our identification process. This research contributed to active surveillance data, helping assess the likelihood of encountering ticks on and off trails in various environments. Currently, no vaccines are approved for human use in the U.S. to prevent TBDs, and the primary strategy remains focused on preventing tick bites. Our findings will serve as baseline data and further contribute to ongoing efforts to improve TBD prevention, early diagnosis, and other public health strategies.

Special categories: Community Engaged Research, Globally Focused Research, OUR Scholars, North Carolina Focused Research, Sustainability Research, Urban-Charlotte Focused Research

Addressing Disparities in Healthcare for Children and Youth Living with Sickle Cell Disease (SCD)

Khadija Ouedraogo
Mentored by: Aimee Smith, College of Health & Human Services

Sickle cell disease is an inherited blood disorder distinguished by hemoglobin polymerization resulting in hemolysis and vaso-occlusion. Over 7 million individuals currently live with SCD, primarily affecting African American populations; however, in the United States, SCD predominately impacts marginalized communities, where patients with SCD experience a reduced life expectancy depending on the severity of their diagnosis. Over time, medical advancements have produced numerous treatments including hydroxyurea, L-glutamine, and Voxelotor. Nonetheless, disparities in healthcare, financial barriers, and systemic racial bias impede patient health outcomes. The financial and racial differences influencing healthcare policies, and delays in treatment or pain management disproportionately impact the quality of life for children and young adults living with SCD. Aspects of the Social Determinants of Health play a critical role in shaping the presence of healthcare disparities. The environmental conditions individuals with SCD experience are, often, in poorer socioeconomic areas where financial limitations hinder access to healthcare services. In addition to inadequate healthcare insurance coverage, systemic redundancies contribute to irregular accessibility to treatment and care options. Historically, the medical mistreatment of Black communities in the U.S. contributes to racial biases present in the healthcare system. Studies describe the typical prolonged emergency room wait times, transportation delays, and lack of physician availability for SCD patients. These experiences contribute to an inherent distrust in the healthcare system, influencing patient adherence to medications and types of patient-provider relationships. Addressing healthcare inequities for younger populations living with SCD requires systemic modifications in healthcare policies and education.

Special category: OUR Scholars

Improving Electroporation Protocols to Effectively Transform a Gram Negative Bacterium

MyAsia Owens
Mentored by: Aylha Pferschy, Ruth Wright, and Morgan Carter, Klein College of Science

Endosymbiosis is a close relationship between two organisms, where one lives within the cells of the other. An example of this is the relationship between the fungus *Rhizopus microsporus* and the bacterium *Mycetohabitans endofungorum,* where *R. microsporus* cannot complete its life cycle without *M. endofungorum*, though the two can be cultured independently of each other and then reintroduced. *M. endofungorum's* ability to be cultured independently from its host allows for the probing of the genetic mechanisms of this endosymbiotic interaction by targeted mutation. One method to genetically modify a bacterium is electroporation, which is the process of using an electric pulse to increase the permeability of a cell's membrane, allowing for the introduction of new DNA. The outcomes of a standard electroporation protocol yield inconsistent results for *M. endofungorum*. In order to optimize electroporation, we surveyed a variety of protocols that have yielded high results for other gram negative bacteria to identify variables for fine-tuning: temperature, wash solution, voltage, and recovery time. By assessing each of these variables in a controlled way, we can develop an optimized technique for electroporation of *M. endofungorum*. Having a reliable base protocol of electroporation that yields efficient generation of mutant *Mycetohabitans* strains will help to uncover the genomic features of these bacterial endosymbionts that affect their relationship with their fungal hosts.

Decoding the Link: Hsp70 Phosphorylation and TORC1 Signaling in Yeast

Shreya Patel
Mentored by: Andrew Truman, Klein College of Science

The yeast Target of Rapamycin (TOR) pathway, involving TORC1 and TORC2 complexes, regulates cell growth and metabolism in response to nutrient availability. TORC1 controls protein synthesis, autophagy, and stress responses, while TORC2 regulates actin cytoskeleton organization and cell survival, crucial for cellular adaptation and homeostasis. The Hsp70 molecular chaperone binds and folds many proteins involved in signal transduction. In this study, we set out to understand the role of yeast Hsp70 phosphorylation and TOR signaling. We screened 146 yeast strains expressing mutations in Hsp70 phosphorylation sites (73 phospho-mutants and 73 phospho-mimics) for sensitivity to the well-characterized TORC1 inhibitor rapamycin. Our phenotypic screen identified 7 phosphorylation sites crucial for the cellular response to rapamycin. Notably, 3 of these sites are located in the client-binding domain, suggesting a role in regulating client interactions. To further explore how Hsp70 phosphorylation affects TOR signaling, we analyzed the total protein levels of Sch9, a key downstream effector of TORC1. We found that the 6 sensitive mutants exhibited altered Total-Sch9 abundance, with one mutant displaying a significantly reduced expression. These findings indicate that Hsp70 phosphorylation plays a vital role in regulating total-Sch9 protein levels and, consequently, modulating the TORC1 pathway. Future research on interactions will focus on determining whether Sch9 functions as a client of Hsp70 and whether the Sch9-Hsp70 interaction is disrupted in these sensitive mutants, potentially resulting in rapamycin sensitivity.

Special category: Honors College

Optimization of Laser-Induced Fluorescence for Frequency-Encoded Detection
Brinda Patel
Mentored by: Laura Casto-Boggess, Klein College of Science

Searching for biosignatures of extraterrestrial life on icy moons requires high-sensitivity techniques with detection limits down to low nanomolar and picomolar concentrations. Capillary electrophoresis(CE) with laser-induced fluorescence(LIF) is a highly sensitive method for *in-situ* trace analysis. Fluorescent amine-reactive probes, including 3-carboxy-6,8-difluoro-7-hydroxycoumarin succinimidyl ester (Pacific blue, lex=405 nm; lem= 455 nm), are used to target primary amine-containing species, which mimic the biosignatures of interest. Capillary electrophoresis separation channels would then separate the fluorescent amine-reactive species based on the charge-to-size ratios. CE with LIF is routinely used for highly efficient separations with nanomolar detection limits. Real-world sample matrices include interfering metal cations and salts that result in destacking and reduced resolution. The goal of this work is to enhance the sensitivity and resolution of this technique with frequency-encoded microfluidics. Fourier-transform detection techniques enable enhanced resolution by converting the intensity-vs-time electropherogram data into the frequency domain with a reference frequency. An increase in peak resolution has been observed upon conversion to the frequency domain. This work addresses the optimization of a LIF detection system and the integration of capillary electrophoresis separations with a microfluidic frequency encoder towards enhanced strategies for *in situ* analysis of potential biosignatures.

Special categories: Honors College, North Carolina Focused Research

Parameter-Efficient Training through Efficient Joint Sparse and Low-Rank Adaptation
Edgar Perez-Raygoza
Mentored by: Christian Kuemmerle, College of Computing & Informatics

For my undergraduate research project with Dr. Kummerle, we aim to reduce the computational strain of large language models through Parameter-Efficient Fine-Tuning (PEFT), enabling deep learning models to be trained on consumer hardware. The recent paper "RoSA: Accurate Parameter-Efficient Fine-Tuning via Robust Adaptation" (https://arxiv.org/pdf/2401.04679) has shown promising results by merging two PEFT approaches: Sparse Adaptation and Low-Rank Adaptation. The study demonstrated that RoSA outperforms either method used independently. In this project, we will build on recent advances in low-rank fine-tuning, utilizing quadratic differentiable rank regularizers to develop PEFT algorithms that achieve improved performance over RoSA and other PEFT methods while maintaining the same parameter budget. Our research aims to further publicize access to fine-tuned language models for specialized applications.

Special category: OUR Scholars

Carbonyl Redox Chemistry: A Versatile Platform to Access Rigid Polycyclic Frameworks with Defined Substituent Patterns

Zachary Perry, Nicholas Brace, and Nikita Spambetov
Mentored by: Markus Etzkorn, Klein College of Science

Polycyclic compounds, often aesthetically pleasing scaffolds, have played a crucial role in probing the scope and limitation of molecular structure, chemical reactivity, and synthetic strategies. Their applications in material science and medicinal chemistry emphasize their value to society, and fluorinated polycycles have recently gained significant attention as novel electron-acceptor materials, spacer units in biologically active compounds, and crucial structural motifs in fundamental research of reactive species. Our group has been using a cage diene framework as a synthetic manifold to prepare unusual oxacage compounds, selectively fluorinated derivatives, and entirely new hydrocarbon architectures. While largely relying on standard synthetic methodology, we have also encountered unusual rearrangement reactions that complicate and enrich our synthetic strategies. The carbonyl group, besides the double bond moiety of the hydrocarbon starting material, is one of the most versatile groups in organic chemistry, and we present several fascinating aspects of its application in our endeavors toward novel derivatives of the cage diene. We will discuss the preparative strategies from carbonyl compounds, a readily available starting material in our laboratory, toward symmetrical dicarbonyls, aromatic derivatives, and other novel cage compounds. In this work, we will highlight the unusual preparative aspects, selected spectroscopic features, and long-term goals of our research project.

Zeolite Nanoresin's Ability to Remove Fluoride from Water

Anna Pham
Mentored by: Jordan Poler, Klein College of Science

Fluoride contamination in water sources poses many health risks, including bone damage such as osteoporosis, arthritis, and fluorosis. Different zeolite nanoresins samples – with varying polymer length – were tested to test their effectiveness to optimize the nanoresin capabilities at removing fluoride in water. Multiple adsorption isotherm and kinetics experiments were carried out to assess the zeolites fluoride removal abilities. It was found that ZNR at 120 polymer length has the average maximum loading capacity at around 0.4 mg/g ZNR, and langmuir isotherm constant remains at around 0.021 L/mg. Preliminary results indicate that the zeolite nanoresins have promising results, but further research is needed.

Special category: Community Engaged Research

Geolocation Authentication

Erica Phann
Mentored by: Heather Lipford, College of Computing & Informatics

Security questions are often used as a backup authentication method, for when users lose their password or are unable to use their primary authentication method. Yet there are many issues with existing challenge questions – answers are easily guessable or can be learned from other online information, increasing security risk. Alternatively, answers can be forgotten or mistakenly entered, increasing the costs of account recovery. A new scheme has been proposed in the research - using location as an answer. The aim is to use location-based security questions in a way that is both deeply memorable yet difficult to guess. The user will choose a location-based security question and select a location grid that reminisces with them. This location grid would then be the backup authentication method to login. In this project, we want to more deeply examine the use of this scheme through a small scale qualitative interview study. The study will examine the usability of creating a location-based security question, compared to traditional questions. We will examine the usability of the answer creation process, strategies users employ, and user perceptions of effectiveness and security. The outcomes will provide evidence of the efficacy of using geolocation as a memorable yet secure method for backup authentication.

A Comparative Study of Pretrained Models for Soybean Disease Classification
Evan Pickett
Mentored by: Opeyemi Alabi, College of Computing & Informatics

The first project explores the challenges undergraduate students face in finding and joining research labs on campus. Despite the availability of numerous research opportunities, students often struggle to access relevant information. To address this, a semi-structured interview will be conducted to map students' experiences and identify barriers. Insights from these interviews will inform the development of a low-fidelity prototype using Balsamiq Wireframes, followed by user testing and refinement into a high-fidelity prototype using tools like Adobe, Figma, or MS PowerPoint. The goal is to create a structured and seamless process for students to discover and join research opportunities.
The second project investigates the effectiveness of domain-specific versus general transfer learning for soybean disease classification. The study compares deep learning models pretrained on an agricultural dataset versus ImageNet (a general dataset) to determine which performs better under varying dataset conditions. Preliminary results indicate that general pre-training is superior when fine-tuning datasets have sufficient images per class, while domain-specific pretraining excels in data-scarce, multi-class scenarios. These findings provide valuable insights for engineers developing machine learning solutions in agriculture and have long-term benefits for precision farming and food security.

Special categories: Community Engaged Research, Globally Focused Research, Sustainability Research

Development of a process for Extracting Nanocellulose Fibers from Plant Matter.
Madhava Aditya Bharadwaj Pinapati
Mentored by: Roger Tipton, William States Lee College of Engineering

Cellulose, the most abundant biopolymer on Earth, plays a critical role in sustainable materials, biocomposites, and nanotechnology. While industrial hemp stalks have been widely studied as a primary source of cellulose due to their high fiber content, agricultural waste presents an alternative, underutilized feedstock with significant potential. Large quantities of crop residues are often discarded or burned, leading to environmental pollution and resource inefficiency. Repurposing these residues for cellulose extraction offers an eco-friendly solution that contributes to waste mitigation and the development of high-value materials. In this study, we investigate the extraction of cellulose from agricultural residues, specifically soybean stalks, corn stalks, and peanut shells, which were selected due to their local availability. Additionally, we compare these sources to pine wood to assess the efficiency of cellulose extraction across different biomass types. Using hemp stalks as a benchmark, we aim to refine established extraction methods and analyze the structural and chemical properties of the obtained cellulose. We expect that optimizing the extraction process will significantly enhance cellulose quality, improving key material properties such as strength, flexibility, and compatibility with nonpolar polymers for composite performance. It is anticipated that controlling cellulose crystallinity will improve mechanical properties, while modifications in the extraction process could enhance moisture resistance and thermal stability without compromising biodegradability. If confirmed, these findings would contribute to addressing existing limitations in cellulose-based material applications.
Our study aims to demonstrate that agricultural residues can serve as viable alternatives to traditional cellulose sources, expanding their potential use in industrial applications. By refining extraction techniques, we seek to provide a pathway toward large-scale, economically viable production of cellulose-based materials. This work supports the transition toward sustainable material development and highlights the broader implications of agricultural waste valorization in reducing environmental impact and promoting circular economy practices.

Special category: OUR Scholars

Building Defiance: Amaza Lee Meredith's Architectural Resistance

Mo Pirela
Mentored by: Emily Makas, College of Arts + Architecture

Architecture has long been a field dominated by white, male narratives, with the contributions of Black women often erased from history. The common perception is that 20th-century modernist architecture was shaped exclusively by figures like Le Corbusier and Frank Lloyd Wright. However, my research challenges this notion by centering the work of Amaza Lee Meredith, a Black woman architect whose pioneering designs and life as a lesbian woman disrupt conventional understandings of race and gender in architectural history. This paper argues that Meredith's work reflects a radical engagement with modernism that defied racial and gendered expectations. By analyzing her architectural designs through the lens of Black feminist spatial theory, I examine how she navigated structural exclusion and created a personal and politically significant space. Through archival research, spatial analysis, and comparative study, I demonstrate how Meredith's strategic use of minimalism, open floor plans, and symbolic geometry actively resisted the racial and gender norms of her time. This study is significant because of its contributions to architectural history but also to contemporary conversations about representation, inclusion, and queerness in design. By amplifying Meredith's legacy, this research provides a model for rethinking how Black women and LGBTQ+ architects are integrated into architectural discourse. This work speaks to scholars in architecture, Black studies, gender studies, and the broader public, making it highly relevant to discussions on diversity in the profession, public memory, and global housing equity.

Special category: OUR Scholars

Serial Evaluation of Knee Cartilage Using Ultrasound in Athletes

Kacey Podielsky
Mentored by: Abbey Fenwick, College of Health & Human Services

Consistent physical activity is vital to maintaining one's health. While participation in athletics is a healthy physical activity, there are risks associated with it. Consistent training and conditioning can lead to injury or accelerate wear and tear on the athletes' joints. It is important to understand the changes in joint health over an athlete's career, but also within a sports season, to possibly inform training to emphasize long-term joint health. The objective of this study is to learn more about the changes in athletes' femoral (knee) cartilage throughout their sport season. Forty-three student athletes from UNCC were enrolled in this study. These athletes came in for three testing sessions, one pre-season, one during the season, and one postseason. During each session, athletes were seated with the knee bent to 125 degrees and the ultrasound probe was placed on top of the bent joint to measure femoral (knee) cartilage on each limb. Then, ultrasound images were analyzed using ImageJ software to quantify cartilage thickness (mm) and echo intensity. Echo intensity (the darkness of the image) was used to assess water content in the cartilage. Darker images signify less water content, which may indicate less healthy tissue. Average cartilage thickness and echo intensity will be quantified for each limb of each athlete at each session and analyzed via repeated measures ANOVAs. From the results of this study, we will gain knowledge about how an athletic season affects cartilage health in athletes.

Special category: OUR Scholars

Investigation of Post Translational Modifications on Copper Chaperone for Superoxide Dismutase

Colin Raddant
Mentored by: Eva Ge, Klein College of Science

Copper is an essential metal for biological systems and plays critical roles in numerous intracellular pathways. Dysregulated copper homeostasis can lead to the development of various diseases, highlighting the importance of maintaining its intracellular balance. Copper chaperone for superoxide dismutase (CCS) is a key metallochaperone protein and delivers copper to the redox protein superoxide dismutase (SOD1). CCS has three domains, with copper-binding sites in domains 1 and 3. Domain 3 is intrinsically disordered and contains a serine residue between the two copper-binding cysteine residues. This serine can be phosphorylated, which we hypothesize may influence copper binding and CCS function. To investigate the role of this post-translational modification (PTM), we synthesized WT and phosphorylated peptides encompassing domain 3 of CCS using Fmoc-based Solid Phase Peptide Synthesis (SPPS). These synthetic peptides will be used to study copper-induced structural changes using Circular Dichroism (CD) spectroscopy. This will help to elucidate the functional impact of serine phosphorylation within domain 3 of CCS.

Sleeping Beauty Transposase - DNA Complex Structure

Ragul Ramesh
Mentored by: Yuri Nesmelov, Klein College of Science

The objective of our research is to explain the molecular mechanism of DNA transposition mediated by the Sleeping Beauty (SB) transposase. To achieve this, we express and purify full-length, single-cysteine SB constructs, label them with fluorophores, assemble SB transposase-DNA complexes, and employ time-resolved Förster Resonance Energy Transfer (FRET) to measure interprobe distances within the complex. These experimental distance measurements are compared with the AI-driven AlphaFold 3 predicted SB transposase-DNA complex structure to refine computed structure models. An accurate structural representation of the complex is important to understand the molecular dynamics involved in DNA excision and transposition. In our study, we designed four single-cysteine SB mutants (T51C, T94C, R126C, and T295C), labeled them with fluorophores TAMRA (TMR) and Cyanine5 (Cy5) at specific positions and performed FRET experiments to find interprobe distances. The formation of the SB complex was verified through Microscale Thermophoresis (MST) and Electrophoretic Mobility Shift Assays (EMSA). Then, the complex was modeled incorporating fluorescent probes positions using AlphaFold 3 and more thoroughly examined through Molecular Dynamics (MD) simulations to improve the accuracy of predicted interprobe distances. Additionally, to ensure precise FRET measurements, time-resolved fluorescence anisotropy was utilized to assess the wobbling dynamics of fluorophores at labeling sites. Here, we present a comparative analysis of both computational and experimental interprobe distances within the SB transposase-DNA complex.

Spatial Patterns of Climate Justice Hotspots in Mecklenburg County

Karen Regalado
Mentored by: Fushcia-Ann Hoover, College of Humanities & Earth and Social Sciences

Spatial patterns of environmental hazards and injustices such as landfills, poor water quality, and exposure to extreme heat have disproportionately impacted low-income populations and minorities, particularly Black communities. As the global effects of climate change continue to intensify, it is important to understand where these impacts are more severe and where climate change solutions are being implemented. One way to address and identify places of climate vulnerability is through a climate justice perspective. Climate justice hotspots are defined as concentrated areas of uneven distribution of climate-related risk and communities disadvantaged by the system. Therefore, an important question to ask is: Where are the climate justice hotspots in Mecklenburg County, North Carolina, based on interactions between Black populations, particulate matter concentration, and air pollution-related illnesses? This study seeks to identify climate justice hotspots across Mecklenburg's Black communities by analyzing data asthma levels and PM2.5 concentrations. Using Geographic Information Systems (GIS), we identify these hotspots and highlight areas where communities are most affected by pollution. Taking into account Charlotte's corridors of opportunity, an initiative launched by the City of Charlotte to strengthen six underinvested areas, we anticipate higher levels of pollution effects along this crescent region. Analyzing these relationships at the local level can provide and/or reinforce support from local environmental and urban planning.

Special category: OUR Scholars

Pavement Marking Detection from LiDAR Data

Kevin Richard
Mentored by: Depeng Xu, College of Computing & Informatics

LiDAR (Light Detection and Ranging) data has revolutionized the collection of high-resolution geospatial information, improving the mapping of terrain. However, manual analysis of LiDAR data is a time-consuming and labor-intensive process, which makes manual inspection not only impractical but also often impossible to complete in a timely manner. One critical application of LiDAR data analysis is road maintenance. Accurate detection of pavement markings ensures road safety while also increasing data processing efficiency. Our research develops a system to detect pavement markings from LiDAR data, which addresses the need for automated road infrastructure monitoring. Using a custom machine learning model, this project seeks to improve the efficiency of pavement marking detection compared to existing methods. Our work involves converting aerial LiDAR data into a dataset of clipped overhead images to include only road data. This dataset is then used to train a YOLO object detection model designed to identify pavement markings. Using this system results in more accurate pavement marking detection, enabling early identification of maintenance needs. In addition to improving road safety, this system can be scaled to various other applications dealing with LiDAR data, such as agriculture, construction, and other forms of infrastructure management. By exploring the applicability of LiDAR data and machine learning in object detection, this project contributes to the development of more efficient and effective methods to maintain infrastructure.

The Structural and Functional Dynamics of the Major Capsid Protease Fusion Protein
Shamanasia Richardson, Daune Signorelli, Joseph Kim, and Heven Siyum
Mentored by: Ellen Wisner and Tonya Bates, Klein College of Science

Bacteriophages, the most abundant organisms on Earth, have unique genomes, with no two phages being alike. The major capsid protease fusion protein (MCPFP) plays a critical role in forming the final capsid (shell encasing viral genome), though its presence and configuration vary among phages. This study aims to gain a comprehensive understanding of the MCPFP in the *Arthrobacter* phage Powelldog and conduct a comparative analysis with unfused proteins found in other phages. While previous research has explored capsid proteins in other phages, MCPFP in Powelldog remains uncharacterized. We will explore this protein comparing it to non-fused proteins found in other phages. AlphaFold 3, Phamerator, BLAST, and HHPred software will be used to predict protein structure, determine domains present in the protein, and compare the MCPFP found in Powelldog to other phages. Structural and genetic data, alongside literature on capsid assembly and phage-host interactions, will guide comparisons between fused MCPFP and non-fused major capsid and protease proteins. We hypothesize that the unique features of Powelldog's major capsid protease fusion protein are critical for assembling a functional capsid for effective host interaction. This research will enhance the understanding of the structural and functional roles of the MCPFP in Powelldog. This discovery could contribute to implications for phage therapy and can help combat antibiotic-resistant bacteria, as well as provide a foundation for future studies on fused proteins.

The Germline Controls HSP-90 Chaperone Expression during Stress and Aging Cell nonautonomously in *Caenorhabditis elegans*

Robbie Richmond
Mentored by: Patricija Van Oosten-Hawle, Klein College of Science

Multicellular organisms like *Caenorhabditis elegans* face stressors throughout their life due to environmental, disease, and aging-related stressors. Cellular stress responses enhance proteostasis components to protect cellular and organismal health and survival. A highly conserved set of proteostasis components are molecular chaperones such as HSP-90. Our lab has previously shown that HSP-90 orchestrates stress responses and proteostasis across the different tissues of a multicellular organism. For example, lysosomal HSP-90 degradation in the *C. elegans* intestine promotes organismal thermotolerance. However, it is unknown how environmental stressors and aging influence the endogenous expression profile of HSP-90 across all tissues. Utilizing a *C. elegans* strain expressing endogenously tagged HSP-90 with a green fluorescent protein we observed that it decreases with age and during heat stress conditions. Notably, we found that pre-fertilized worms exposed to heat stress significantly reduce HSP-90 expression in all tissues and that this prevents the development of a functional germline compared to post-fertilized worms. This indicates that the germline is essential in regulating HSP-90 expression in somatic tissues. Thus results suggest compounding effects of aging and environmental stress on HSP-90 expression via the germline. We anticipate these early observations of germline-dependent modulation of HSP-90 expression will provide new insights into how chaperone expression is regulated within organisms and how this influences stress resilience in the face of neurodegenerative diseases and aging. Ultimately, this study aims to unravel how the germline controls chaperone expression in somatic tissues in response to neurodegenerative and other age-related stressors.

Special category: Honors College

Bacteriophages: The Future in Everywhere and Anywhere

Jessica Robles Gonzalez and Lily McGuirt
Mentored by: Michelle Pass and Sharon Bullock, Klein College of Science

Bacteriophages are the most abundant organisms on earth with millions of unknown species. Bacteriophages are viruses that are essentially known as ‘bacteria eaters' and can be found anywhere bacteria can be found. The sample location was chosen based on high bacteria counts commonly found in a high animal traffic environment. Soil samples were taken from SouthPoint Animal Hospital, bacteriophages were extracted, amplified, and isolated using methods and techniques established by the SEA-PHAGES program run by the Howard Hughes Medical Institute (HHMI). After the presence of bacteriophage was able to be identified in our samples, they were amplified through the host bacteria *Arthrobacter globiformis*. These cultivated phages, named “SPAH” and the phage were further amplified to achieve a good titer for Transmission Electron Microscopy (TEM) analysis. While SPAH lacked qualifications to send the sample to HHMI for sequencing for further genetic analysis, TEM analysis revealed that the SPAH sample contained all three bacteriophage morphologies, Siphoviridae, Myoviridae, and Podoviridae. SPAH samples are now being held in UNC Charlotte's phage library and will be used in the future analysis and as positive controls. Having banks of bacteriophages can add to the knowledge of phage morphology and they serve as a small step in understanding the abundant and mysterious bacteriophage which may hold the future of medical therapies, antibiotic, genetic research. With the rapid growth of antibiotic resistant bacteria and bacterial infections over the last several decades, having bacteria-eating microbes on our side could be another tool of future medical treatments.

Utilizing ZNR for Effective Water Purification

Adrian Rodriguez
Mentored by: Jordan Poler, Klein College of Science

Per- and polyfluoroalkyl substances (PFAS) remain a significant challenge in purifying drinkable water due to conventional methods being unable to effectively remove this forever chemical. Consequently, adsorbents have grown in popularity as a viable method to remove PFAS from wastewater due to their environmental and economical advantages for PFAS remediation. In this study, a relatively novel material known as zeolite nano resins (ZNR) were tested as adsorbents for PFAS removal as well as its potential for regeneration and reusability. Using fluorescein (FL), a surrogate compound to PFAS, optimal adsorption and regeneration parameters of ZNR were measured to determine and enhance wastewater treatment strategies. The results demonstrated that ZNR successfully adsorbed more than 90% of the introduced FL and retained its reusability when regenerated with a solution of calcium chloride ($CaCl_2$) in 20% water in methanol by volume. Rapid small scale column testing (RSSCT) was also conducted to assess the capabilities of ZNR in real world applications.

Special category: Sustainability Research

Developing an Evidence-Based Children's Book Based on Emotional Clarity as a Pathway to Public Dissemination

Tori Rogers
Mentored by: Sara Levens, College of Humanities & Earth and Social Sciences

Emotion regulation skills have been identified as vital for health and social relationships, yet one's emotions and how to regulate them are not well understood by the general population. Emotional clarity, the ability to identify and label one’s emotions, is a particularly important emotional skill that underlies the use of more advanced emotion regulation skills. The aim of the present study is to develop a children's storybook that incorporates evidence-based research on emotional attention and emotional clarity into the storyline to help parents and young children identify and label their emotions. Background research on emotional clarity will be incorporated including its definition, how it is assessed, and its importance. A best practice review will also be conducted to identify storyline dynamics and characters that best connect with readers. Next, focus groups will be conducted with parents with young children to provide feedback. Revisions to the storybook draft will be made based on iterative feedback from target readers. We hope to illustrate that Children's books have the potential to disseminate emotion processing and regulatory skills to families and individuals. Through the curation of a children's storybook, we are implementing ideas of emotional clarity into a compelling narrative that may be used to help readers understand and label their emotions.

Special category: Honors College

TickBusters: Investigating tick-borne diseases in North Carolina and Brazil
Marielle Rosalez
Mentored by: Rafael Vieira, College of Health & Human Services

Ticks are significant vectors of many pathogens affecting both human and animal health. This study focuses on two tick species, the Lone Star tick (*Amblyomma americanum*) and the Gulf Coast tick (*Amblyomma maculatum*), assessing their distribution and potential public health risks in public parks in Mecklenburg County, North Carolina. Both species are aggressive toward humans and are vectors of important diseases such as ehrlichiosis, tularemia, and Rocky Mountain spotted fever. The Lone Star tick has also been linked to alpha-gal syndrome, also known as red meat allergy. Our study aims to fill a gap in tick surveillance in this region of North Carolina, where data on these species are limited. Our methodology includes training for taxonomic identification, photographing mapping their distribution, and reviewing the existing literature. This study will provide baseline data that will be used to understand how environmental changes are impacting tick populations and the associated risk of human exposure to tick bites. Future research will continue with on-site tick collection in the characterization of the tick microbiome to further define their role as vectors of tick-borne pathogens.

The Influence of Modal Mineralogy and Grain Size on the Coefficient of Thermal Expansion (CTE) in North Carolina Aggregates

Davis Rowe
Mentored by: Valerie Reynolds, College of Humanities & Earth and Social Sciences

North Carolina's complex geology ranges from coastal sedimentary rocks to igneous and metamorphic rocks in the Blue Ridge Mountains. The state is a prominent source of aggregate, which comprises about 60-70% of concrete mixture and significantly influences its thermal properties. This project aims to determine the influence of modal mineralogy and average grain size on the coefficient of thermal expansion (CTE) of North Carolina aggregates, with the primary goal of producing lower CTE concrete for infrastructure construction. Low CTE concrete experiences less thermal expansion, reducing premature cracking and deterioration to produce more durable, cost-effective infrastructure. This project furthers Rogers' (2024) research assessing the relationship between modal mineralogy and aggregate CTE by expanding the dataset with more samples and considering average grain size as influencing aggregate CTE. Sample sites and nearby quarries were mapped for future aggregate collection to produce concrete mixtures and assess if aggregate CTE can predict concrete CTE. Calculated CTE values in this project were consistently higher than those reported by Rogers, though most remained low, ranging from 5.891 to 7.780 (10-6m/m*°C-1) compared to measured values of 5.938 to 8.512 (10-6m/m*°C-1). The average grain size ranged from 0.031 to 3.320 (mm2). There was a minor positive correlation between grain size and measured CTE, though this does not explain the difference between measured and calculated CTE. Difficulty distinguishing quartz and alkali-feldspar during point count analysis may have produced inaccurate CTE calculations. XRD analysis for modal mineralogy may correct this.

Special category: Honors College

Perceptions of Diversity and Sense of Belonging Among Arts Majors and Alumni
Jahdoi Russell
Mentored by: Vaughn Schmutz, College of Humanities & Earth and Social Sciences

Recent research points to the importance of a sense of belonging as a key predictor in the retention and success of college students. Among the factors that shape a student's sense of belonging are their perceptions of diversity and inclusivity on campus and in their field of study. By assessing perceptions of diversity and other sources of social and institutional support among students in art programs, I aim to uncover potential effects on students' overall sense of belonging within their specified art program at UNC Charlotte. In this study, I examine how different levels of diversity, such as resources, representation, and career development opportunities in the arts program, impact the trajectory of the art students' college careers. Factors I analyze regarding a sense of belonging include community, recognition, and institutional connectedness. I aim to examine how perceptions of these factors foster feelings of belonging or lack thereof. Based on a national survey of arts alumni (SNAAP) as well as qualitative interviews with students at UNC Charlotte who are majoring in different artistic disciplines, I will examine the relationships between perceptions of diversity and sense of belonging. Quantitative methods of analysis using SNAAP survey data will allow me to examine patterns and correlations between perceptions of diversity and belonging among alumni who graduated from UNC Charlotte, as well as other institutions across the United States. Qualitative analysis methods will allow me to explore the experiences of students to help understand the quantitative patterns. The findings of this research can be utilized to identify what variables affect students' sense of belonging in various art programs and develop a variety of supportive initiatives designed to enhance diversity and inclusion.

Special category: OUR Scholars

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

Prabhtej Sahni
Mentored by: Erina B. Joyee, William States Lee College of Engineering

Humidity sensors are vital in biomedical applications, particularly for wearable and implantable devices where precise humidity monitoring can significantly enhance patient care. This research focuses on improving the fabrication process of flexible, fully integrated humidity sensors using extrusion based additive manufacturing, specifically Direct Ink Writing (DIW). DIW is a promising method due to its material versatility and ability to print intricate structures. We explore how introducing parameters such as, a 70°C heated substrate and a 20 mT magnetic field, affect printing accuracy when applied to a nanocomposite ink composed of 70% polyvinyl alcohol (PVA) with 15% iron(III) oxide (Fe_3O_4) and 15% silicon carbide (SiC). This ink was homogenized via sonication. Droplet and line printing trials were performed under heat and magnetic conditions to assess resolution and accuracy during the printing process. Results demonstrated that both heat and magnetic influence significantly improved line precision and print quality. These findings help refine the DIW process for humidity sensor development, with the goal of supporting more accurate and reliable long term health monitoring.

Special category: OUR Scholars

Utilizing Atomistic Simulations to Investigate the Thermal and Ionic Transport in Superlattice Perovskite Cells

Nizam Sait
Mentored by: Xiang Chen, William States Lee College of Engineering

While silicon based optoelectronics are widely popular due to their cost effectiveness and efficiency, metal halide perovskite (MHP) cells have emerged as a competitive alternative, rivaling silicon in efficiency. However, perovskite based optoelectronics have an issue - their short life spans. This is influenced by both thermal and ionic transport mechanisms, which govern how heat and charged particles move within the material and are significantly influenced by temperature. While the ionic transport mechanisms are well studied, thermal transport mechanisms are surprisingly understudied. In this research project, molecular dynamics simulations were utilized to analyze how different superlattice configurations, also known as periodically layered structures, influence the thermal and ionic conductivity of perovskite cells. As a result, a deeper understanding of the fundamental thermal and ionic transport mechanisms, as well as their coupled effects on material properties, can be achieved. These insights into the short lifespan of perovskite cells can in turn contribute to the design of improved new-generation solar cells.

Special category: OUR Scholars

Sandham's Perambulations of a Bee and A Butterfly: Introducing Nature to Young Readers in the Early 19th Century

Abeer Saleem Naznin
Mentored by: Alan Rauch, College of Humanities & Earth and Social Sciences

This analysis examines Elizabeth Sandham's *Perambulations of a Bee and a Butterfly* in the context of early 19th-century children's literature, alongside works like Anastasia Barbuled's *Evenings at Home* and Arabella Buckley's *Eyes and No Eyes*. Sandham's allegorical narrative, featuring anthropomorphized animals, blends natural observation with moral lessons, aiming to educate and shape the character of young readers in ways like Barbuled's family-centric tales and Buckley's explorations of sensory experiences. Like, *Charlotte's Web* by E.B. White, many of Sandham's works strengthens a connection to nature, emphasizes kindness, provides life lessons, and proselytizes an appreciation for the natural world while fostering intellectual curiosity. These texts reflect the educational ideals of the period – romanticism and moral character development – which laid the foundation for modern education by blending moral, academic, and practical instruction. By examining these works in tandem, this paper argues that Sandham's text, alongside those of her contemporaries, played a significant role in shaping the perceptions and development of young readers, cultivating intellect, morals, and character through engaging, didactic narratives making a lasting influence on modern literature and education.

Special category: OUR Scholars

Evaluation of Lightning Network Pathfinding Algorithms

Rohan Salwekar
Mentored by: Christian Kümmerle, College of Computing & Informatics

As the use of digital payments increases, there is a rising demand for faster, cheaper, and more effective means of sending money online. Cryptocurrencies, led by Bitcoin, provide a peer-to-peer means of transferring funds, but making such transfers directly on the blockchain is slow and expensive. The Lightning Network is a layer on top of the Bitcoin network that addresses this issue by facilitating near-instant and almost free transactions. Normal payments are not made directly on Bitcoin but through a network of temporary, private lines, just as with information on the internet. But to achieve this, one has to understand how to find the best path through the network based on time, availability, and cost. Different implementations of the Lightning Network currently employ distinct path selection methods, each designed with unique objectives. This project presents a new design that combines these methods into one flexible system. Users are not locked into one routing method; they can change their settings according to their preferences. For instance, a business will likely want to minimize the cost, while a person making a time-sensitive transfer will likely want to ensure that the transaction is fast and reliable. Real payment data is used to test this system, and various routing strategies are compared under different scenarios. Our study aims to explore whether allowing users to manage their payment paths could enhance the effectiveness of transactions, depending on various factors and user preferences. Therefore, this research contributes to the improvement of digital finance by enhancing the ability of cryptocurrency payments to cater to the dynamic needs of consumers.

Special category: OUR Scholars

Leveraging AI to Enhance Medical Adherence in Older Adults with Type 2 Diabetes
Sneaha Santra
Mentored by: Mohsen Dorodchi, College of Computing & Informatics

This study examines the critical challenge of medication adherence among older adults with Type 2 diabetes, a population often hindered by barriers such as cognitive decline, forgetfulness, and physical limitations. Non-adherence can lead to poor health outcomes and increased healthcare costs. The research explores how mobile technology, particularly medication logging applications, can mitigate these challenges and enhance adherence. Key questions include identifying barriers to adherence, determining how a medication logging app can address these issues, and defining design features that ensure high accessibility and usability for older adults. The study also investigates the potential of generative AI (genAI) within the SunRx platform to verify medication adherence, provide proactive reminders, and personalize interventions, while also examining the application of traditional AI algorithms like natural language processing (NLP) and predictive analytics for verifying medication authenticity, tracking trends, and offering personalized recommendations. The findings aim to provide actionable insights into mobile health solutions for older adults with Type 2 diabetes, with broader implications for healthcare innovation, chronic disease management, and AI applications in geriatric care.

Interactive Learning and Assessment Modules for Early CS Learning
Jacob Sasser and Brandon Tiseo
Mentored by: Kalpathi Subramanian, College of Computing & Informatics

The goal of the following project is to develop animations that will be utilized in highly engaging and adaptable computer science learning modules. These modules are intended to have significant customization abilities to meet the needs of instructors and allow them to cater to the needs of their student populations. In addition, the modules will also cater to the individual needs of the students, allowing customization based on individual skill levels. The modules will include several approaches to implementing the above goals, such as lecture material, assessments, and multimedia segments. One of these implementations, and the focus of this project, is animations which will demonstrate key computer science concepts in action. These animations will also be accompanied by interactive elements. These elements will enable instructors to input activities, like assessments, into the animations as well as adapt the animation's configuration to meet the learning objectives of the course. Students will also be able to adapt the animation to meet their specific learning needs, such as changing the playback speed or the depth of the explanation. Eventually, these animations and other implementations are to be integrated into the learning modules, providing instructors with a highly customizable method to demonstrate key course concepts while also allowing students to meet their own learning needs.

Special category: OUR Scholars

The Use of Games to Train Cognitive Flexibility: A Proposal of Mechanics and Interviews Among Therapists and Clients

Nikhil Saxena
Mentored by: Doug Markant, College of Humanities & Earth and Social Sciences

Cognitive flexibility is a skill that helps individuals adapt to fluctuating emotional burdens. Training cognitive flexibility is a challenging and lengthy process, as such it is efficacious to seek support methods outside of and in conjunction with traditional therapy. One such method may be through the lens of game design, as multiple game mechanics may be utilized to train aspects of cognitive flexibility such as reappraisal, perspective taking, approach-avoidance conflicts, and problem solving through attention bias modification. We conducted a qualitative interview study with N = 4 practicing therapists and N = 5 clients to delineate common themes surrounding the use of mental health-based games. Clients and clinicians show optimism when presented with these proposals and insights gained from interviews with these individuals shape subsequent game design. Here we present the thoughts and attitudes of clinicians and clients when interviewed about their experiences and expectations with mental health-based games, as well as congruent mechanics that may be utilized within a game to help train cognitive flexibility.

Special category: Community Engaged Research

Developing Antibacterial Metallic-coated Silica-capped Iron Oxide Nanoparticles

Laura Scala
Mentored by: Juan Vivero-Escoto, Klein College of Science

The presence of antibiotic resistance genes (ARG) in the wastewater environment contributes to the spread of antibiotic-resistant bacteria (ARB). Iron oxide nanoparticles (IONPs) present several advantages for combating this emerging global health crisis. IONPs produce reactive oxygen species which can be deadly to bacterial cells. In addition, IONPs have a magnetite core, allowing the nanoparticles to be extracted along with the treated bacteria using an external magnetic field. As gold and silver nanoparticles have previously demonstrated antimicrobial properties, adding a metallic coat over the IONPs may also provide enhanced antibacterial activity. Therefore, this project aims to investigate the antibacterial effect of gold- or silver-coated, silica-capped IONPs functionalized with either amine or thiol ligands. Characterization of the IONPs includes a colorimetric assay to quantify the concentration of each ligand type, Fourier-transform infrared spectroscopy to confirm the presence of expected functional groups, and dynamic light scattering and *zeta* potential to measure nanoparticle size, dispersity, and stability. Transmission electron microscopy and dark field scattering are used to compare morphology and coating, and inductively coupled plasma/optical emission spectroscopy is used to analyze the loading efficiency of the metallic coating. Lastly, the best-performing IONPs will be bioapplied to *Escherichia coli* to determine treatment efficacy and retrieval of the nanoparticles. Overall, this study will help contribute to understanding the antibacterial mechanisms of IONPs by investigating both the interaction of the chosen ligands with silver and gold, and the physical properties of the metallic coating itself.

Mapping and Illustration of the Atlantic Sea Floor

Erin Sescourka
Mentored by: Missy Eppes, College of Humanities & Earth and Social Sciences

Connections between art and science allow for a greater extent of communication across disciplines and can convey a message beyond its original scope. Art allows for creative interpretation that opens informed conversation to new audiences and mindsets. To better understand and practice Earth science communication through art, the goal of my project is to build my knowledge of how geology is influenced by tectonic processes along the Mid-Atlantic Ridge. I will research my topic using geologic maps like those published in *The Geology of the Atlantic Ocean* by Kenneth Emery and Elazar Uchupi. I will also collect research from preexisting publications on accompanying landforms and geology. I have always found motivation in the quest for knowledge and have been inspired by the unlimited potential behind making discoveries. I want to channel that into a work of art and science that explores techniques of both disciplines. This work will be created using a multi-medium approach, using mediums of colored pencil, gauche, and acrylic paint. I expect to learn more about the formation of different rock types and how landforms are molded over time along with varying techniques of representing these components through mapping. I also expect to expand my artistic skill set and experiment with new techniques for creating depth and elements of realism within my work.

Surficial Geology of Earthquakes Pertaining to Human Experience

Yana Staroverov
Mentored by: Missy Eppes, College of Humanities & Earth and Social Sciences

People get lost in the world of scientific technicalities and don't have time to search for explanations. Using art will efficiently visualize and elucidate important scientific messages - building personal connection between you and Earth. Profoundly understanding it will encourage people to care and therefore protect it. In order to better understand and practice Earth science communication through art, the goal of this project is to build my knowledge of seismology, in the US, focusing on surficial geology while relating it to Earth being interconnected with humans. Methods include using NOAAs 40 Years of Earthquakes in the United States: 1980 - 2020 map showing recurring vs. rare earthquake locations. Then, compare the surficial geology between sites using the 'Offshore surficial geology of California' map and 'Geological and geophysical maps of the Illinois Basin-Ozark Dome region', both from USGS. I would conduct interviews asking where people felt prosperous vs. idle and when they felt strongest vs. weakest. I'd research why earthquakes occur to find similarities with human experiences. The execution uses photography through a Sony-Cybershot, iPhone, and potentially film camera. The prints of earthquakes and their surficial geology will come from the USGS maps. I expect to learn the when, where, how, and why about earthquakes as well as a way to express feeling, emotion, and growth of people through photography. A specific skill I'd learn is how to properly use those cameras and interpret seismology.

Supporting the Socioemotional Needs of Unhoused Black Students in an Urban School District

Emma-Leigh Stoll
Mentored by: Susan Harden, Cato College of Education

Nearly 5,000 students in the school district that is the context of this study were identified as unhoused in the 2022-23 school year, and Black students are overrepresented in this population. The purpose of this study was to understand the resources available to unhoused Black students, as well as those available to educators in supporting the socioemotional needs of these students. I engaged in community-based qualitative research, and the service aspect of my project was helping to develop an Ambassadors Program with my community partner. I utilized qualitative research methods including interviews and thematic analyses of websites. I interviewed Black young adults who experienced houselessness in their youth as well as teachers. This study was conducted in the Southeast of the United States and took place over the summer. Limitations of this study included adults reflecting on experiences in their youth and limited access to potential participants.

Special category: Community Engaged Research

Testing the Transactivation Abilities of Four Tumor Suppressor (p53) Mutants

Ruth Tamirat, Kaustubh Tiwari, Simran Bali, Adrienna Fanelli, and Bryson Schreiner
Mentored by: Ellen Wisner, Klein College of Science

The tumor suppressor gene TP53 encodes p53, a transcription factor responsible for DNA damage response and cell cycle control against tumor growth. The normal wild-type (wt) version of p53 binds to p53 response elements (p53-RE) which activates genes for DNA repair; CDKN1A (p21) for cell-cycle arrest or Bcl-2-associated X (Bax) for apoptosis. This process helps protect from the formation of tumors because it is triggered when a cell has DNA damage. Mutations (mut) in TP53 could decrease transactivation abilities, potentially increasing the likelihood of tumor development. This study aims to evaluate the overall transactivational abilities of p53 mutants — G154V, Y220C, H233D, and L344P — and deduce what may be causing these mutants to not efficiently transactivate their target genes. Through engineered yeast cultures of wild-type (wt), mutant (mut), and negative-control (Δ), an ADE2 spot assay was performed to qualitatively determine each mutant's functionality as transcriptional activators for p53-REs. Also, a β-galactosidase (β-gal) assay was measured to assess the experimental mutants' transactivation ability quantitatively. The DNA binding affinity of each mutant was measured for each variant using a protein-DNA binding assay. We predict that mutants that have decreased transactivation will show less DNA binding. The results of this study will contribute to understanding the functionality alterations from p53 mutations, which can aid in the understanding of how to navigate cancer treatments better because 50% of cancers are caused by mutations in p53.

Investigating and Comparing Sustainable Development Goal #5 in Germany and the United States

Aiden Terrick, Lucy Weaver, Tati Greer, Jana Dengel, and Anesa Agaj
Mentored by: Erik Jon Byker and Benjamin Ade-Thurow, Cato College of Education

Our research investigates and compares aspects of the Sustainable Development Goal (SDG) #5: Gender Equality. The main research questions for our international comparative study are: What are the similarities among Germany and the United States related to target goals for Sustainable Development Goal #5, which is to achieve gender equality and empower all women and girls? What are the differences? To what degree are the countries on track to make progress on SDG #5 by the 2030 goal year? To conduct this research, we each wrote a Research Memo paper based on a literature review methodology. The Research Memo included international reports and peer-reviewed journal articles. The Research Memo was framed by Bereday's (1964) Comparative Model. To sharpen our critical thinking skills, we also engaged with an Artificial Intelligence (AI) Debate Bot to further strengthen our findings. This collaborative study was part of a semester-long Global Networked Learning (GNL) research collaboration among students at UNC Charlotte and students at the PH Ludwigsburg in Germany. A GNL project is a collaborative approach to learning that enables students and instructors from different locations around the world to participate in learning and creation of knowledge together. In our research, we report the comparative findings of our GNL project. The research includes an examination and discussion of the challenges and possibilities in meeting SDG #5, which is to achieve gender equality and empower all women and girls by the 2030 goal year.

Special categories: Globally Focused Research, Sustainability Research

Comparing the Effects of Human Fitspiration, Anime-themed Fitspiration, and Body Image Flexibility Quotes on State Body Image, Mood, and Exercise Motivation in Young Adult Men

Joseph Thompson
Mentored by: Jennifer Webb, College of Humanities & Earth and Social Sciences

Social media is recognized as a risk factor for body image disturbances for women, while men remain understudied yet are increasingly recognized as impacted by body image concerns, particularly with growing research surrounding the muscular ideal. Beyond gender, body image is nuanced by sexuality, hence gay and bisexual men tend to have greater body image disturbances, including muscularity concerns relative to their heterosexual counterparts. Fitspiration has become a popular trend on social media, whose creators often claim to be promoting exercise motivation but has been empirically found to pose health risks in the context of body image. A primary mechanism for conferring this risk is appearance comparisons, especially to idealized bodies often seen in fitspiration. Within fitspiration, anime characters have recently emerged as contemporary mainstream media targets for comparison, often in the form of physical appearance goals. The proliferation of anime fitspiration content raises new public health concerns given characters are often portrayed with exaggerated, cartoonish physiques, performing impossible feats of strength. Alternatively, body image flexibility may represent a possible strategy to motivate exercise that does not simultaneously confer a detrimental impact on body image and mood relative to both traditional human fitspiration and modern anime fitspiration social media content. This is because body image flexibility encourages individuals to openly accept challenges to their body image, without trying to change the thoughts or feelings that arise in the service of moving in valued life directions. The present study will expose young adult men to one of four image conditions: human-based fitspiration, anime fitspiration, body image flexibility quotes, or a control condition to examine the differential effects of viewing this content on body image satisfaction, mood, and exercise motivation. An exploratory aim is to provide a preliminary evaluation of whether sexual orientation further moderates the hypothesized effects.

Special category: Honors College

Mapping Trash: Improving Environmental Quality in Mecklenburg County Through a Community Partnership

Dylan Toh
Mentored by: Youngseob Eum, College of Humanities & Earth and Social Sciences

Urban litter is persistently affecting public spaces and community well-being. This study examines litter accumulation in the University City Area of Charlotte-Mecklenburg County using a community-driven, GIS-based approach to assess the effectiveness of volunteer-led cleanups and inform local policy. To track the spatial distribution of litter accumulation, we collected trash data (e.g., item counts, weights, material types, and GPS locations) across 22 sites, using crowdsourced data platforms, such as Litterati and ESRI's Survey123. GIS-based tools and a database were designed to process and transform this raw data into actionable insights. These tools allow us to derive key metrics, like cumulative trash counts and changes in litter accumulation rates over time. We developed a web-based GIS tool to visualize how the distribution of litter shifted across both space and time. We also incorporated local business data and applied Non-Metric Dimensional Scaling (NMDS) to analyze clustering patterns and explore the influence of social and environmental factors on litter accumulation. Our findings revealed several distinct patterns: litter counts spiked during Halloween; active construction sites correlated with increased metal debris; and certain areas, despite cleanups, remained litter-prone. These results suggest that factors beyond waste disposal infrastructure, such as behavioral or systemic influences, contribute to persistent littering. This study demonstrates how combining crowdsourced data with expert analysis can provide valuable insights for urban sustainability and guide effective interventions to reduce litter accumulation.

Special categories: OUR Scholars, Sustainability Research, Urban-Charlotte Focused Research

Earth Science and Art: The Blending of Two Disciplines

Zachary Tolman
Mentored by: Missy Eppes, College of Humanities & Earth and Social Sciences

Most members of society view things through different perspectives. A great example of this statement is a satellite signature of a hurricane. Earth Scientists and Meteorologists may view the cyclone and state “Wow! That system looks as if it could have major implications for humanity.” The artist is most likely to view that same hurricane from a different lens and state a quote along the lines of “That area of clouds looks like art.” To practice Earth science communication through art, as a non-artist, I look to build my knowledge of fine and visual arts while also exploring how it relates to the communication of Earth and Atmospheric Sciences. The primary objective on how I plan to achieve this understanding is to analyze satellite imagery of historical atmospheric phenomena and how it changed the landscape of Florida, this will be available from sources like ArcGIS and from NOAA. My hope is to interview members of the UNC Charlotte Art Department to broaden my perspective. The final product of this project is to be a poster created using digital tools such as ArcGIS and Q-GIS for the scientific element and Canva for artistic elements. The final outcome of this project is expected to be a greater understanding of the artistic lens of mapping and how it could be related to Earth and Atmospheric Sciences. This is vital to enhance both my fine art skills as well as my skillet in weather and earth science communications.

Special categories: Community Engaged Research, Sustainability Research

Assessing MLL Gene Translocations in Human Cells Treated with Bioflavonoids and other Genotoxins

Emilee Trivette
Mentored by: Christine Richardson, Klein College of Science

Infant leukemia is an aggressive disease, accounting for 16.4% of infant malignancies. *In utero* translocations involving the mixed lineage leukemia (*MLL*) gene, often with the *AF9* gene partner, are markers of infant acute myeloid leukemias. The *MLL* gene, crucial in hematopoiesis, contains an 8.3 kb breakpoint cluster region (bcr) where double-strand breaks (DSBs) frequently occur, leading to genome rearrangements including translocations. Topoisomerase 2 (Top2) poisons, such as etoposide, have been shown to introduce DSBs in *MLL* by inhibiting Top2's re-ligation ability, and illegitimate repair of these DSBs can potentially cause translocations. Previous research has established that bioflavonoids such as quercetin and genistein, similar in biochemical structure to etoposide, can promote *MLL-AF9* bcr translocations in a genetically engineered cell line. This research further examines these bioflavonoids and other genotoxic compounds that may cause *MLL-AF9* translocation events in non-hematopoietic and hematopoietic human cells. CAOV cells and HL-60 cell lines, along with primary progenitor/stem cell enriched CD34+ cells, are treated with bioflavonoids, other natural compounds, and flame retardants at different doses to induce DNA damage. Fluorescence in situ hybridization (FISH) using an *MLL* split probe signal is used to visualize and quantify the frequency of rearrangements. Sequencing across translocation breakpoint junctions demonstrates the DNA repair pathways used. We expect these compounds to cause DSBs and rearrangements in all cell lines, with highest numbers in CD34+ cells. This research will help elucidate compounds that induce *MLL* translocations, contributing to risk assessment and potential mitigation strategies for infant and childhood leukemias.

How Perceptual Variability Impacts the Communication of Probabilities with Icon Arrays

Isabella Tsai and Ata Yilmazemre
Mentored by: Douglas Markant, College of Humanities & Earth and Social Sciences

Icon arrays are graphical displays in which a subset of shapes are filled to represent the probability of an outcome (e.g., the probability of side effects from a medical treatment). Prior work has shown that perceptions of risk can be more accurate with icon arrays compared to other verbal and visual methods for representing probabilities. As a result, they are now widely used to communicate information about risk and uncertainty to the general public. However, little is known about how the design of icon arrays—in particular, the kinds of shapes and their spatial arrangement—affect perceptions of risk. The present study builds on other research on visual perception which suggests that variation in icon shape may distort their perceived numerosity. N=69 participants completed a task in which they judged the proportion of a target outcome in a series of icon arrays. Arrays were experimentally manipulated to determine a) whether icons were organized in groups or random configurations, and b) whether there was variability in the icon shapes used to represent each outcome. The results showed that participants' proportion judgments were highly accurate for grouped arrays, with no effect of icon variability. For random configurations, however, icon variability in one of the outcomes led to systematic distortions in proportion judgments. These findings provide initial evidence that perceptual variability—while irrelevant to the proportion judgment—can alter how participants interpret information about risk under some conditions, providing new insight into how icon arrays can be designed most effectively.

Development of a Method for Preparing and Purifying Myofibrils from Rabbit Skeletal Muscle Tissue to Study Myosin Motors Cooperativity in Sarcomeres During Muscle Force Production

Riley van Ravesteyn
Mentored by: Yuri Nesmelov. Klein College of Science

Muscle cells contain contractile fibers known as myofibrils, which possess all the necessary protein machinery to generate force. This force is produced by the muscle motor protein myosin. Current understanding of myosin suggests that these proteins function independently. However, emerging evidence implies that myosin may instead function cooperatively. A preferred sample for studying the cooperativity between myosin consists of isolated myofibrils of a specific length (20-50), free from clumping, or other cellular debris. Here, we discuss a protocol for such sample production. We use low speed centrifugation to separate myofibrils of desired length. Further optimization of the preparation process will be attempted with the use of cellular strainers, as well as gradient ultracentrifugation. We plan to use these prepared myofibrils in experiments utilizing the homo-FRET effect between fluorescent probes attached to myosin heads in myofibrils. We will employ either ensemble time-resolved fluorescence lifetime measurements or fluorescence lifetime imaging microscopy (FLIM) using a confocal microscope equipped with a FLIM module. Regardless of the confirmation of myosin cooperativity in muscle, new insight into muscle physiology at the sarcomere level will still be made. If myosin cooperativity is confirmed, it would represent a novel regulatory mechanism that could potentially be targeted by pharmaceuticals for the treatment of muscle diseases.

Social Well-Being and Pain Interference: The Role of Self-Esteem

Drew VanDine and Olivia Woods
Mentored by: Scott Ravyts, College of Humanities & Earth and Social Sciences

Past research has highlighted the connection between social well-being and pain interference, as well as between self-esteem and pain interference, but studies have yet to investigate the possibility of self-esteem as a mediator between social well-being and pain interference. The purpose of the present study was to examine whether self-esteem partially mediates the relationship between social well-being and pain interference among individuals with chronic pain. A secondary data analysis was conducted to examine the relationship between social well-being, self-esteem, and pain interference among 868 adults with chronic pain (56.4% Female; Mean age = 54.9) participating in the Midlife in the United States (MIDUS) study. A direct negative relationship was found between social well-being and pain interference (b = -.02 , p = .002). Additionally, mediation analyses revealed that social-well-being indirectly predicted pain interference via self-esteem (b = -.02, 95% CI = -.03, -.02). Specifically, there was a significant positive relationship between social well-being and self-esteem (b = .27, p

Enhancing Reliability and Performance of Marine Energy Systems

Shreyas Vimaldev
Mentored by: Wesley Williams and Michael Smith, William States Lee College of Engineering

Marine energy stands as one of the most promising renewable resources, harnessing the ocean's untapped kinetic potential to generate clean energy for a sustainable future. Among the innovative technologies in this field, point absorber wave energy converters capture the dynamic motion of ocean waves to produce electrical power. This project is focused on a detailed force analysis and strategic material selection for a marine energy point absorber device, emphasizing the engineering challenges and technical intricacies associated with its design. In particular, the investigation centers on a screw-channel assembly mounted on the top of the device. Comprehensive evaluations assess multidirectional loads, including front-to-back, side-to-side, and top-to-bottom forces, as well as torsional stresses that could impact performance. To ensure the device's structural integrity and resilience in harsh, corrosive marine environments, a thorough review of contemporary research, technical articles, and industry best practices has been conducted. Comparative analysis of several metals with respect to mechanical strength and corrosion resistance informs the recommended material solution. The outcomes of this research will serve as a foundation for subsequent prototyping, rigorous testing, and eventual field deployment, contributing to enhanced reliability of marine energy systems. Ultimately, this project aims to establish a robust analytical methodology for evaluating critical components of wave energy converters, thereby aligning design considerations with optimal engineering performance and environmental durability. In doing so, the study advances the broader field of marine energy research, offering actionable insights that may accelerate the adoption of sustainable ocean-based energy technologies.

Quantum Computing: Beyond Classical Limits

Sushanth Yarlagadda
Mentored by: Todd Dobbs, College of Computing & Informatics

With quantum computing making great strides in recent years, it's only a matter of time until this technology sees wider use across the world. This literature survey aims to consolidate and analyze the ramifications of existing literature in the space of quantum computing to identify unexplored aspects of the technology, with a focus on Applications of quantum computing in fields like AI, Data Science, Cloud Computing, Finance, & Cybersecurity, and how the introduction of quantum computing may shake up industry norms. Peer-reviewed research papers and articles discussing implementations of quantum computing to increase efficiency in current tech fields will be considered for the consolidation of sources for this survey, taking into account aspects of quantum computing not explored by these papers to posit "next steps" researchers can take in order to advance the field as a whole. Current research literature on quantum computing indicates massive potential in the technology, especially when used for complex optimization problems, or problems with large amounts of solutions that must be explored deeply. The unique properties of quantum computing allow it to solve these problems much quicker and more efficiently than a classical computer. The findings of this survey will provide key insights for all kinds of innovators, business owners, tech professionals, finance experts, analysts, and many more, who stand to gain much from learning about potential implementations of quantum computing in the future.

Special category: Globally Focused Research

Exploring the Neural Correlates of Immersion in Virtual Reality

Ata Yilmazemre
Mentored by: Mark Faust, College of Humanities & Earth and Social Sciences

Immersion is a mental state in which an individual becomes deeply engaged or absorbed in an activity, often resulting in a diminished awareness of the external world. This state involves a series of cognitive processes, including attention, perception, and memory, which work together to create an integrated experience of being involved in a particular environment or task. While frequently achieved in interactive media environments such as video games, immersion lacks robust theoretical underpinnings. Our study tested the 3-dimensional framework for psychological immersion proposed by Nilsson et al. by identifying the EEG neural correlates associated with immersive experiences. Participants engaged with a driving simulator game displayed on a traditional flat computer screen and through a more immersive 3D virtual reality (VR) headset, with varying difficulty levels across sessions. The findings indicate a notable increase in theta (4-8 Hz) wave amplitude during 3D VR gameplay compared to 2D screen gameplay, particularly on the easier racetrack, suggesting that task complexity and the immersive quality of the display technology significantly influence neural engagement. The study cross-validated findings using subjective (immersion surveys) and objective (EEG) measures. Such triangulation helped confirm that the observed brain activity correlated with participants' immersion experiences. Combined, the EEG data and survey responses supported the distinction between challenge-based and system/perceptual-based dimensions of immersion. These results contribute to the theoretical development of immersion by empirically validating specific dimensions within the framework and establishing theta band activity as a reliable neural indicator of increased immersion across digital media. This study fills a critical gap in immersion research and clarifies the psychological and neural mechanisms underpinning immersive experiences in virtual environments.

Special category: Globally Focused Research

Shifting Downtime: The Impact of Habitat Type on Resting Behavior in White-Handed Gibbons Across Thailand

Lauren Yost
Mentored by: Lydia E. O. Light, College of Humanities & Earth and Social Sciences

The effects of climate change on white-handed gibbons (*Hylobates lar*) in Thailand have yet to be fully investigated. Typical gibbon habitats, such as those in Khao Yai National Park, consist of lush evergreen forests with consistent fruiting seasons. However, such forests are becoming increasingly rare due to fluctuations in temperature, rainfall, human activity, and other impacts of climate change. Understanding and anticipating the challenges that gibbons and other primate species will face is vital for guiding research and conservation efforts. Huai Kha Kaeng Wildlife Sanctuary, located about five hours northwest of Khao Yai, presents a unique opportunity to observe how white-handed gibbons may adapt to their changing environment. The sanctuary is divided into two distinct biomes: an evergreen forest similar to Khao Yai and a savanna with sparse tree cover and lower abundance of ripe fruit. Gibbons are efficient energy minimizers, typically resting more during the cool season from November to January when fruit is in lower abundance. In the coming years, as habitats continue to decline, drastic shifts in the phenology of plants and animals will destabilize ecosystems. Conducting comparative studies between different habitats is essential for predicting how species may adapt their behavior to these changes. We hypothesize that one way gibbons facing lower levels of fruit availability adapt is by maintaining higher rates of rest year-round. This study assesses differences in behavior between two gibbon groups in Khao Yai National Park and two groups in Huai Kha Kaeng Wildlife Sanctuary to understand better how habitat influences rest.

Special category: Globally Focused Research

Dragonfly Larvae Distribution in Ponds in the Charlotte-Mecklenburg Region

Mckenna Zelna
Mentored by: Sandra Clinton, College of Humanities & Earth and Social Sciences

Dragonflies are semi-aquatic insects that rely on freshwater habitats for reproduction, with their egg and larval stages being aquatic. They are commonly associated with streams and are used as indicators of the health of aquatic and terrestrial habitats. Most current studies evaluate dragonfly populations in streams, overlooking their pond and swamp habitats. Charlotte-Mecklenburg Storm Water Services has observed a decline in dragonfly numbers, with data exclusively from streams. This limited data may not accurately capture dragonfly population trends, since they breed in other freshwater bodies. Land-use change from increased urbanization results in greater stormwater runoff leading to degraded freshwater habitats. The effects of urbanization are more likely to affect specialist species than generalists due to specialists' limited range, and many dragonfly species are considered to be specialists. As predators, dragonflies are also important components of both the freshwater and terrestrial food webs. Therefore, understanding how urbanization affects dragonfly distribution in Charlotte-Mecklenburg is crucial for conservation.
This research evaluates dragonfly populations in Charlotte-Mecklenburg ponds. By sampling ponds, we can determine if the dragonfly data show a similar trend to streams with low abundance. If ponds have ample dragonflies, these habitats may help restore stream ecosystems. If not, conservation efforts are needed. The study will investigate the correlation between urbanization and dragonfly abundance in ponds. Dragonfly larvae were collected using aquatic dip nets and will be identified using taxonomic keys. This research will enhance our understanding of dragonfly distribution and their response to urbanization, informing conservation strategies.

Special categories: Honors College, North Carolina Focused Research

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